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Mr. James Bearzi
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P.O. Box 26110
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RED LANL TA-16

SUBJECT: SUBMITTAL OF SAMPLING AND ANALYSIS PLAN FOR MDA P (PRS 16-018), VCA PLAN FOR REMEDIATIONOF CONSOLIDATED PRS 16-016(c)-99, AND CLOSURE PLAN FOR THE TA-16-387 FLASH PAD

Dear Mr. Bearzi:

Enclosed please find two copies of *the Sampling and Analysis Plan for Material Disposal Area P* [Potential Release Site (PRS) 16-018], which includes as Attachment 3 a *Voluntary Corrective Action Plan for Remediation of Consolidated PRS 16-016(c)-99*. Also being submitted are two copies of the *Closure Plan for the TA-16-387 Flash Pad* (Enclosure 2). If you have any questions, please contact Warren Neff at (505) 665-9259 or Joe Mose at (505) 667-5808.

Sincerely,

Julie A. Canepa, Program Manager
LANL/ER

Sincerely,

Theodore J. Taylor, Program Manager
DOE/LAAO

JC/TT/NR/ev

Enclosures: 1) SAP for MDA P, which includes VCA Plan for 16-016(c)-99
2) Closure Plan for TA-16-387 Flash Pad

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Sampling and Analysis Plan for Material Disposal Area P

Environmental Restoration Project
A Department of Energy Environmental Cleanup Program

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ACRONYMS AND ABBREVIATIONS

Ba	barium
BMP	best management practices
BV	background value
COPC	chemical of potential concern
CSM	conceptual site model
DQO	data quality objective
EDL	estimated detection limit
ENG	engineering
EP	extraction procedure
EPA	US Environmental Protection Agency
EQL	estimated quantitation limit
ER	Environmental Restoration
ESA	Engineering Sciences and Applications (Division of LANL)
ESL	ecological screening level
HE	high explosive
HMX	1,3,5,7-tetranitro-1,3,5,7-tetrazacyclooctane (Cyclotetramethylenetetranitramine)
HRMB	Hazardous and Radioactive Materials Bureau
HSWA	Hazardous and Solid Waste Amendments (of 1984)
HxCDD	Hexachlorodibenzo-p-dioxin
HxCDF	Hexachlorodibenzofuran
LANL	Los Alamos National Laboratory
MDA P	Material Disposal Area P
NMED	New Mexico Environmental Department
NOD	notice of deficiency
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
Pb	lead
PCB	polychlorinated biphenyl
PeCDD	Pentachlorodibenzo-p-dioxin
PeCDF	Pentachlorodibenzofuran
PETN	Pentaerythritol tetranitrate
PRG	preliminary remediation goal
PRS	potential release site
QC	quality control
RCRA	Resource Conservation and Recovery Act

RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
RFI	RCRA facility investigation
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
SOW	statement of work
strata	non-overlapping sub-areas or zones within the investigation area
SVOC	semivolatile organic compound
TA	technical area
TAL	target analyte list
TCDD	Tetrachlorodibenzo-p-dioxin
TCDF	Tetrachlorodibenzofuran
TCLP	toxicity characteristic leaching procedure
TNT	2,4,6-Trinitrotoluene
TPH	total petroleum hydrocarbons
TSS	total suspended solids
U	uranium
UTL	upper tolerance limit
VCA	voluntary corrective action
VOC	volatile organic compound
XRF	x-ray fluorescence

1.0 INTRODUCTION

This sampling and analysis plan (SAP) supports collection of data to determine whether residual chemical concentrations in the environment following waste removal activities at Material Disposal Area P (MDA P) present an unacceptable risk to human or ecological receptors. This SAP is organized into four sections. In Section 1, the objectives of the Phase II sampling are discussed and the technical approach for meeting these objectives is described. Regulatory issues that constrain the sampling, and the planning process that led to development of the objectives and scope of the investigation, are also described. In Section 2, the potential release sites (PRSs) addressed in the SAP are described and the operational history of the PRSs is presented. The existing environmental data characterizing the area under investigation are discussed and a conceptual model of the site is provided that identifies data gaps relative to the SAP objectives. The sampling activities proposed to fill the data gaps are also presented in Section 2. In Section 3, the data quality objectives (DQOs) for the investigation, the quality assurance parameters, and field activities in support of SAP implementation are discussed. Section 4 addresses project management issues.

MDA P is located in Technical Area 16 (TA-16). TA-16 is located in the southwest corner of the Laboratory (Figure 1-1). TA-16 is bordered by Bandelier National Monument along State Road 4 to the south and by the Santa Fe National Forest along State Road 501 to the west. To the north and east, it is bordered by TA-8, -9, -14, -15, and -49. TA-16 is fenced and posted along State Road 4. Water Canyon, a 200-foot-deep ravine with steep walls, separates State Road 4 from actives sites at TA-16. Cañon de Valle forms the northern border of TA-16.

MDA P operated from the early 1950's until 1984 as a disposal site for debris originating from the burning of high explosives (HE) and HE-contaminated material at Technical Area (TA) 16. In 1995, a Closure Plan for MDA P was submitted to the New Mexico Environment Department (NMED) indicating that Los Alamos National Laboratory (the Laboratory) intended to close MDA P in accordance with the clean closure requirements of 20 NMAC 4.1, Sections 265.111 and 264.258(a). The Closure Plan was approved by NMED on February 20, 1997. This sampling and analysis plan (SAP) describes the rationale and technical approach for collecting confirmation samples and evaluating these samples in order to ensure that unacceptable levels of contamination do not remain in the environment following waste removal activities.

Closure activities at MDA P will occur in two phases. Phase I consists of removal of the waste pile and associated residues and structures. The primary objective of Phase I activities with regard to residual environmental contamination is to ensure that all waste has been removed. The primary objective of Phase II sampling and assessment, as described in the MDA P Closure Plan, is to determine if residual contamination associated with MDA P remains in the environment following waste removal and, if so, whether this contamination poses potentially unacceptable human health risks. Although this objective is still valid, additional objectives have been identified since the Closure Plan was written. Specifically, the scope of this SAP has increased to include evaluation of residual contamination associated with mesa-top PRSs proximal to MDA P. Furthermore, ecological risk is now recognized by NMED and the Laboratory as a necessary assessment endpoint, in addition to human health risk, for ER Project site assessments.

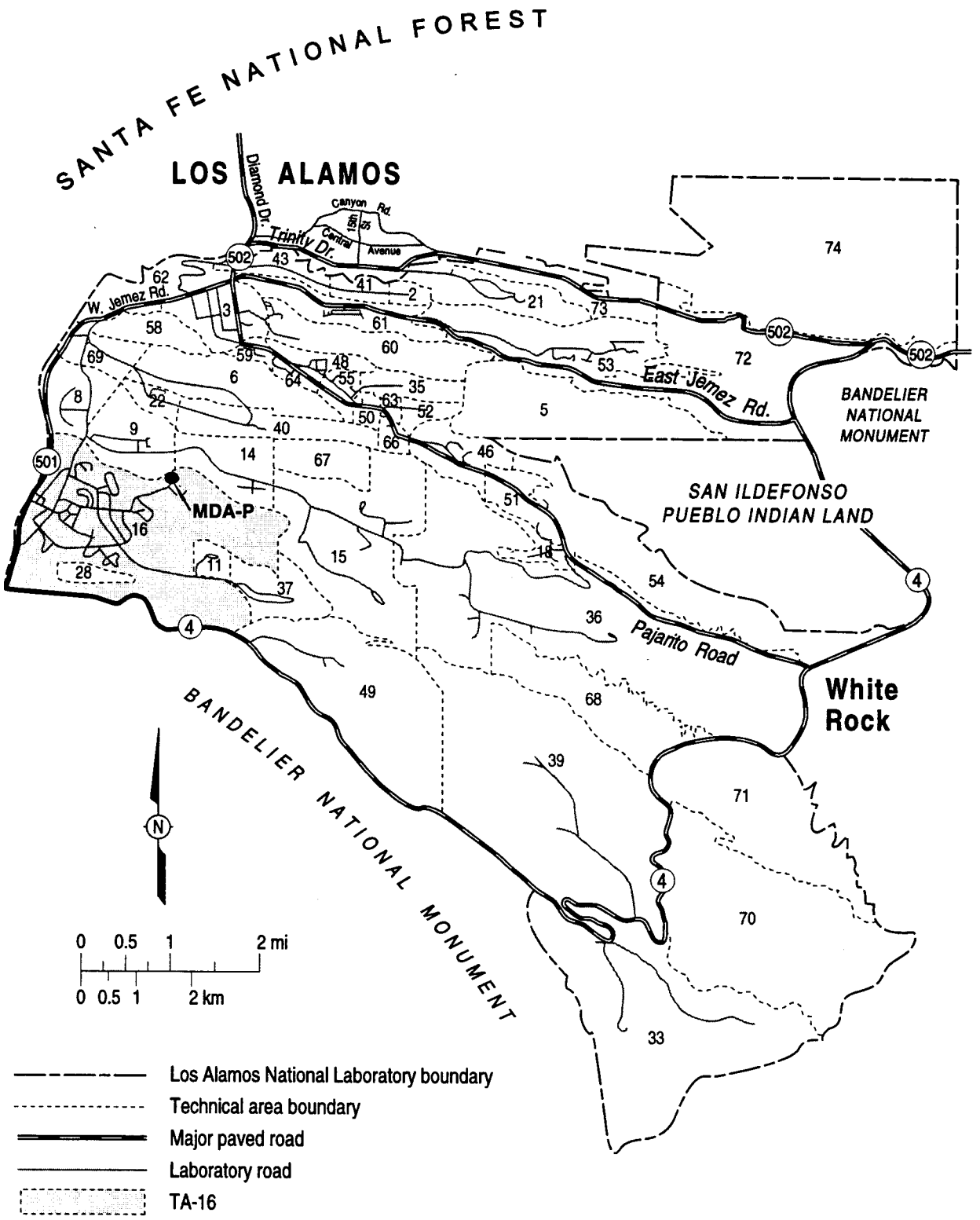


Figure 1-1. Location of TA-16 with respect to Laboratory technical areas and surrounding landholdings; MDA-P is also shown.

In the approved Closure Plan, for areas outside MDA P that were potentially impacted by closure operations, a strategy was proposed of comparing Phase II sampling data to baseline levels of environmental contamination attributable to sources adjacent to MDA P. This strategy was intended to discriminate between MDA P related contamination and contamination that was attributable to nearby PRSs. As described above, however, the ER Project and NMED HRNB decided that any residual contamination associated with PRSs adjacent to MDA P will be assessed and remediated concurrently with MDA P. Therefore, a comparison of Phase II data with baseline levels of contamination will not be performed.

The PRSs adjacent to MDA P include the former barium nitrate pile [PRS 16-016(c)], the TA-16-386 Flash Pad [PRS 16-010(a)], the TA-16-387 Flash Pad [PRS 16-010(b)], and a septic tank, drain field and outfall [PRS 16-006(e)]. MDA P and the adjacent PRSs are shown in Figure 1-2 and background information on site histories and operations are provided in Section 2.1. Collectively, MDA P and this group of PRSs will be referred to in this SAP as the MDA P cluster.

The TA-16-387 Flash Pad [PRS 16-010(b)] is proposed for RCRA closure. The other three PRSs (the barium nitrate pile [PRS 16-016(c)], the TA-16-386 Flash Pad [PRS 16-010(a)] and the septic tank, drain field [PRS 16-006(e)]) were consolidated during the Laboratory's last Annual unit Audit (LANL 1998, ER ID 63175.1). Collectively the three PRSs are now described as consolidated PRS 16-016(c)-99. Consolidated PRS 16-016(c)-99 is discussed in detail in a VCA Plan included as Attachment 3 to this SAP. The TA-16-387 Burn Pad is discussed in detail in a separate document (Closure Plan for Flash Pad TA-16-387, ER ID 63547) accompanying this SAP.

1.1 Objectives and Scope

The goal of this SAP is to obtain sufficient data to enable a determination to be made as to whether residual contamination associated with MDA P, operations to remove waste associated with MDA P, and the PRSs proximal to MDA P present an unacceptable human health or ecological risk. The specific uses for the data collected as a result of this SAP are to:

- identify the nature and extent of residual environmental contamination associated with the PRSs within the MDA P cluster, and,
- calculate spatially-averaged contaminant concentrations within the areas affected by the MDA P cluster to support assessment of the potential human health and ecological impacts associated with residual environmental contamination.

These objectives will support a decision of whether additional remedial or investigatory activities are necessary within the affected area, or whether a recommendation of No Further Action is possible, as described in Module VIII of the Laboratory's Hazardous Waste Facility Permit, Subpart K. Identifying the extent of residual environmental contamination will consist of determining which media (principally soil, fill, and tuff) are affected and establishing a spatial trend of diminishing concentrations to acceptable levels.

In order to support decisions regarding the PRSs investigated in this SAP, information is required to address the following questions for the MDA P cluster:

- What specific contaminants remain in the environment at concentrations greater than LANL-wide background concentrations?

- What is the spatial extent of residual contamination in the environment?
- What are the distributions of contaminant concentrations in the environment at spatial scales appropriate for assessing human health and ecological effects?
- What is the potential for future migration of residual contaminants to Cañon de Valle?

The scope of the project is defined by its physical, administrative and temporal boundaries. The boundaries of the SAP investigation are Cañon de Valle to the north, the watershed divide along the access road to the south, and the areas beyond the Phase I operational area (exclusion zone) to the east and west used to establish the extent of contamination (Figure 1-2).

The geographic boundary between Cañon de Valle and the MDA P investigation is the toe of the slope, a boundary that is consistent with the geomorphic survey taken for the TA-16-260 Outfall [PRS 16-021(c)] RFI report (LANL 1998, 59891.3) This SAP will not address residual environmental contamination north of that boundary. The investigation of impacts from MDA P on Cañon de Valle will be addressed by the Laboratory in the following manner. Some data from boreholes between MDA P and Cañon de Valle will be collected under this SAP to maintain consistency with the approved MDA P Closure Plan. The results from these samples will be used for future contaminant transport investigations in the watershed. Additional data collection activities in Cañon de Valle are planned by the Canyons focus area to address potential legacy inputs to Cañon de Valle from all sources, including MDA P. A surface water monitoring station is scheduled for installation directly below MDA P within Cañon de Valle during the summer of 1999. There is no outfall at MDA P. This station will monitor both surface water quality and quantity of all upstream sources under the requirements of the Multi-sector General Permit for the Laboratory. If permit levels or water quality standards are exceeded at this station, additional corrective actions may be required.

This SAP will not address any residual environmental contamination south of the watershed divide that is approximately consistent with the location of the access road that separates the MDA P cluster from PRSs 16-010(c-n). The area south of the watershed divide includes some active operations, and thus will be addressed at some future time. The boundaries to the north and south are therefore both physical and administrative.

To the east and west, the boundaries of the SAP investigation will be determined by the actual extent of significant contamination attributable to the MDA P cluster. The project boundary in these directions is therefore defined by physical characteristics only. The process of delineating the eastern and western boundaries will be discussed in Sections 2.2.2 and 2.2.3 of this SAP.

This SAP will support assessment of current and near-future human health and ecological risks at the MDA P cluster following Phase I activities. The temporal boundary associated with "near-future" is approximately 30 years, the length of time for which the Laboratory publishes intended land use for areas within its boundaries. This SAP is also intended to provide guidance to the MDA P excavation team for removal of contaminated soil and fill within the MDA P cluster during Phase I activities at MDA P. Removal of obviously contaminated environmental media during Phase I (when personnel and equipment are already in place for waste removal) is intended to minimize the likelihood that Phase II sampling will indicate the need for additional remedial activities at a later date. Long-term concerns for the MDA P cluster, in terms of cumulative risk associated with multiple groups of PRSs at a watershed-level scale, will be evaluated at a later date in a manner consistent with the approach currently under development by the ER Project.

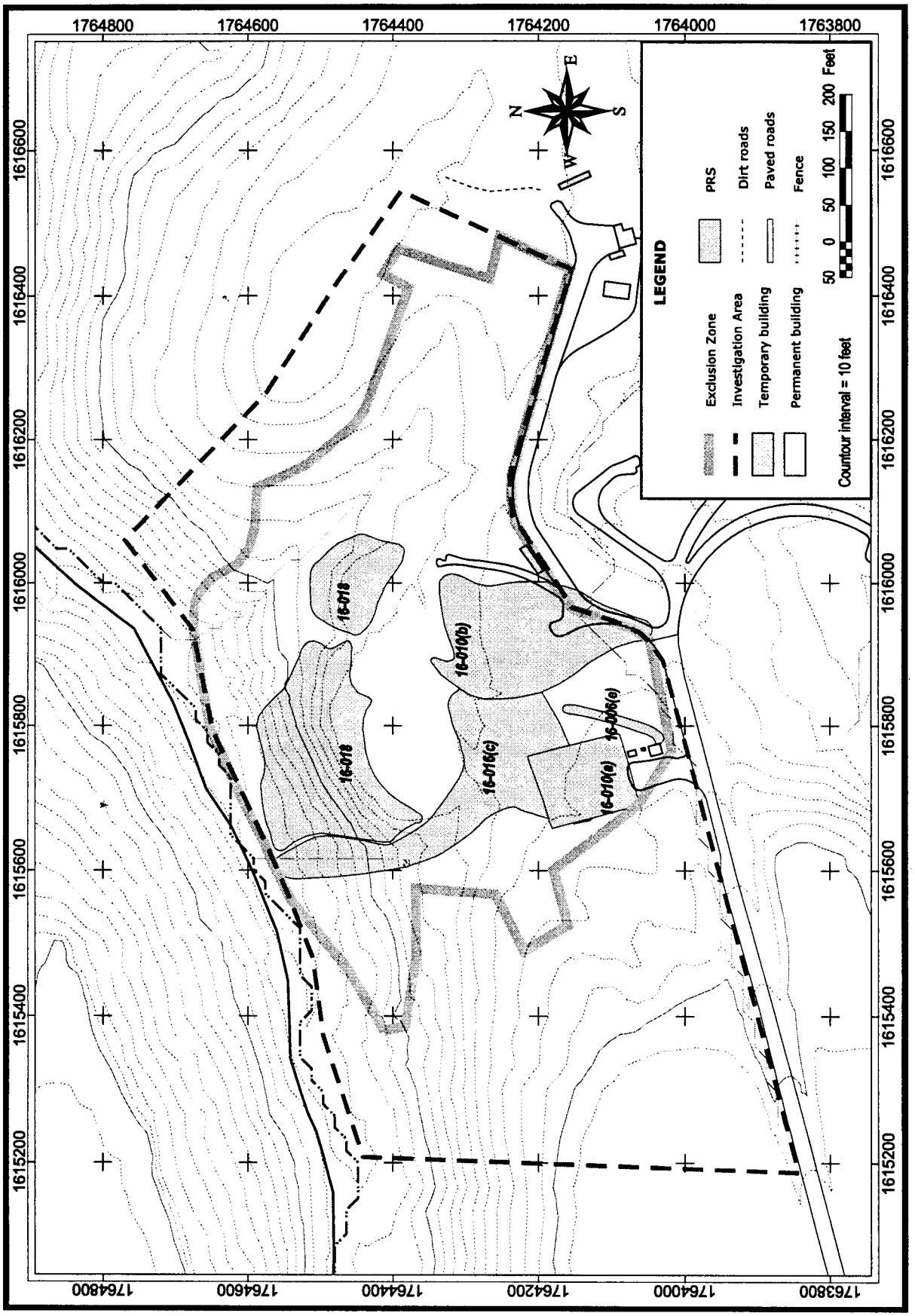


Figure 1.2. Locations of PRSs within MDA P cluster investigation area.

Based on a review of historical activities and available site data associated with the MDA P cluster, inorganic chemicals (primarily barium and lead) and organic chemicals (primarily high explosives and to a lesser extent semivolatile organic compounds including PAHs and phthalates) are expected to be the principal potential contaminants of concern. With the possible exception of uranium, no radionuclides are suspected to have been associated with historical activities within the MDA P cluster. However, final selection of analytical suites for Phase II sampling will also incorporate an assessment of the waste characterization data collected during Phase I waste removal.

1.2 Approach and Implementation

The technical approach underlying the design of this SAP is based on the assumption that the distribution of residual environmental contamination is likely to vary in a predictable way. In brief, it is expected that residual contamination will be highest in the area of MDA P and surrounding PRSs and decrease with distance from this area. Contaminant concentrations are also expected to rapidly decrease to background levels with depth. These expectations are based on the results of previous sampling campaigns (discussed in detail in Attachment 1). Collecting confirmatory samples from strata (non-overlapping subareas or zones within the overall investigation area) that correspond to expected differences in contaminant concentrations will facilitate the calculation of average chemical concentrations in the environment and allow statistical methods to be employed for determining whether spatial trends in concentrations exist.

Another benefit of collecting confirmatory samples within strata is that such a sampling design will allow exposure concentrations for risk assessment to be calculated on several spatial scales within the area of this investigation. The advantage of this approach is that specific receptor exposure areas (which are inherently subjective) do not need to be rigorously defined prior to sampling.

The overall technical approach and sequence of activities for sampling, and subsequent data assessment, is summarized below. More detailed information pertaining to these activities is presented in subsequent sections of this SAP.

1. Evaluate the results of previous sampling campaigns in the area of the MDA P cluster to identify risk-driving contaminants, determine the locations and media that have been historically affected, and develop a site conceptual model.

2. Establish preliminary remediation goals (PRGs) for contaminants identified in Sections 2.2.1 and 2.2.2. The PRGs are primarily used to supplement waste criteria as target levels to be achieved in environmental media during Phase I activities. The tabulated PRGs in this SAP pertain primarily to human rather than ecological receptors.

3. Comply with established sampling protocols described in the approved MDA P Closure Plan. These protocols include sampling within MDA P on a 10m x 10m grid and collecting samples from boreholes located immediately south of the Cañon de Valle stream channel between MDA P and the channel.

4. Develop a sampling plan for areas outside of MDA P to achieve objectives of determining contaminant nature and extent and calculating spatially-averaged contaminant concentrations. Because excavation activities change the physical appearance of MDA P daily, it is not possible to foresee the final condition of the site following Phase I. Therefore, the sampling design

integrates field surveys and screening during the implementation of the SAP to finalize the number and locations of confirmatory samples outside MDA P.

5. Evaluate Phase I waste characterization data to determine if additional analytical suites should be specified for some or all of the confirmatory samples.

6. Apply ER Project background values (BVs) for comparison to contaminant concentration data. Background comparisons are utilized to identify those chemicals that may be related to releases from sites within the MDA P cluster. Identify detected chemicals for which no BVs are available.

7. For those chemicals present above background concentrations, or for which background data are not available, evaluate whether the nature and extent of contamination have been satisfactorily established with Phase II data. The types of contaminants observed, and the pattern of their distribution in the environment, will be evaluated relative to expectations based on the conceptual site model included in this SAP and the additional information obtained during Phase I and during the site survey and screening activities associated with this SAP. The range of observed contaminant concentrations relative to potential human and ecological impacts will also be used in assessing whether extent has been satisfactorily determined.

8. For those chemicals present above background concentrations, or for which background data are not available, compare contaminant concentrations to PRGs. Additional PRGs may be identified beyond those tabulated in this SAP if other chemicals are identified in Step 5. If average contaminant concentrations (95% upper confidence limit for the mean) do not exceed PRG concentrations at any spatial scale for the MDA P cluster, no further human health assessment activities will be performed. If concentrations of one or more contaminants exceed PRGs, additional human health assessment activities will be conducted. The scope of additional assessment activities may involve a combination of evaluation of remedial alternatives, uncertainty analyses in support of additional data collection, development of site-specific remediation goals, or other assessment activities.

9. Because the PRGs tabulated in this SAP do not pertain directly to ecological risk assessment endpoints, ecological assessment activities will be conducted for all chemicals identified in Step 6. As was done for the human health assessment, average contaminant concentrations will be evaluated for potential impacts at a variety of spatial scales.

10. Based on the outcome of Steps 6–9, additional remedial activities may be recommended which could necessitate a second round of confirmatory sampling. If subsequent confirmatory sampling were to take place, the assessment activities described above are envisioned to be repeated. When the nature and extent of residual environmental contamination is satisfactorily determined and shown to pose no unacceptable risk, final reports documenting these conditions will be produced.

1.3 Background Issues

1.3.1 Regulatory Requirements

The purpose of this SAP is to guide data collection to verify whether the closure performance standards specified in the approved Closure Plan for MDA P (MDA P, 1995) have been met. In general, performance standards for MDA P will be extended to cover closure of the TA-16-387 Flash Pad and the

VCA for consolidated PRS 16-016(c)-99. The performance standards for MDA P closure specified in the approved Closure Plan provide for using risk assessment as a tool for determining if residual levels of environmental contamination are acceptable. Risk-based decisions are also compatible with current Corrective Action guidance governing PRSs on the Laboratory's Hazardous Waste Facility Permit, including consolidated PRS 16-016(c)-99.

1.3.2 Other Issues

The TA-16-387 Flash Pad will be closed in accordance with an approved closure plan. A closure plan for the TA-16-387 Flash Pad (Closure Plan for Flash Pad TA-16-387, ER ID No. 63547) is provided as a separate document for review and approval by the administrative authority. However, the TA-16-387 Flash Pad is considered part of the MDA P cluster and the closure plan will be consistent with this SAP. The performance standards identified in this SAP are also proposed for the TA-16-387 Flash Pad.

The VCA Plan for the barium nitrate pile consolidated PRS [consolidated PRS 16-016(c)-99] will also be consistent with this SAP. The VCA Plan is included as Attachment 3 to this SAP. The same performance standards used for MDA P and the TA-16-387 Flash Pad will be used to demonstrate acceptable levels of residual risk for these PRSs.

1.4 Data Quality Objectives

When the scope of this SAP increased to include the proximal PRSs and an ecological risk endpoint, the data quality objectives changed accordingly. Following completion of Phase I activities, a decision must be made as to whether or not the closure performance standards have been met for the closure units, and whether or not NFA can be approved for the consolidated PRS. To inform the decision, confirmatory samples will be collected to support risk assessments on spatial scales appropriate for human health and ecological receptors and to determine the nature and extent of residual contamination. A decision for the investigation area will be made based on the results of the human health and ecological risk assessments.

A narrative account is provided in this section of the events and decisions that led to the change in the scope of the original MDA P Closure Plan Phase II sampling objectives.

The confirmatory sampling plan described in the approved MDA P Closure Plan consists of the following activities; sampling within the footprint of MDA P on a 10m by 10m grid, sampling in areas to be used for waste handling operations prior to beginning operations to establish a regional baseline level of contamination, and sampling in areas used for waste handling operations at the close of operations to determine whether additional contamination due to closure activities associated with MDA P had occurred. Contaminant concentrations were to be compared to EPA Region 9 PRGs as the basis for determining whether residual concentrations were acceptable.

During the course of ER Project activities in the past year, it became apparent that MDA P closure activities were likely to affect the schedule of activities at two nearby PRSs that were proceeding simultaneously, namely the VCA planned by the ER Project for the barium nitrate pile consolidated PRS and the RCRA closure planned for the TA-16-387 Flash Pad . The area associated with consolidated PRS 16-016(c)-99 could reasonably be expected to be impacted by operational activities for the removal and processing of material from MDA P. The MDA P Closure Plan specified that operational areas be sampled following closure operations. It seemed appropriate to address sampling requirements associated with actions for PRSs 16-016(c)-99 and 16-010(b) together with the MDA P operational areas

in the Phase II SAP for MDA P. The combined approach will make better use of resources for the planned activities for MDA P and the nearby PRSs.

The initial decision to address sampling for these additional PRSs in this SAP was also observed to be logical from the perspective of exposure assessment for human and ecological impacts. The relatively small size of these PRSs indicates that neither human nor ecological receptors are likely to confine their activities to the footprint of one PRS. However, the presence of other nearby PRSs precludes the possibility of assuming that areas beyond the extent of contamination related to any one PRS are unaffected. Therefore, if screening assessments revealed the possibility of potentially unacceptable risks, increasing the spatial scale of the assessment to evaluate exposure concentrations over a larger area necessitates evaluating multiple PRSs simultaneously. This observation led to the definition of the MDA P cluster of PRSs as a basis for sampling and risk-based decision making.

An objective of this SAP is to outline the technical approach to estimate residual contaminant concentrations in the environment based on the confirmatory sampling results. The subdivision of the overall investigation area into strata based on prior knowledge of contaminant distribution is a tool to optimize sample collection. The overall investigation area is divided into strata for sampling purposes based on the expectation that there are differences in contaminant distributions between the strata. The types and concentrations of contaminants within a strata are expected to be more homogeneous than those found across the overall investigation area, because of factors like past site operations and site topography. Adequate numbers of samples in each strata are proposed to insure good estimates of means and variances of contaminant concentrations for the individual strata.

The use of spatial scales is a tool for risk-based decision making. A spatial scale is a receptor exposure area (a subarea of the investigation area, up to and including the overall investigation area) used to assess an applicable risk scenario. For an ecological risk model the appropriate spatial scale could be a plausible home range for a target ecological receptor population. A risk assessment could be done on the individual strata if that is an applicable spatial scale. If so, the means (or upper confidence limits on the means, UCLs) can be used to assess the individual strata. However, because both the human health and ecological assessments for several ecological receptors are anticipated as risk-based decision inputs, it will be desirable to assess the data on a variety of spatial scales. Exposure concentrations for spatial scales larger than individual strata may be calculated by combining the information from the strata. The exposure concentration for a spatial scale that includes more than one strata is estimated by weighting the contaminant concentrations for the included strata proportional to their size.

2.0 MDA P CLUSTER DESCRIPTOR

2.1 Characterization and Setting

2.1.1 Site Description

Site descriptions are provided for the following five PRSs within the scope of the SAP for the MDA P cluster: PRS 16-018 [MDA P], PRS 16-016(c) [barium nitrate pile], PRS 16-010(a) [TA-16-386 Flash Pad], PRS 16-010(b) [TA-16-387 Flash Pad], and PRS 16-006(e) [septic system]. All of these PRSs are located within a small watershed of approximately 55,000 m^2 (12 acres) on the south slope of Cañon de Valle (see Figure 1-2).

PRS 16-018 [MDA P] - MDA P is located on the south side of Cañon de Valle in TA-16. It was constructed in 1951 to serve as the main disposal site for nonradioactive waste generated at S-Site (also known as

Operative Unit 1082). S-Site includes TA-16 and three adjacent Technical Areas: TA-11, TA-28, and TA-37 (shown in Figure 1-1).

The surface manifestation of MDA P is a flat mesa-top area to the south with steep sides grading down into Cañon de Valle to the north. A top layer of soil was brought in to cover the material that makes up the waste pile. Over the course of time, erosion occurred and the underlying debris became evident, especially on the steep sides, but to a lesser degree on the mesa-top. Grasses and weeds grow on top of MDA P. The depth of the waste pile is approximately 12 to 14 feet.

PRS 16-010(a) [TA-16-386 Flash Pad] - TA-16-386 is an inactive flash pad now used as a storage area by Engineering Sciences and Applications (ESA) and MDA P operations. The flash pad was constructed in 1951 in a level area located just west of the TA-16-387 Flash Pad. The burn area consists of a bare soil surface surrounded by a cyclone fence. The northeastern corner of the area enclosed by the fence was used as a storage site for a pile of barium nitrate in the 1950s and 1960s. The release area from the former barium nitrate storage is now designated as PRS 16-016(c).

PRS 16-016(c) [Barium Nitrate Pile] - PRS 16-016(c) is located next to and partially overlapping inactive Flash Pad TA-16-386. Photographs taken in 1959 and 1965 show that the barium nitrate pile was within TA-16-386. A current burning ground employee describes the pile as roughly two dump truck loads of material resembling a large pile of snow. The footprint for this PRS, including a small drainage from the area of the former pile to Cañon de Valle, is approximately 0.85 acres. The site is on a steep north-facing slope at the head of the small drainage channel into Cañon de Valle.

PRS 16-010(b) [TA-16-387 Flash Pad] - TA-16-387 is a flash pad constructed during 1951 in a flat area south of MDA P. The open burn unit is a concrete structure consisting of a base pad and a shield deflector around three sides (the west, north and east sides). The burn area is enclosed by a 100 ft long by 100 ft wide by 8 ft high cyclone fence. An asphalt-lined diversion channel, approximately 4 ft wide and at least 2 ft deep, was constructed to the north of the flash pad. This run-on, run-off diversion channel currently prevents residue from theTA-16-387 Flash Pad from reaching MDA P via sheet flow. It directs precipitation flows to the east around MDA P and directly into Cañon de Valle.

PRS 16-006(e) [septic system] - PRS 16-006(e) is a 385-gal. steel septic tank that was installed in 1963 to serve structure TA-16-389, a control shelter at the burning ground. The septic tank serves a water closet, lavatory, and a floor drain. Drawing ENG-C 23442 indicates that an outfall is associated with the overflow line from the tank.

2.1.2 Operational History

PRS 16-018 [MDA P] MDA P operated from the early 1950s until 1984 as a disposal site for rubble and debris generated by the burning of HE, HE-contaminated equipment and material, barium nitrate sands, building materials, empty drums and bottles, trash, and trees or slash removed during construction operations. Downed trees and non-combustible material such as concrete or metal construction debris were dumped directly on the slopes leading down to Cañon de Valle. Other materials were burned on one of the nearby open burn units and the resulting debris or residue was pushed over the mesa rim. Gradually, this practice formed the existing waste pile. The disposal site operation began at the western portion of the canyon rim, gradually progressing toward the east on the narrow mesa. The western area of MDA P received primarily construction debris from the demolition of World War II buildings; the eastern area received the debris or residue from the open burn units. The western area of the disposal site has been leveled and covered with crushed tuff and sandy clay soils from the surrounding area. However,

wastes such as demolition rubble and pipe remain visible on the north-slope face. The eastern area was covered with soil as waste deposition proceeded. A thorough description of the operational history of MDA P is provided in the Closure Plan for MDA P.

PRS 16-016(c) [Barium Nitrate Pile] The high explosive baratol is produced by adding barium nitrate to TNT. Barium nitrate was stored in a pile during the 1950's and 1960's in the portion of 16-016(c) that overlaps the fenced area enclosing Flash Pad TA-16-386. Barium nitrate was transported to other areas in TA-16, as needed, for production of baratol. The pile was removed by the 1970's.

PRS 16-010(a) [Flash Pad TA-16-386] and PRS 16-010(b) [Flash Pad TA-16-387] The TA-16-386 Flash Pad has been inactive while the TA-16-387 Flash Pad has operated under interim status. The flash pads were utilized to burn combustible material associated with high explosive experiments, and to "flash" non-combustible equipment and materials that may have been contaminated with HE. Materials were "flashed" to minimize available HE that could prove to be a safety hazard when the material was disposed. After material was burned or flashed on the sand-covered flash pads, the sand and resultant residue or debris was disposed in MDA P. After 1984 when disposal operations at MDA P ceased, the burned or flashed debris was disposed off-site. Additional information on operational activities at the TA-16-387 Flash Pad is provided in a separate document accompanying this SAP (Closure Plan for Flash Pad TA-16-387, ER ID No. 63547).

PRS 16-006(e) [Septic System] Structure TA-16-389, the control shelter served by the septic system, was generally occupied only during burning ground operations. Operations at the burning ground occurred sporadically (an average of 1-2 days a week). Wastewater flow into the septic system came from the toilet, sink, and a floor drain located in this structure. In 1987, the Laboratory obtained a sanitary waste permit for the septic tank from Los Alamos county. The overflow outlet from the tank was sealed, and contents have been subsequently pumped and disposed on a routine basis (additional details are provided in the VCA Plan provided as Attachment 3 of this SAP).

2.1.3 Waste Characteristics

The barium nitrate pile consisted only of solid barium nitrate. Thus, the only waste expected from the residual contamination associated with the pile would be barium nitrate. Process knowledge suggests that liquid wastes introduced into the septic system were sanitary wastewater. The types of residual contamination associated with the flash pads would also be associated with MDA P because MDA P received the residual debris from their burning operations. For this reason, the discussion of waste characteristics will focus on the information regarding waste in MDA P.

The available MDA P waste-pile disposal records, and data obtained from test pits dug in the landfill in the fall of 1997, show that the material disposed of in the West Lobe is building debris from WW-II era buildings that were burned and disposed of in the mid-1960s. This material is primarily concrete, steel and various forms of asbestos material. The East Lobe received material from the nearby open burn units from 1950 until 1984. Significant levels of barium and residual HE characterize the East Lobe.

According to the available burn site records, wastes containing the following materials were burned at the burn site: HE, solvents, depleted uranium, and miscellaneous HE-contaminated waste (barium nitrate sands, filter baskets, trucks). The records indicate that gasoline and kerosene on excelsior were commonly used in the ignition train to burn the waste. Based on the available burn site records, when wastes containing depleted uranium was burned at the burn site, the residue was disposed at off-site. According to site personnel, no depleted uranium was known to have been placed in MDA P.

Based on the available MDA P disposal and burning ground records, the wastes expected to be in MDA P include HE residues, barium, residues from burning of solvents, and asbestos.

2.2 Investigatory Approach

2.2.1 Existing Data

MDA P, other PRSs within the MDA P cluster, and areas representing background or baseline conditions proximal to MDA P have been characterized in numerous sampling events. The results are reviewed in this SAP for the purpose of developing a conceptual site model. The nature of the contaminants released to the environment from historical activities is identified to determine which analytical suites should be included in the confirmatory sampling. This information will be supplemented with the results of Phase I waste characterization data to determine if additional suites may be necessary for some confirmation samples. The distribution of historical contamination within and among environmental media is evaluated to support the sampling design provided in Section 2.2.3 of this SAP. A summary of the sampling activities that have occurred in the area of MDA P is provided in the conceptual model in Section 2.2.2.1 of this SAP. A more detailed review of these data, with accompanying data tables and figures, is provided in Attachment 1 of this SAP.

2.2.2 Conceptual Model

The conceptual site model (CSM) in this SAP consists of four components: 1) nature and extent of contamination; 2) fate and transport of contaminants; 3) human and ecological exposure models; and 4) data gaps. The section on nature and extent of contamination summarizes what is known regarding the types and locations of contaminants in the MDA P cluster. The section on fate and transport of contaminants discusses the processes affecting the chemical stability and potential migration of known or suspected contaminants in the environment. The human and ecological exposure models describe current and anticipated near-future land use as well as key characteristics of human and ecological receptors potentially at risk from residual site contamination. Finally, the section on data gaps identifies the questions that must be answered to achieve the SAP objectives.

2.2.2.1 Nature and Extent of Contamination

The geographical boundaries of the investigation area are shown in Figure 1-2. These boundaries include the toe of the slope where MDA P resides on Cañon de Valle to the north, and the watershed divide along the access road to the south. To the east and west, the boundaries of the investigation area will be determined by the actual extent of contamination attributable to the MDA P cluster. Determination of the lateral boundaries will initially be based on the extent to which visible HE is collected on slopes bordering the Exclusion Zone (see Section 2.2.3). Final determination of the lateral boundaries will focus on concentrations of soil contamination found during the confirmation sampling of the area.

The distribution of residual contamination summarized by results from previous environmental samples described below is being affected by the closure activities for MDA P. To date, approximately one-half to three-quarters of the land within the Exclusion Zone has been directly impacted by closure activities. These impacts include materials removal, road building, regrading, and introduction of fill for constructing staging and waste handling areas. The application of fill and construction activities have been carefully managed. The fill came from the overburden in the bermed area between MDA P and the TA-16-387 Flash Pad, from crushed concrete recycled from demolition activities at TA-16 and from backfill soil and

soil/cobble brought in from TA-51. The concrete material was screened for HE and radionuclides before and after it was crushed. The fill from TA-51 was taken from an area categorized as "clean". All fill was screened for HE and metals prior to use. The construction phase is complete. Project engineers foresee additional impacts due to the removal of existing terrain as excavation operations continue. In addition, the removal of structures during closure of Flash Pad TA-16-387 in the near future is expected to affect the usability of some of the data from previous sampling events. Many locations previously sampled were covered during construction or removed during excavation. Therefore, the data described in this section will not be used in the site assessments following Phase II sampling. [The above comments about previous sampling do not pertain the Phase I samples collected to date.]

Large-Scale Lateral Extent

The summaries of existing environmental data are presented in Attachment 1 to this SAP. A significant result of field surveys performed to date is the discovery that fragments of HE are present in a broad area around the MDA P cluster. Visible pieces of HE, primarily RDX and HMX, have been collected from throughout the Exclusion Zone and it is likely that some exists beyond Exclusion Zone boundaries as well.

In addition to ER Project and ESH data collected to characterize contamination at the PRSs in the MDA P cluster, environmental data have been collected to establish local background and baseline concentrations of certain analytes in the area of MDA P. Fifty-five (55) background soil samples for inorganic chemicals were collected in 1995 from areas to the west of MDA P and on the north hill slope of Cañon de Valle (see Figure 2 in Attachment 1). Although barium concentrations were slightly higher in surface soil intervals when compared to underlying soils, surface soils were still below ER Project LANL-wide background concentrations. The elevation of surface soil barium may be related to airborne deposition of contamination from burning operations at Flash Pads TA-16-386 and TA-16-387. If so, the barium results indicate that widespread contamination from such burnings, while observable, is negligible.

Twelve soil and 19 tuff baseline samples were collected for inorganic chemical analyses in 1995 from three areas near MDA P prior to finalization of MDA P closure operational areas. However, the three areas are not being used operationally as foreseen in 1995. Two areas were immediately south and southeast of the east lobe of MDA P, respectively. The third area was located at a greater distance to the southwest of MDA P beyond the MDA P cluster. The sampling locations are identified in Figure 2 (in Attachment 1). Barium was observed above LANL-wide background concentrations in both soil and tuff samples from the decontamination pad and segregation areas, but not the staging area. In the area of the decontamination pad, barium was elevated in tuff below contaminated surface fill, indicating that infiltration of barium from fill into tuff may have occurred. The distribution of barium in these soils may be a result of windborne deposition from burning operations at Flash Pads TA-16-386 and TA-16-387. The 1995 background samples and the baseline samples collected in the staging area, did not have significantly elevated barium, indicating that the region affected by burning operations is localized to the near-vicinity of the flash pads.

Ten soil samples were collected in 1998 from areas to be used for waste removal operations during MDA P closure. In this second campaign to measure baseline concentrations, samples were analyzed for metals, HE, gamma-emitting radionuclides, herbicides/pesticides, VOCs, and SVOCs. Three of these sample locations were southwest of the west lobe of MDA P, the remaining samples were located in the immediate areas of the PRSs in the MDA P cluster. Two samples failed the barium TCLP waste criterion (maximum concentration of contaminants for the toxicity characteristic) of 100 mg/L. No organic chemicals were detected above approximately 2-3 times detection limits. These data indicate that these areas were essentially unaffected by PRS-related contamination with the exception of barium.

A number of sediment and water samples were collected in Cañon de Valle between 1994 and 1998. These samples do not indicate that different types of analytes are detected upstream and downstream of MDA P nor are concentrations of analytes such as barium, lead, and HE apparently present at higher concentrations downstream of MDA P than they are immediately upstream. The Cañon de Valle samples therefore indicate that any contributions to the canyon from MDA P are not distinguishable from other contaminant sources.

In conclusion, field surveys and existing environmental data for areas beyond the immediate location of the MDA P PRS Cluster, show that no metal contamination is widespread in the area. Samples in outlying areas for other analytes exist in only one direction from the MDA P cluster and for only three samples; therefore existing data are inconclusive regarding widespread soil contamination for chemicals other than metals. Fragments of HE, however, are suspected to occur at some distance from the MDA P Cluster, based on field surveys. The contribution of MDA P contamination to surface water and sediments in Cañon de Valle appears indistinguishable from upstream sources.

Nature and Extent of Contamination within MDA P PRS Cluster

Many of the environmental samples collected at these PRSs show some evidence of chemical contamination. Since the areas from which these samples were collected are subject to operational impacts, however, these data cannot be directly applied in the future to evaluate the extent of contamination for post- MDA P closure conditions. The data can be used, however, to identify the types of contaminants associated with historical PRS releases to date. Information on the relative concentration of contaminants at the location of these environmental samples can also be used in conjunction with site reconnaissance prior to Phase II sampling to select confirmatory sampling locations.

The four samples collected at the septic system [PRS 16-006(e)] showed no evidence of contamination. As described in Attachment 1, residual contamination was discovered at locations within the other MDA P Cluster PRSs. The principal contaminants observed in soil samples collected at barium nitrate pile consolidated PRS [at the barium nitrate pile and Flash Pad TA-16-387] are barium, lead, uranium, HE, and phthalates. All of these chemicals are associated with the types of contaminants stored or handled at these PRSs. Phthalates were used as plasticizers in certain HE formulations. PAHs were infrequently observed in soil samples, and may have resulted from incomplete combustion of organic materials such as wood forms at the TA-16-386 Flash Pad. Barium and chromium were measured above background in tuff samples at this location. The barium concentrations observed were generally lower than those measured in soil. The presence of elevated chromium in the tuff samples, when chromium was not observed above background in soil samples, is unexpected and anomalous relative to observations in the baseline samples.

The principal contaminants observed in soil samples collected at Flash Pad TA-16-387 are barium, lead, cadmium, silver, and HE. Trace levels of certain SVOCs including phenol, dichlorobenzene, and two PAHs were measured in one of ten samples, but the concentrations were found to be at or below analytical detection limits. No tuff samples were collected at this PRS.

Samples of soil from overburden placed on MDA P were collected from exploratory trenches in 1997 for the purpose of waste characterization. As anticipated, barium, lead, phthalates, and PAHs were observed. However, trace levels of dioxins, certain environmentally persistent pesticides, and PCBs were infrequently observed in these samples. These contaminants are ubiquitous at very low concentrations in

the Laboratory environment and were never measured above approximately 2-3 times their detection limits.

Common contaminants between PRSs 16-010(a) and 16-016(c), PRS 16-010(b), and the east lobe overburden soil include barium, lead, and HE. With the exception of total uranium, the other metals observed are included in the metals analyses that will be requested for the confirmatory sampling. Because phthalates and PAHs were observed in some samples, and because their presence is consistent with historical knowledge of the types of contaminants associated with these PRSs, SVOC analyses are also proposed for a percentage of the confirmatory samples (see Section 2.2.3). Because uranium, pesticides, dioxins, and PCBs were observed sporadically and at very low concentrations, a decision of whether to include these analytes in confirmatory sampling will await evaluation of Phase I waste characterization data. If these or other analytes additional to metals, HE, and SVOCs are found to be representative of the disposed waste at MDA P, they will be included in the analytical suites for confirmatory samples.

Stormwater runoff samples from interceptor trenches located between MDA P and Cañon de Valle were collected in December of 1998. The analytical results indicated that the water was not characteristically hazardous (did not exceed the maximum concentration of contaminants for the toxicity characteristic). The concentrations of metals and HE reported were similar to concentrations seen in surface water samples taken from Cañon de Valle. The samples collected at MDA P cluster PRSs did not conclusively bound the extent of contamination. It is clear from the existing soil data that contaminants associated with the barium nitrate pile consolidated PRS have migrated down a natural drainage towards Cañon de Valle, but current best management practices prevent potentially contaminated stormwater and sediments from reaching Cañon de Valle. A review of existing soil data also shows that barium and HE tend to be collocated; that is, elevated concentrations of one are correlated with elevated concentrations of the other. This information will be used to develop the confirmatory sampling design in Section 2.2.3.

2.2.2.2 Fate and Transport

The objective of this discussion on chemical fate and transport is to support sampling activities by evaluating those processes that affect the occurrence of contaminants in the environment. Because the principal contaminants identified in Section 2.2.2.1 are barium, lead, and HE, this discussion will focus primarily on these chemicals. The factors affecting chemical fate, such as chemical transformation, adsorption on soil particles, and precipitation are discussed first. An evaluation of transport processes such as erosion, infiltration, and volatilization is then provided that draws on some of the information presented for chemical fate.

Chemical Fate

The environmental fate of the principal HE contaminants detected in previous sampling (TNT, RDX, 2,4-DNT and HMX) is expected to be relatively similar. Each of these chemicals tend to be relatively immobile in soils due to low volatility and their tendency to adsorb onto soil particles, rather than dissolve into soil pore water. None of these HE contaminants are expected to quickly biodegrade under the aerobic soil and tuff conditions that exist in the environment. The presence of aminodinitrotoluenes (2-amino-DNT and 4-amino-DNT), the primary metabolites of TNT, in one sample at PRS 16-016(c) indicate that some biodegradation of TNT may be occurring. The dinitrotoluenes, detected in the 1997 trench samples from the west lobe of MDA P, are likely present due to impurities in the TNT source material, rather than chemical or biological degradation. Both TNT and HMX are susceptible to photolytic decomposition, a

process that may be important in limiting the importance of aeolian mechanisms for transport of these chemicals in the environment.

Barium occurs in the +2 oxidation state in the environment and is known to preferentially bind via cation exchange to clay particles and soil humus. This mechanism results in barium being a relatively immobile element in soils. Barium is also known to readily form compounds such as barium carbonate and barium sulfate in soils. The formation of these relatively insoluble compounds of barium, occurring when free barium cations are liberated from clay or humus binding sites, limits the mobility of barium in terrestrial systems. The complexing of lead in soils is similar to that of barium, as would be expected since both are divalent metals. Like barium, lead will also form stable complexes with organic matter as well as relatively insoluble precipitates with anions such as carbonate and phosphate. Since the organic matter content of Pajarito plateau soils is generally low, cation exchange and the formation of insoluble complexes with anions are expected to be the primary processes that limit the solubility of these metals within the MDA P investigation area.

It is known that barium contained in the barium nitrate pile and present as contamination in materials flashed on the flash pads was primarily barium nitrate. During combustion on the flash pads, particulate matter containing barium may be released to the surrounding soil environment and will eventually convert to stable compounds (such as barium carbonate). Therefore, residual barium contamination in much of the investigation area would be expected to be insoluble, as discussed above. Barium as barium nitrate is relatively soluble, however, and barium in a dissolved state may have been released to the environment while barium nitrate was present on the ground surface in the barium nitrate pile. Because large pieces of barium nitrate have been discovered within MDA P, it is possible that migration of soluble barium from MDA P may also be of concern.

Bioaccumulation for certain constituents from soil may be part of the environmental fate for the principal HE, phthalates, and metals. Constituents that bioaccumulate are those that persist in an organisms tissues, blood, or cellular fluids over time. These constituents are not readily excreted or are excreted more slowly than they are accumulated by an organism. Thus, whether a constituent bioaccumulates depends on its availability and form in the environment, the rate of uptake for a given organism, as well as rates of excretion for particular organisms. The State of New Mexico lists the following potential bioaccumulators, specific to the potential contaminants identified in Attachment 1 of this SAP: bis(2-ethylhexyl)phthalate, 2,4,6-TNT, Ba, and Pb.

Chemical Transport

The primary mechanism of contaminant transport at this site is expected to be erosion due to surface water runoff. The actual relevance of this transport mechanism for future migration of residual contaminants is highly dependent on final site conditions including the presence of run-on controls, contouring of the site including addition of clean fill on top of the remediated surfaces, and the coverage and type of remaining vegetation or of revegetation efforts. Diversion trenches for capturing run-on to MDA P, and interceptor trenches for capturing sheet flow below MDA P, are currently in place to limit migration. Following the completion of Phase I waste removal and sampling, these trenches will be removed. The site will be stabilized and restored after Phase II sampling is completed. Site restoration will minimize, to the highest degree possible, the amount of runoff from MDA P. Details regarding the erosion controls and other pollution prevention practices in place at MDA P are given in the Storm Water Pollution Prevention Plan (LANL 1999, ER ID 63399).

Because site contaminants are expected to show very low solubility over much of the investigation area, transport of dissolved chemicals, including migration into tuff, is expected to be insignificant. In the unlikely case that moisture may have accumulated below MDA P, the types of materials predominantly disposed of at MDA P (construction debris, barium sand, HE-contaminated materials, and wastes from HE synthesis and processing) would not be expect to generate acidic leachate from decomposition of organic matter (such as that observed in municipal landfills). The organic materials that were placed in MDA P consisted of construction timbers and partially burned trees and would not be expected to have significantly decomposed over the past few decades. For these reasons, cationic metals (such as barium and lead) would generally not be expected to have moved in solution.

As described above, where barium nitrate is present in high concentrations migration in the dissolved state may be expected. If sufficient moisture was collected beneath the MDA P due to run-on and precipitation, migration of dissolved barium either into the tuff or as interflow (flow at the soil/tuff interface) may be possible. Because MDA P exists on a steep slope, migration of any dissolved barium as interflow to Cañon de Valle would be expected to predominate. Investigation of the MDA P for guiding Phase I activities has shown that a pre-existing drainage channel exists beneath MDA P. This channel may have served to collect any liquids moving downwards through MDA P. The location of the boreholes between MDA P and the stream channel of Cañon de Valle will include the region below this pre-existing drainage channel.

The eventual importance of airborne resuspension and redistribution of contaminated surface soil is difficult to predict in advance because this transport mechanism is highly dependent on such factors as were described for water-driven erosion. It is suspected that this transport mechanism is responsible for much of any residual contamination observed to the east and west of the MDA P cluster. However, the source of any such contamination (from burning at Flash Pads TA-16-386 and TA-16-387) will not be present in the future and, therefore, this mechanism is not expected to play as potentially significant a role for contaminant migration in the future as it may have had in the past. The force of detonations of any sizable pieces of HE during "flashing" of HE-contaminated materials is a possible source for the HE fragments observed throughout the exclusion zone. It is anticipated that some airborne contamination to the investigation area may continue due to active RCRA burn structures more distant from MDA P.

2.2.2.3 Human and Ecological Exposure Models

The area in and around MDA P is predicted to be used for continued Laboratory operations into the foreseeable future. Although the general area may be slated for continued industrial use, it is possible that the particular areas addressed in this SAP may remain undeveloped following closure activities. If new activities were to occur in the area, they would likely occur on the relatively flat mesa top portion of the MDA P investigation area. A Laboratory employee or construction worker scenario would be most appropriate for the mesa top area of MDA P, in the eventuality that the area is developed following MDA P closure. Potentially complete exposure pathways for both human and ecological mesa top receptors for metals, HE, and SVOCs include direct soil ingestion, dermal absorption via skin contact, and inhalation of contaminated soil as dust. Ecological receptors may also be exposed to these contaminants via food uptake.

The mesa slope in the area of MDA P is very steep and construction of permanent structures on this terrain is considered infeasible and will not be included as a potentially viable land use scenario. Potential human exposure along the mesa slope will be addressed via a recreational scenario, consistent with occasional visits by an individual who is hiking, birding, or engaged in similar activity. Because Laboratory employees frequently engage in such activities, a recreational scenario is consistent with continued

restricted access to the area for the public. Depending on how and if the mesa top is developed for industrial purposes, a recreational scenario may also apply to the mesa top.

Individuals engaged in hiking or birding are likely to cover considerable terrain. Consequently, the entire area of the small watershed that contains this investigation is considered a plausible area for exposure assessment. An appropriate area for industrial/commercial human receptors is more difficult to define because the actual activities that might result in exposure (construction or maintenance, or indoor exposure to dust with a soil component) are not intuitively associated with a particular area. In such cases, collecting data in such a way that exposure concentrations can be calculated for varying spatial scales is a reasonable approach because it is possible to determine the consequences of specifying one or another size for an exposure area. The same principle is useful for ecological assessment because the appropriate scale for evaluating the risks to an ecological population is likewise difficult to assign *a priori*. Exposure concentrations for several spatial scales will therefore be used to evaluate potential ecological impacts for the target ecological receptors.

Target ecological receptors for use in screening ecological risks have been tentatively approved by NMED for terrestrial biota. Receptors were chosen to be generally protective of the terrestrial food web developed for LANL grounds. The list of terrestrial receptors currently includes:

- A generic plant species;
- An unspecified earthworm;
- Desert cottontail;
- Vagrant shrew;
- Field mouse;
- Gray fox;
- American Robin;
- American kestrel (omnivorous insectivore/carnivore);
- American kestrel (carnivore)

Aquatic ecological receptors will not be included in the investigation of MDA P, as these will be considered as part of the investigations for Cañon de Valle.

Exposure to potential bioaccumulators is part of the consideration given to ecological receptors. As discussed above, bioaccumulation for certain constituents from soil may be part of the environmental fate for the principal HE, phthalates, and metals contaminants. For HE, the only principle constituent considered a potential bioaccumulator is 2,4,6-TNT. The metabolites of TNT, mentioned above, have been shown to persist in tissues of various organisms (Johnson et al. 1999, ER ID 63115; AQUIRE database 1997, ER ID 62898). These metabolites have been shown to have persistence in biotic tissues and may have deleterious effects on various organs and may also have negative reproductive effects for certain organisms over time. Similar effects may be manifest for bis(2-ethylhexyl)phthalate as well as the metals Ba and Pb. Although the toxicity of Ba and Pb varies with the associated anion, each have been shown to have a variety of toxic effects for a wide variety of organisms.

2.2.2.4 Data Gaps

Phase I waste removal activities at MDA P are intended to identify and remove both waste pile debris and contaminated soil and fill from the environment. The following data gaps pertain to uncertainties that are expected to exist regarding the condition of the MDA P cluster following Phase I activities. These data gaps include the following:

- What analytical suites, if any, are associated with contaminants identified in Phase I waste characterization samples in addition to metals, HE, and SVOCs?
- What is the spatial extent of visible HE to the east and west of the operational exclusion area?
- What areas within the MDA P exclusion zone are most likely to have received contamination associated with closure operations?

When these data gaps are filled, it will be possible to address the following specific data gaps to assess human and ecological risk;

- What contaminants of anthropogenic origin remain in the environment in the MDA P investigation area?
- What is the spatial extent of residual soil and tuff contamination in the MDA P investigation area?
- What are the mean and variance of contaminant concentrations in the environment and do these change over varying spatial scales within the MDA P investigation area?
- What is the potential for residual contamination to migrate into Cañon de Valle?
- What, if any, bioaccumulators remain on site and in what concentration?

2.2.3 Sampling Activities

This section provides details on the sampling protocols to be conducted under the activities outlined in Section 1.2. These protocols comply with protocols specified in the approved MDA Closure Plan, while also filling Phase I and Phase II data gaps identified in Section 2.2.2. The proposed sampling is expected to be adequate to confirm clean closure of MDA P and theTA-16-387 Flash Pad and to confirm NFA following the VCA at the barium nitrate pile consolidated PRS.

2.2.3.1 Contamination Source

Characterization of the source of contamination has been conducted under previous investigations, including exploratory trenches at MDA P and under individual PRS sampling campaigns. These data are summarized in Attachment 1 to this SAP. Additional source characterization data will be collected during sampling of the waste in Phase I. Therefore, all sampling and analysis activities detailed in this section will target environmental media.

2.2.3.2 Media Characterization

Although the scope of this sampling plan primarily addresses Phase II data gaps and confirmatory sampling, activities to fill Phase I data gaps are also addressed in this section. Phase I activities associated are included here in order to ensure that sufficient information is available to conduct Phase II

operations in an efficient and technically defensible manner. Coordination of Phase I and Phase II data collection activities will also minimize the probability that Phase II confirmatory data will reveal unacceptable contamination.

Phase I Activities

Several Phase I data gaps were identified in Section 2.2.2.4. These data gaps will be addressed prior to implementation of Phase II confirmatory sampling. Information to address these data gaps will be collected by performing field surveys and evaluating Phase I waste characterization data. Phase I activities also include field analyses for barium, lead, and HE to determine whether residual soil concentrations are likely to be acceptable prior to Phase II sampling. Guidelines for removing soil or fill during Phase I are provided in this section with supporting information in Section 3.1. Because Phase I data collection does not fall directly under the scope of this SAP, procedures for surveying, sample collection, or other activities are not addressed.

Guidelines for Field Decisions on Phase I Soil Removal

Identification and removal of contaminated soil, fill or tuff during Phase I operations while equipment is already mobilized is considerably more cost effective than remobilization at a later date. Such removal also minimizes the possibility that Phase II confirmatory sampling will reveal unacceptable residual contamination. To facilitate field decision regarding when sufficient soil and tuff have been removed, preliminary remediation goals (PRGs) have been identified and are provided in Section 3.1 of this SAP. The PRGs are intended to apply to environmental media that may be left in place following closure activities. These PRGs are not intended to reflect definitive cleanup standards but are useful for ensuring that Phase I removal targets likely contaminants in addition to barium. Section 3.1 provides further details on the derivation and application of PRGs for Phase I decisions.

Field Survey and Soil Sampling

Based on the results of existing surveys within the Exclusion Zone (as described in Attachment 1) it is probable that visible fragments of HE exist beyond the Exclusion Zone boundaries. Therefore, a field survey of the areas east and west of the extended sampling grid will be conducted to establish the approximate boundaries of visible HE and to remove this material from the environment. The locations from which HE fragments are removed will be flagged or otherwise recorded by the personnel conducting the survey so that the extent of visible HE contamination can be reported. The chunk HE sweep of the investigation area is also a health and safety issue and will be conducted as part of this SAP prior to Phase II sampling. HE sweeps of the area will be performed for health and safety as part of Laboratory policy prior to any future activities in the area.

The construction phase within the Exclusion Zone is complete and site maps will be updated to reflect final locations of roads, staging and handling areas. Any additional physical changes that take place during waste removal or soil excavation operations associated with the closure plans and VCA plan are supported by this SAP should be documented in the final site map.

Within the area of the Closure Units, Phase I personnel will evaluate residual barium, lead, and HE contamination on a 10 m by 10 m grid cell basis. Although this grid is extended further for the purpose of Phase II sample collection, Phase I personnel expect to measure residual soil, fill, and tuff contamination in areas outside of MDA P and theTA-16-387 Flash Pad by judgmentally choosing sampling locations. The rationale for the selection of judgmental sampling locations will be documented. Sampling locations

should also be flagged or otherwise recorded so that field analytical results can be correlated with definitive locations. The number of judgmental locations chosen for Phase I sampling is not specified in this SAP. However, Phase I sampling team will use the minimal number of Phase II samples proposed in the spatial scales outside the Closure Units as a guide.

Waste Characterization

Data collected to characterize waste removed from the MDA P east and west lobes will be evaluated for potential suites of analytes that will be included in Phase II confirmatory sampling. These samples are being sent for fixed laboratory analyses. The expectation prior to analysis of the Phase I waste characterization data is that confirmatory sampling will include HE, SVOCs, and inorganic chemicals. This expectation is based on results of data analysis presented in Sections 2.2.1 and 2.2.2 of this SAP. If chemicals associated with other analytical suites are detected in a significant number or fraction of the samples and/or at significant concentrations, these suites will be added to some or all of the Phase II samples. A protocol for determining how additional suites will be identified based on the Phase I waste characterization data (in terms of defining the fraction of samples detected or the magnitude of concentrations that will be considered significant) has not be finalized at the time this SAP was written.

Confirmatory Sampling Activities

The following text provides information on the technical approach for collecting confirmatory samples, the types of samples to be collected, and the associated analytical suites. Procedures for sample collection and specific information on laboratory analyses and quality assurance measures are discussed in Section 3 of this SAP.

Confirmatory Sampling

The objectives of the Phase II investigation are determining nature and extent of residual contamination and calculation of spatially-averaged contaminant concentrations within the investigation area to support assessment of the potential human health and ecological impacts associated with residual environmental contamination. Samples will be collected from strata that are associated with likely differences in residual contaminant concentrations. As shown in Figure 2-1, the strata from east to west are: (1) eastern extent (within the Investigation Area and beyond the Exclusion Zone), (2) eastern Exclusion Zone (beyond the PRS Cluster), (3) the Closure Units (samples from areas associated with the lobes of MDA P and TA-16-387 Flash Pad), (4) the PRS Cluster excluding the Closure Units, (5) western Exclusion Zone (within the Investigation Area and beyond the PRS Cluster), and (6) western extent (within the Investigation Area and beyond the Exclusion Zone).

It is anticipated that the strata will be combined on the following spatial scales. From small to large these scales, identified in Figure 2-1, include:

- the Closure Units: MDA P, and theTA-16-387 Flash Pad,
- the PRS Cluster: the contiguous area encompassing the Closure Units and PRSs 16-016(c), 16-010(a), and 16-0006(e),
- the Exclusion Zone: the PRS Cluster and all areas impacted by closure activities as defined during Phase I operations, and
- the Investigation Area: the Exclusion Zone and the east and west extent of contamination outside of the Exclusion Zone boundary.

The numbers and types of confirmatory samples in Table 2-6 and discussed in detail in the paragraphs below.

The Closure Plan originally proposed sampling the MDA P lobes based on a 10 by 10 meter grid (Figure 4.1 of the Closure Plan). To ensure consistency with the Closure Plan, the Closure Unit strata (consisting of MDA P and the TA-16-387 Flash Pad) will be sampled on a 10 by 10 m grid by a discrete grab (soil) or auger (tuff) sample taken from the center of grid cells at a depth of 0 -12 inches This will result in approximately 87 samples (see Figure 2-1). Samples will be analyzed for HE, SVOCs, inorganic chemicals, and for any other suites indicated by evaluation of waste characterization data (according to the final protocol). This approach is both consistent with the MDA P Closure Plan and facilitates data collection for closure of the TA-16-387 Flash Pad. Contamination at depth below MDA P is not expected based on the conceptual site model (Section 2.2.2). In order to confirm that contamination has not penetrated the tuff below MDA P or the flash pad, a second sample will be collected by auger at some grid cell locations at a depth of 24 - 36 in. below the surface. Ten percent of the grid cells collected from the area of the MDA P will be chosen at random for the depth samples. Three of the approximately 12 grid cells at the TA-16-387 Flash Pad will be selected and sampled at depth in an identical manner. The MDA P Closure Plan does not require depth samples. This sampling plan includes them to look for evidence of leachate through the waste pile and to establish vertical extent.

To facilitate the sampling design outside the Closure Units, the 10 by 10 meter grid was expanded to cover the PRS Cluster and Exclusion Zone.

MDA P excavation activities have affected the Exclusion Zone by extensive grading, and application of fill to construct roads and staging areas to fulfill closure objectives. Since the area within the PRS Cluster is anticipated to be most impacted by operational activities, and because this is also where residual contamination from historic PRS activities may be found, the grid cells within the PRS Cluster (but outside the Closure Units) will be sampled using 0 – 12 in. sample intervals at the relatively high density of approximately every other cell (see Figure 2-1) for a total of approximately 50 samples. Areas occupied by buildings within the PRS cluster will not be included in the sampling. Based on the review of existing data (see Attachment 1), contamination at depth is not expected to be observed in the PRS Cluster area. However, ten percent of the surface sampling locations will be chosen at random and a 24 - 36 in. sample will be collected by auger to confirm that contamination at depth is not present.

Excavation activities will ultimately define the Exclusion Zone making the final boundary of this area difficult to anticipate at this time. Physical changes to the original MDA P landscape are extensive and pervasive such that sampling each cell in the expanded grid outside the PRS Cluster may not provide a representative and cost effective characterization of residual contamination for use in a risk assessment. Given this conclusion and since ongoing closure activities make the final site characteristics uncertain prior to completion of Phase I, sampling of grid cells within the Exclusion Zone but outside the PRS Cluster will be judgmentally based. Samples collected from depth using an identical protocol as described for the PRS Cluster area should be collected from eight locations in the Exclusion Zone, four locations to the east and four to the west of the PRS Cluster area.

Although the final number of grid cells to be sampled at surface intervals cannot be determined at this time, it is estimated that at least 25 percent of the cells within the Exclusion Area to the west of the PRS Cluster and 15 percent to the east of the PRS Cluster should be sampled. This sampling density will result in approximately 10 or more samples from the area west of the PRS Cluster within the Exclusion

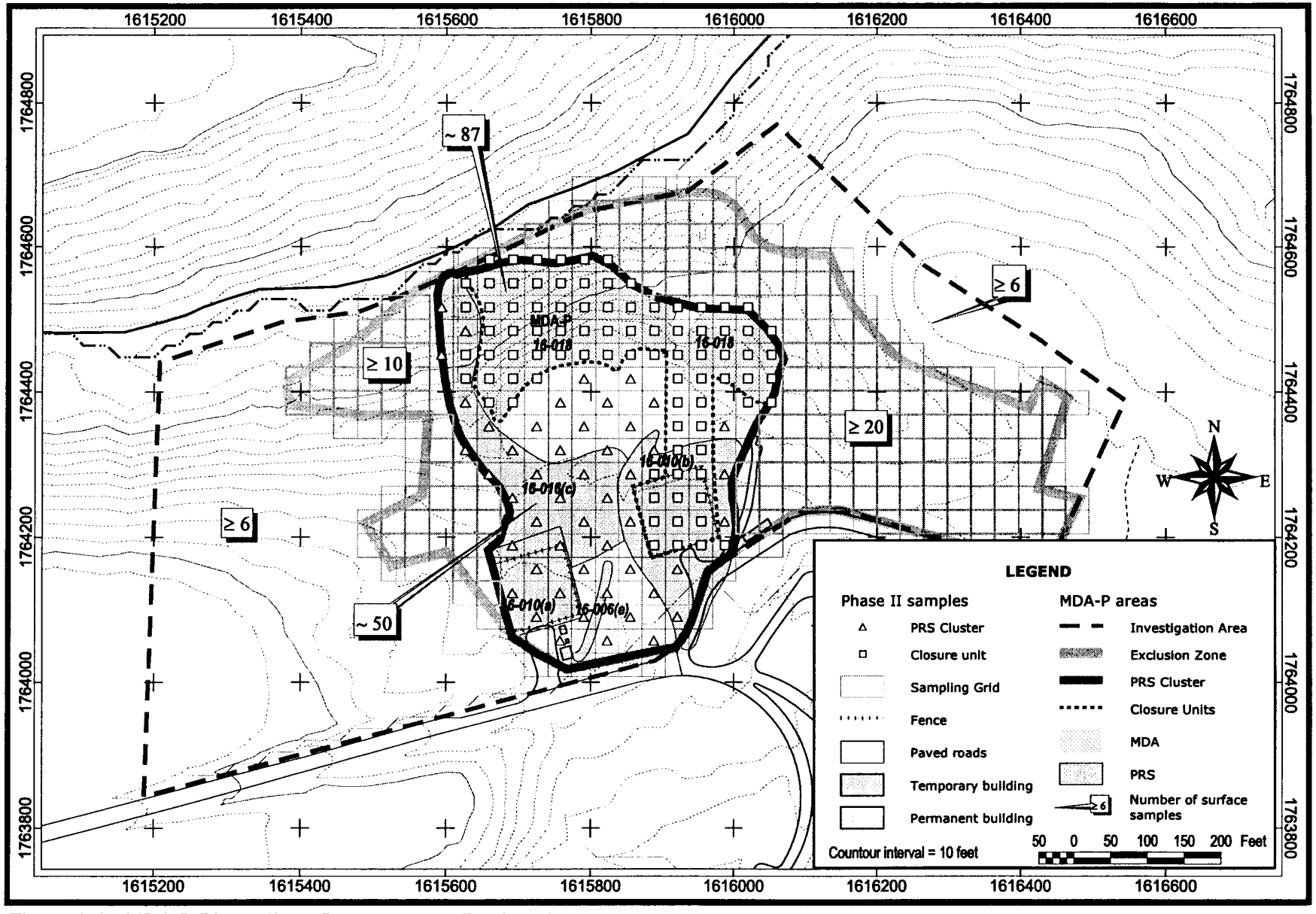


Figure 2.1. MDA P Phase II confirmatory sampling locations.

Area, and 20 or more samples from the area to the east (Figure 2-1). The minimum number of samples should provide sufficient data to determine if average contaminant concentrations at this spatial scale differ from concentrations at other scales. The statistical tests proposed for discriminating among spatial scales are discussed later in this section. Information to be used in judgmentally selecting grid cells includes:

1) historical information on PRS locations,

2) historical data collected as part of PRS investigations,

3) the final site map, and

4) results of the chunk HE field survey and Phase I field analyses.

These four information sources will be composited using a graphical information system (GIS) to categorize grid cells into groups with similar characteristics. Cells will be chosen for sampling such that each cell category is adequately represented. Since this process can be implemented only after Phase I waste removal activities are completed, a final tally of the number and locations of grid cells to be sampled can not be made prior to the completion of Phase I.

At least six soil or fill samples each will be taken in western and eastern areas within the Investigation Area outside of the Exclusion Zone (see Figure 2-1). Although areas within the Exclusion Zone will be sampled using 0-12 in. sample intervals, this large interval is considered inappropriate in the undisturbed area beyond the Exclusion Zone where contaminant releases are associated primarily with surface deposition. A more traditional 0-6 in. sample interval is proposed for soils in this area. These sample locations will be based on an evaluation of the HE field survey and the results of field analyses. Sampling locations should predominantly be selected in areas where field analyses indicate potentially elevated residual contamination, but some samples should be located in other areas to confirm that residual soil contamination is in fact spatially correlated with visible HE and field screening results. Based on a review of existing environmental data, it is expected that residual soil and fill contamination in this area will be negligible due to distance from the flash pads that are the suspected source of airborne releases. If, however, field analyses indicate that HE or barium concentrations are elevated (50% of PRG values or higher) in Phase I samples an additional six samples will be collected in both western and eastern areas to better establish the extent and average concentrations of potential contaminants. Samples collected from depth using an identical protocol as described for the PRS Cluster area should be collected from three locations in the Investigation Area to the east and to the west of the Exclusion Zone.

Table 2-6 summarizes the Phase II confirmatory sampling at MDA P. Phase II soil, fill, and tuff samples will be analyzed for inorganic chemicals, SVOCs, and HE. Because SVOCs were observed to be less prevalent than barium and HE in existing environmental samples SVOC analyses are proposed for only a percentage of Phase II samples. After samples are collected from each spatial scale, the designated percent or number of samples to be analyzed for SVOCs will be selected at random from among the samples. After evaluation of Phase I waste characterization data, additional analytical suites may be selected for some samples. The basis for selecting additional suites for Phase II samples, and the final number of samples for spatial scales larger than the PRS Cluster scale, will be established subsequent to this SAP and documented in the final reports (closure reports for MDA P and for the TA-16-387 Flash Pad and VCA report for consolidated PRS 16-016(c)-99) that present the results of the Phase II investigation.

TABLE 2-6

Confirmatory Samples Table

Sampling Scale	Number	Medium	Analytical Suites	Sampling Method
Closure Unit	87 surface 12 at depth	Soil/Fill Tuff	Metals HE SVOCs[a]	Soil: 0-12 in. surface or auger grab Tuff: 0-12 in. auger core interval Tuff: 24-36 in. auger core interval
PRS Cluster	approx. 50 surface 5 at depth	Soil/Fill Tuff	Metals HE SVOCs[a]	Soil: 0-12 in. surface or auger grab Tuff: 0-12 in. auger core interval Tuff: 24-36 in. auger core interval
Exclusion Zone	At least 30 surface 8 at depth	Soil/Fill Tuff	Metals HE SVOCs[a]	Soil: 0-12 in. surface or auger grab Tuff: 0-12 in. auger core interval Tuff: 24-36 in. auger core interval
Investigation Area	At least 12 surface Six at depth	Soil/Fill	Metals HE SVOCs[b]	Soil: 0-6 in. surface or auger grab Tuff: 24-36 in. auger core interval

a. SVOC analyses performed for (approximately) 25% of surface samples and (approximately) 50% of depth samples.

b. SVOC analyses performed for (approximately) 50% of surface samples and (approximately) 50% of depth samples.

Statistical tests will be used to determine if the distribution of COPCs among adjacent strata is significantly different. As shown in Figure 2-1, the adjacent strata from east to west include: (1) eastern extent (within the Investigation Area and beyond the Exclusion Zone), (2) eastern Exclusion Zone (beyond the PRS Cluster), (3) the Closure Units (samples from areas associated with the lobes of MDA P and TA-16-387 Flash Pad), (4) the PRS Cluster excluding the Closure Units, (5) western Exclusion Zone (within the Investigation Area and beyond the PRS Cluster), and (6) western extent (within the Investigation Area and beyond the Exclusion Zone). If it reasonable to assume that the data sets follow statistically Normal distributions, Analysis of Variance will be used to evaluate differences between the areas. If not, a non-parametric test will be employed for comparing the areas. Exploratory data analysis with graphical presentation will be performed prior to running any statistical tests.

Those areas which are adjacent and not significantly different may be combined when calculating spatially-averaged contaminant concentrations for risk assessment purposes. If contaminant concentrations for contiguous areas are significantly different, concentrations will be calculated independently for the areas. Exposure concentrations for larger scales may then be calculated by weighting the contaminant concentrations for the smaller areas proportionally to their size.

Cañon de Valle boreholes

After Phase II confirmatory sampling has been completed and the data evaluated, four boreholes will be drilled in Cañon de Valle between MDA P and the watercourse to a depth of 20 feet, as described in approved Closure Plan for MDA P. The location of the historical drainage below MDA P should be used to select the location of one of the boreholes. Samples will be taken in 5 foot intervals and analyzed for inorganic chemicals, VOCs, and semivolatiles. The vertical extent of contamination will be defined as the depth below which organic constituents are not detected or inorganic constituent concentrations are below the background UTLs. Data collected from these boreholes will aid in assessing the data gap regarding contamination migration from the MDA P to Cañon de Valle. These data will be provided to the Canyons Focus Area for evaluation in contaminant transport investigations in the watershed, but will not be used for assessing human or ecological risk associated with residual contamination within the Investigation Area.

3.0 DATA COLLECTION DESIGN AND PROCEDURES

3.1 Data Quality Objectives

The sampling design for this SAP is constrained since it is being written while Phase I waste removal operations are being conducted at MDA P. The final physical appearance of the MDA P cluster and Exclusion Zone cannot be foreseen prior to completion of Phase I activities; therefore, a sampling design that uses judgmental criteria for choosing sampling locations cannot be completed. For this reason, where judgment is called for in choosing the number or locations of samples, this SAP is limited to describing the factors contributing to these judgments.

Data quality issues related to SAP implementation include:

- Adequate sample support to perform statistical tests for differences in contaminant concentrations among spatial scales;
- Adequate sample support to allow a subjective evaluation of spatial trends of contaminant concentrations in soil and fill in x, y, and z dimensions;
- Adequate sample support to allow a subjective evaluation of trends of contaminant concentrations with depth in tuff.

Data adequacy for evaluating spatial trends and performing statistical tests is addressed in Section 2.2.3 of this SAP. In summary, the statistical tests for determining whether contaminant concentrations differ with spatial scale will also test whether contaminant concentrations are decreasing with distance from the area of PRS releases and closure operations. These tests will therefore be used to establish spatial trends. Graphical plots of the Phase II data will also be used to assess whether contaminant trends are decreasing with distance from source areas.

A comparison of analytical detection limits with ER Project background values and risk-based PRGs is provided in Table 3-1 in Section 3.2. Analytical suites for Phase II sampling include TAL metals, HE, and SVOCs. Background values for soil and tuff are available for most of the TAL metal analytes. It is desirable to achieve detection limits below these background values, even when risk-based levels are considerably higher, because this allows for evaluation of whether a site-related release has occurred. Identifying the nature of residual site contamination is an important component of confirming the site conceptual model.

SVOC analyses are not proposed for every Phase II sample. Existing samples (see Attachment 1), as well as process knowledge, indicate that barium and HE are the primary contaminants in the investigation area and that elevated concentrations of these and other less prevalent contaminants should be collocated. Phase I removal activities that address residual barium and HE in the environment using the PRGs provided below are therefore also expected to address other residual contaminants. SVOC analyses will be performed on a fraction of the samples from each of the four spatial scales, as discussed in Section 2.2.3. The limited SVOC analyses requested are judged to be sufficient to establish residual concentrations of SVOCs and determine whether elevated concentrations of these analytes are in fact collocated with barium and HE.

Depending on the results of Phase I waste characterization sampling, additional analytical suites for Phase II sampling may be specified. A protocol for determining how additional Phase II analytical suites are to be identified will be finalized after this SAP is produced. If additional suites are identified, the

information in Table 3-1 will be updated prior to sample collection to ensure that analytical detection limits are adequate for site decisions. In Table 3-1, PRGs are provided only for those analytes identified as chemicals of potential concern in the conceptual model (Section 2.2.2) of this SAP.

Background Values and PRGs

Background values (BVs) used for comparison with sample data are those summarized in Inorganic and Radionuclide Background data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory" (Ryti et al. 1998, ER ID 58093). The BVs for soil will be applied to backfill. Treating backfill as soil for the background comparisons is prudent since contaminant concentrations at or below background levels do not distinguish the site from a risk-based perspective regardless of the origin of the contamination. Analytical detection limits for the TAL metals are provided in Table 3-5. No BVs are available (or appropriate) for HE or SVOC analytes.

With the exception of barium (discussed below), the PRGs presented in this SAP are based on human health effects and industrial land use conditions, the most likely future use for accessible portions of the MDA P investigation area. Although the relationship of these PRG concentrations to ecological screening values is discussed below, these PRGs are not directly a product of ecological assessment and therefore are not intended to represent acceptable (final) levels of residual contamination for the MDA P investigation area. An ecological assessment that addresses the potential impacts associated with residual levels of soil contamination will follow analysis of the Phase II confirmatory data. Similarly, the applicability of the PRGs for site decisions related to human health effects will also be evaluated after analysis of the Phase II confirmatory data. The tabulated PRGs (Table 3-1) are intended to represent soil concentrations that, if greatly exceeded in an appreciable volume of soil, will likely result in findings of unacceptable risk under any foreseeable human or ecological exposure conditions. The tabulated PRGs' primary function is to provide guidance during Phase I operations for the removal of soil, fill, and tuff so that the likelihood that additional material will need to be removed following Phase II sampling is minimized.

Analytes identified as chemicals of concern in the data review (Attachment 1) and conceptual model (Section 2.2.2) of this SAP include barium, lead, HMX, RDX, 2,4,6-TNT, dinitrotoluenes, PAHs, and phthalates. Of these chemicals, barium, lead, and the HE analytes (HMX, RDX, 2,4,6-TNT, and dinitrotoluenes) were observed with relatively high frequency and at elevated concentrations relative to background and/or detection levels in previous sampling events. They are also the chemicals for which the Phase I team is presently prepared to perform field analyses. For this reason, the PRGs for these chemicals will be used during Phase I operations for comparison with the results of field analyses to determine whether areas are sufficiently "clean" to cease removal of soil, fill, or tuff.

The PRG proposed for barium (2,500 mg/kg) is based on a conservative assumption that a barium soil sample concentration of 2,500 mg/kg by XRF analysis would produce a result of less than 100 mg/L by TCLP analysis. The value of 100 mg/L for barium is identified as characteristic of a hazardous waste and as such must be removed from the environment during clean closure under RCRA. This will be used as a PRG throughout the investigation area with the understanding that risk-based criteria may be applied at a later date. The risk-based level for barium in industrial soils provided by EPA Region 6 is in excess of 100,000 mg/kg.

Human health PRGs for the MDA P Phase I and II sampling campaigns are provided in Table 3-1. The PRGs for the remaining chemicals of concern are identical to the industrial soil screening levels published as EPA Region 6 Human Health Medium-Specific Screening Levels, October 1998. The Region 6 values

are risk-based levels that are derived using exposure assumptions that are identical to those employed by EPA Region 9 in the calculation of their PRGs. However, because EPA Region 6 employs a target risk level of 10^{-5} rather than 10^{-6} for Class C carcinogens, some PRG values differ from those tabulated by Region 9. Furthermore, the industrial scenario PRG for lead differs between Region 6 and Region 9 because Region 6 employs a different lead uptake model that is specifically parameterized for adults.

TABLE 3-1

Human Health PRGs for MDA P Phase I and Phase II Sampling Campaigns

Analyte	Soil Value (mg/kg)	Toxicity Basis for PRG
Barium	2,000	RCRA waste criterion; not a risk-based value
Lead	2,000	noncarcinogen
4-Amino-2,6-dinitrotoluene	530[a]	PRG for 2,4,6-TNT used as a surrogate
2-Amino-4,6-dinitrotoluene	530[a]	PRG for 2,4,6-TNT used as a surrogate
2,4/2,6-Dinitrotoluene	4.4[b]	B2 carcinogen class; 10^{-6} risk
HMX	53,000[c]	noncarcinogen
RDX	270[c]	C carcinogen class; 10^{-5} risk
2,4,6-Trinitrotoluene	530	noncarcinogen
Dibutyl phthalate	100,000	"ceiling" limit, not a risk-based value
Bis(2-ethylhexyl)phthalate	210	B2 carcinogen class; 10^{-6} risk
PAHs [benzo(a)pyrene]	0.36[d]	B2 carcinogen class; 10^{-6} risk

a. No EPA-approved toxicity values are available for aminodinitrotoluenes. The PRG for 2,4,6-trinitrotoluene is used as surrogate because aminodinitrotoluenes are the primary known metabolites of TNT in the body. Also, these aminodinitrotoluenes are not distinguishable from TNT by SW-846 Method 8515 used for field analysis in Phase I.

b. The potential presence of dinitrotoluenes in this area is based on their presence as trace impurities in TNT. Their concentrations in the MDA P investigation area following waste removal are therefore expected to be negligible. This contention is consistent with the results of existing HE data from PRSs in the MDA P cluster. For this reason, and because dinitrotoluenes are not distinguishable from 2,4,6-TNT by SW-846 Method 8515 for field analysis in Phase I, the PRG for 2,4,6-TNT should be used as a guide for soil and tuff removal during Phase I.

c. RDX and HMX are not resolved by SW-846 Method 8510 used for field analysis in Phase I. Based on existing data and historical knowledge of operations, RDX is expected to be more prevalent than HMX in this area. For this reason, the PRG for RDX should be used as a guide for soil and tuff removal during Phase I.

d. Benzo(a)pyrene is the most potent carcinogen among the PAHs and has the most restrictive PRG. PRGs for other PAHs are significantly less restrictive; the risks associated with PAHs in soil are therefore contingent on the actual prevalence and concentrations of the specific PAHs

Decisions to release an area following Phase I operational activities will be based on the results of field analyses by XRF and HE analyses in a mobile laboratory. Phase I samples will be collected on a 10m x 10m grid extending over the east and west lobes of MDA P and the TA-16-387 Flash Pad, and from judgmentally chosen locations within areas used for operational support during removal of waste materials. If Phase I field analyses indicate that residual concentrations of barium, lead, and HE in a grid cell are clearly well below the PRG values, removal of the material should not be considered. If field analyses indicate that concentrations in a grid cell exceed one or more of these values, additional material should be removed from the environment. Judgment must be exercised where Phase I analytical results are approximately equal to PRG values. In such cases the mobility of the affected medium and the number of analytes with concentrations exceeding these values should be considered.

Because the PRGs are *preliminary,* and do not address ecological effects, definitive guidance on how to make field decisions relative to these PRGs is not provided in this SAP. As field data are collected, Phase I project managers must weigh the relative costs and efficiencies of removing contaminated soil before Phase II sampling and assessment against the possibility that confirmatory sampling and assessment will

indicate the need to initiate further remedial actions. To assist managers in making Phase I cleanup decision relative to the barium, lead, and HE, for which they will have data from Phase I field analyses, these PRGs are evaluated relative to a range of receptor-specific ecological screening values. Screening values are based on the methods of Ryti et al. (1999, ER ID XXXX) and LANL's Ecorisk Database (LANL 1998, ER ID Package 186)

Barium – Ecological screening levels (ESLs) for the target ecological receptors described in Section 2.2.2.3 of this SAP range from 40 mg/kg for the robin to 10,000 mg/kg for the kestrel as a carnivore. With the exception of the fox (3,800 mg/kg), the ESLs for the other target receptors are all at or below 1,000 mg/kg. A PRG of 2,000 mg/kg is therefore relatively high considering the range of ESLs available. Additionally, barium is considered to be a persistent bioaccumulator for ecological receptors. Residual concentrations in excess of 2,000 mg/kg are therefore expected to be increasingly problematic from an ecological perspective as the size of the affected area increases.

Lead - ESLs for the target ecological receptors described in Section 2.2.2.3 of this SAP range from 20 mg/kg for a generic plant to 5,900 mg/kg for the fox. In addition to plants, the earthworm (100 mg/kg) and robin (58 mg/kg) also have relatively restrictive ESLs. For the remaining receptors, ESLs range from approximately 500 to 2,000 mg/kg. The PRG is considered relatively consistent with the range of ESL values since most ecological receptors have ESLs within a factor of 4 of the PRG. Lead, however, is considered to be a persistent bioaccumulator for ecological receptors and therefore values in the lower range of the ESLs should be weighted more heavily.

TNT and related HE – The PRG recommended for use by Phase I personnel is 530 mg/kg. ESLs for 2,4,6-TNT for the target ecological receptors described in Section 2.2.2.3 of this SAP range from 2.6 mg/kg for the mouse to 1,200 mg/kg for the fox. Available ESLs for other target receptors however are 9.6 mg/kg (rabbit), 9.9 mg/kg (shrew), and 30 mg/kg (plant). A PRG of 530 mg/kg is therefore relatively high considering the range of ESLs available. Additionally, aminodinitrotoluene metabolites of TNT have been shown to have persistence in biotic tissues, and over time may have deleterious effects on various organs and reproductive processes for certain organisms (ATSDR ToxFAQs 1999, ER ID XXXX). Residual concentrations in excess of 530 mg/kg for TNT and the aminodinitrotoluenes are therefore expected to be increasingly problematic from an ecological perspective as the size of the affected area increases. For the dinitrotoluenes, the human health PRG of 4.4 mg/kg is expected to be reasonably conservative for ecological effects.

RDX and HMX - The PRG recommended for use by Phase I personnel is 270 mg/kg. ESLs for RDX for the target ecological receptors described in Section 2.2.2.3 of this SAP range from 5.2 mg/kg for the mouse to 5,200 mg/kg for the fox. For HMX, the ESLs range from 1.1 mg/kg for the mouse to 2,200 mg/kg for the fox. Available ESLs for most other target receptors range from near these minimum values up to approximately 50 mg/kg. A PRG of 270 mg/kg is therefore relatively high considering the range of ESLs available. Residual concentrations in excess of 270 mg/kg are therefore expected to be increasingly problematic from an ecological perspective as the size of the affected area increases. For HMX, the human health PRG of 53,000 mg/kg is expected to be unacceptable for potential ecological effects, although in practice it is the RDX PRG of 270 mg/kg that will be employed during Phase I.

3.2 Quality Assurance/Quality Control

Field Activities

LANL field operations are governed by standard operating procedures (SOPs). The field procedures that apply to this effort are discussed in Section 3.3. The field QA/QC activities specified in the SOPs will be adhered to during the sampling effort.

Field Quality Assessment

This SAP makes use of a small number of field QA samples to provide information on the contribution of field activities to overall sampling and analysis accuracy and precision.

The SAP calls for sampling within four spatial zones, or scales; the closure units, the area encompassing all former PRSs (PRS Cluster), the Phase I Exclusion Zone, and an area east and west bounding the extent of contamination (Investigation Area). Two field split duplicate samples will be collected from the Closure Unit scale. One field split duplicate sample will be collected from the PRS Cluster scale. One field split duplicate sample will be collected from both the east and west Exclusion Zone areas. One field split duplicate sample will be collected from both the east and west Investigation Areas. A split duplicate is defined as two portions of the same sampled interval. The purpose of these samples is to provide an indicator of variability within a specific sample location and how well the sample was homogenized before packing into the bottles. The results from these samples also provide a benchmark for evaluation of laboratory duplicate quality indicators. Split duplicates will be submitted in this manner for TAL Metals, HE, SVOCs and potentially other analytical suites identified on the basis of the Phase I waste characterization data.

Precleaned and dedicated sampling equipment will be used for each surface soil sample. Using this equipment makes the need for equipment rinsate blanks unnecessary. A minimum of one trip blank for SVOCs, consisting of a standard sample container filled with water, is included in the SAP for the purpose of helping to identify organic contamination introduced during transport and handling.

The Closure Plan calls for a matrix spike field QC sample in each sample delivery group for the purpose of evaluating laboratory performance and potential matrix effects. These field matrix spikes will not be required because the laboratory will routinely perform matrix spikes analyses as well as analyze laboratory control and check samples as part of their normal operations. The results from these QC tests will be included in the analytical data package.

<u>Laboratory Quality Assessment</u>

The contribution of laboratory (analysis) to overall accuracy and precision will be assessed using standard quality indicators reported by the service laboratories. The types and frequencies of QC analyses required for fixed laboratory analyses is described in the ER Project Statement of Work (SOW) for Analytical Services (LANL, 1995, ER ID 49738). Those sample types include:

- method blanks used to estimate whether contamination is present in reagents and solvents used in the analysis;
- sample preparation blanks (preparation blanks) used to infer whether contamination is introduced during sample preparation;

- calibration blanks used to ensure that the analytical measurement system is free of contamination and to establish the zero point for quantitation;
- check standards of various types used to verify the acceptable initial and continuing accuracy and precision of calibrations;
- laboratory control samples (LCSs) used to check that the analytical measurement system is operating within specifications prior to commencing the analysis of samples;
- analytical system performance checks used to ensure that analytical measurement parameters have been properly established prior to analyses;
- sample spikes used to evaluate the ability to recover analytes from samples either prior to or after preparation for analysis; and
- duplicate samples used to estimate the analytical measurement precision and sample heterogeneity.

These indicators will be reviewed following current Laboratory Sample Management Office (SMO) procedures and criteria. As needed, the indicators may be used in a focused review of the data by a project chemist.

3.3 Field Activities

On-site Activities

All field activities will be conducted under approved Laboratory ER Project procedures. The field teams will utilize ER Project SOPs for locating sample locations, collecting samples, screening for health and safety, shipping and storage of samples, and maintenance of field records. The SOPs that will be used in the effort include those listed in Table 3-2. In addition to these requirements, all general and site-specific health and safety requirements shall be observed.

Analytical Chemistry

Samples will be submitted for analysis to analytical service laboratories through the SMO. The ER Project Statement of Work (SOW) (LANL 1995, 49738) for Analytical Services contains all general requirements for routine analyses. Except as modified by this SAP, all requirements of the SOW must be met by the laboratory. The SOW requirements and special requirements for each class or suite of analyte are reviewed below.

The required analytical suites are the TAL metals, high explosives, and semi-volatile organics. Additional suites may need to be specified following assessment of the Phase I sampling results. Methods comparable to SW-846, Update III or Draft Update IVA are required. The SW-846 method combinations listed in Tables 3-3 and 3-4 are satisfactory.

TABLE 3-2

List of LANL ER SOPs to be used in MDA-P Sampling Activities

LANL SOP Identifier	SOP Title
ER-SOP-1.01	General Instructions for Field Investigations
ER-SOP-1.02	Sample Container and Preservation
ER-SOP-1.03	Handling, Packaging and Shipping of Samples
ER-SOP-1.04	Sample Control and Field Documentation
ER-SOP-1.08	Field Decontamination of Drilling and Sampling Equipment
ER-SOP-3.01	Land Surveying Procedures
ER-SOP-6.03	Sampling for Volatile Organics
ER-SOP-6.09	Spade and Scoop method for Collection of Soil Samples
ER-SOP-6.10	Hand auger and Thin-Wall Tube Sampler
ER-SOP-6.24	Sample Collection from Split-Spoon Samplers and Shelby Tube Samplers
ER-SOP-6.26	Core Barrel Sampling for Subsurface Earth Materials
ER-SOP-6.29	Single-Stage Sampling for Surface Water Run-Off
ER-SOP-4.01	Drilling Methods and Drill Site Management
ER-SOP-4.04	General Borehole Logging
ER-SOP-10.06	High Explosives Spot Test
ER-SOP-10.08	Operation of the Field Portable XRF Instrument
ER-SOP-10.10	Radiation Scoping Surveys
ER-SOP-10.11	Soil Sample Field Screening to meet Radioactive Sample Shipping Requirements
ER-SOP-12.02	Transportation, Receipt, and Admittance of Borehole Samples for the Sample Management Facility
ER-SOP-14.01	

TABLE 3-3

Analysis Methods for Fixed Laboratory Inorganic Analyses

Inorganic Analytes	Prep Method Options	Determinative Method Options
Hg	7471A (7471B)	
All inorganic chemicals except Hg	3050B 3051(3051A)	6010B 6020(6020A) 7000 Series

TABLE 3-4

Analysis Methods for Fixed Laboratory Organic Analyses

Organic Analyte Suite	Ground/Surface Water SW-846 Methods		Soils/Tuff SW-846 Methods	
	Preparation	Determination	Preparation	Determination
Semi-Volatiles Organic Compounds (SVOCs)	3510 3520	8270	3540 3541 3550	8270
High Explosives (HE)	8330[a]		8330	
a. Water samples receive low level sample preparation option.				

Methods in parentheses in Table 3-3 pertain to Draft Update IVA of Method SW-846. Deviations from these methods in Tables 3-3 and 3-4 must be discussed with an ER Project Chemist. Laboratory QC must follow the guidance given in the methods. The hardcopy data package delivered to the Laboratory must specify the standard methods (*e.g.* SW-846 series) employed by the analytical laboratory for sample preparation and analyte determination. The SOW lists the required analyte lists and estimated quantitation limits for organic analyses. The required target analyte lists and detection limits for Phase II confirmatory samples appear in the Tables 3-5, 3-6, and 3-7 for metals, SVOCs, and HE, respectively. Note that this SAP requires improved detection limits for certain inorganic analytes compared to the SOW in order to ensure that detection limits are below ER Project Background Values for the TAL metals. The required estimated detection limits (EDLs) listed below must be reviewed and agreed to by the analytical laboratory before samples are shipped to that laboratory.

TABLE 3-5

Required Detection Limits for Elemental Analyses

Metals TAL	SOW EDL mg/kg	Special EDL Request mg/kg
Al	40	40
Sb	12	0.4
As	2	1
Ba	40	20
Be	1	0.6
Cd	1	0.2
Ca	1000	1000
Cr	2	2
Co	10	1.5
Cu	5	4
Fe	20	20
Pb	0.6	0.6
Mg	1000	1000
Mn	3	3
Hg	0.1	0.08
Ni	8	6
K	1000	1000
Se	1	0.3
Ag	2	0.5
Na	1000	450
Tl	2	0.4
V	10	10
Zn	4	4

TABLE 3-6

Required Analytes and Method Detection Limits for Organic Analyses

Semivolatile Organics (SVOC)			
		Required MDL	
CAS No.	Analyte Name	Water µg/L	Solids µg/kg
83-32-9	Acenaphthene	10	330
208-96-8	Acenaphthylene	10	330
62-53-3	Aniline	20	660
120-12-7	Anthracene	10	330
103-33-3	Azobenzene	20	330
56-55-3	Benzo[a]anthracene	10	330
205-99-2	Benzo[b]fluoranthene	10	330
207-08-9	Benzo[k]fluoranthene	10	330
191-24-2	Benzo[g,h,i]perylene	10	330
50-32-8	Benzo[a]pyrene	10	330
65-85-0	Benzoic acid	50	1700
100-51-6	Benzyl alcohol	20	660
111-91-1	Bis(2-chloroethoxy)methane	10	330
111-44-4	Bis(2-chloroethyl)ether	10	330
117-81-7	Bis(2-ethylhexyl)phthalate	10	330
101-55-3	Bromophenylphenyl ether[4-]	10	330
85-68-7	Butyl benzyl phthalate	10	330
59-50-7	Chloro-3-methylphenol[4-]	20	660
106-47-8	Chloroaniline[4-]	20	660
91-58-7	Chloronaphthalene[2-]	10	330
95-57-8	Chlorophenol[o-]	10	330
7005-72-3	Chlorophenylphenyl ether[4-]	10	330
218-01-9	Chrysene	10	330
53-70-3	Dibenzo[a,h]anthracene	10	330
132-64-9	Dibenzofuran	10	330
84-74-2	Di-n-butyl phthalate	10	330
95-50-1	Dichlorobenzene (1,2) [o-]	10	330
541-73-1	Dichlorobenzene (1,3) [m-]	10	330
106-46-7	Dichlorobenzene (1,4) [p-]	10	330
91-94-1	Dichlorobenzidine[3,3'-]	20	660
120-83-2	Dichlorophenol[2,4-]	10	330
84-66-2	Diethyl phthalate	10	330
105-67-9	Dimethylphenol[2,4-]	10	330
131-11-3	Dimethyl phthalate	10	330
534-52-1	Methyl-4,6-dinitrophenol[2-]	50	1700
51-28-5	Dinitrophenol[2,4-]	50	330
121-14-2	Dinitrotoluene[2,4-]	10	330
117-84-0	Di-n-octyl phthalate	10	330
206-44-0	Fluoranthene	10	330
86-73-7	Fluorene	10	330
118-74-1	Hexachlorobenzene	10	330

TABLE 3-6 (concluded)

Required Analytes and Method Detection Limits for Organic Analyses

Semivolatile Organics (SVOC)			
		Required MDL	
CAS No.	Analyte Name	Water µg/L	Solids µg/kg
87-68-3	Hexachlorobutadiene	10	330
77-47-4	Hexachlorocyclopentadiene	10	330
193-39-5	Indeno[1,2,3-cd]pyrene	10	330
78-59-1	Isophorone	10	330
91-57-6	Methylnaphthalene[2-]	10	330
95-48-7	Methylphenol[2-]	10	330
110-86-1	3-Methylphenol	10	TBD
106-44-5	Methylphenol[4-]	10	330
91-20-3	Naphthalene	10	330
100-01-6	Nitroaniline[4-]	20	660
98-95-3	Nitrobenzene	10	330
88-75-5	Nitrophenol[2-]	10	330
100-02-7	Nitrophenol[4-]	50	1700
62-75-9	Nitrosodimethylamine[N-]	20	330
86-30-6	Nitrosodiphenylamine[N-]	10	330
621-64-7	Nitrosodi-n-propylamine[N-]	10	330
108-60-1	2,2'-Oxybis (1-chloropropane)	10	330
87-86-5	Pentachlorophenol	50	1700
85-01-8	Phenanthrene	10	330
108-95-2	Phenol	10	330
108-39-4	Pyridine	TBD	330
129-00-0	Pyrene	10	330
120-82-1	Trichlorobenzene[1,2,4-]	10	330
95-95-4	Trichlorophenol[2,4,5-]	10	660
88-06-2	Trichlorophenol[2,4,6-]	10	330
Surrogates - SVOC			
321-60-8	2-Fluorobiphenyl		
367-12-4	2-Fluorophenol		
4165-60-0	Nitrobenzene-d5		
13127-88-3	Phenol-d6		
1718-51-0	p-Terphenyl-d14		
118-79-6	2,4,6-Tribromophenol		
Internal Standards - SVOC			
3855-82-1	1,4-Dichlorobenzene-d4		
1146-65-2	Naphthalene-d8		
15067-26-2	Acenaphthene-d10		
1517-22-2	Phenethrene-d10		
1719-03-05	Chrysene-d12		
1520-96-3	Perylene-d12		

TABLE 3-7

Required Analytes and Method Detection Limits for High Explosives Analyses

High Explosives (HE)			
		EQL	
CAS No.	Analyte Name	Water µg/L	Solids mg/kg
35572-78-2	2-Amino-4,6-Dinitrotoluene (2-Am-DNT)	0.5	0.5
1946-51-0	4-Amino-2,6-Dinitrotoluene (4-Am-DNT)	0.5	0.5
99-65-0	1,3-Dinitrobenzene (DNB)	0.5	0.5
121-14-2	2,4-Dinitrotoluene (2,4-DNT)	0.5	0.5
606-20-2	2,6-Dinitrotoluene (2,6-DNT)	0.5	0.5
121-82-4	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1	1
479-45-8	Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	0.8	0.8
98-95-3	Nitrobenzene (NB)	0.5	0.5
88-72-2	2-Nitrotoluene (2-NT)	0.5	0.5
99-08-1	3-Nitrotoluene (3-NT)	0.5	0.5
99-99-0	4-Nitrotoluene (4-NT)	0.5	0.5
2691-41-0	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2.2	2.2
99-35-4	1,3,5-Trinitrobenzene (1,3,5-TNB)	0.5	0.5
118-96-7	2,4,6-Trinitrotoluene (TNT)	0.5	0.5
Surrogates - High Explosives			
610-39-9	3,4-Dinitrotoluene (required)		
99-55-8	2-Methyl-4-nitroaniline (optional)		
100-25-4	1,4-Dintrobenzene (optional)		

Samples will be handled under chain of custody following the appropriate SOPs covering collection, preservation, tracking and shipping requirements. All analytical results will be subject to verification and routine validation by the Laboratory ER project. Data reported with non-compliant laboratory data quality indicators will be flagged with the appropriate data qualifier. The data may be furthered assessed by a Laboratory project chemist through a focused validation process on case by case basis.

4.0 PROJECT MANAGEMENT

The goals of the Phase II investigation are 1) to identify the nature and extent of residual environmental contamination at MDA P and 2) to calculate spatially averaged contaminant concentrations affected by the MDA P cluster with regard to human health and ecological impacts. The structure of the project management has been established during Phase 1 activities and will remain in place throughout the project until closure of MDA P. Best management practices (BMPs) continue to be important in the operations of MDA P activities. BMPs will be assessed, modified, and implemented as appropriate during Phase II and until completion of all obligations related to clean closure of MDA P.

4.1 Project Schedule

Phase II sampling activities are scheduled to begin toward the end of Phase I activities in the fall of 1999 and continue until all sampling and analyses are completed. Field sampling at the MDA P cluster will begin as soon as Phase I excavation and disposal activities allow. Laboratory analyses will occur concurrently. Data analysis will be conducted as analytical data sets become available. Independent contractor oversight of MDA P activities that began in October 1998 will continue through completion of

Phase II sampling and analytical activities. The contractor providing this oversight will provide verification that activities at MDA P are executed according to the Closure Plan and SAP and that all deviations from the Closure Plan or SAP are documented and justified. Oversight from LANL will be provided throughout Phase II and includes radiation monitoring support (ESH-1) and industrial hygiene support (ESH-5) for the duration of the project.

The MDA P closure report will be written after all data are collected, analyzed, and interpreted against the Closure Plan. The final draft of the closure report is currently scheduled for November 2000.

4.2 Site Controls and Stabilization

The MDA P cluster will be under administrative control in the interim between Phase I excavations and Phase II confirmatory sampling. Appropriate site control will be reinstated as part of start-up operations for Phase II sampling. Site control practices for Phase I excavations will be the template for Phase II activities with appropriate modifications.

Stabilization of MDA P will occur if there is a significant gap between the end of Phase I activities and the beginning of Phase II in accordance with BMPs. Jute matting and hay bails will be installed to minimize the effects of runoff/run-on and erosion from the excavated portions of MDA P. The stabilization should ensure that the physical condition of the area does not deteriorate due to natural erosion processes that occur during the interim. MDA P will be restored at the completion of the Phase II sampling and after the administrative authorities approve certification that the closure units are in compliance with the closure performance standards, and decide that the MDA P cluster does not present unacceptable human health or ecological risk.

5.0 REFERENCES

If you would like to obtain a copy of any of the following references, please call the ER Project's Records Processing Facility (RPF) at 505-665-5359. Ask that a copy of the reference be mailed to you (be sure to give them the ER ID number of the document you are requesting.).

ATSDR (Agency for Toxic Substances and Disease Registry, Various years. ATSDR's Toxicological Profiles on CD-ROM. **(ATSDR various years, ER ID 56531.3)**

Dye, A., September 25, 1996. "Field Surveys at MDA-P TA-16," Los Alamos National Laboratory Memorandum to Ken Bostick from Albert Dye, Los Alamos New Mexico. **(Dye and Bostick 1996, ER ID 55227.1)**

Dye, A., and M Childs, March 1997. "Surface Sampling at Canon de Valle, TA-16, Draft Report, March 1, 1997," Los Alamos National Laboratory Draft Report, Los Alamos New Mexico. **(Dye and Childs 1997, ER ID 58712.1)**

Dyntel Corporation, March 1997. "Aquire Aquatic Toxicity Information Retrieval Database, A Technical Support Document, GSA Contract No. GS04K95KFD0169, Task #CCA686461," March 1, 1997, Dyntel Corporation, Office of Research & Development, Support Documentation, [CITY, STATE]. **(Dyntel 1997, ER ID 62898.1)**

Johnson, M., L. Frank, and R. Lee, January 1999. "Bioaccumulation of 2,4,6 Trinitrotoluene and Polychlorinated Biphenyls through Two Routes of Exposure in a Terrestrial Amphibian: Is the Dermal Route Significant?" in *Environmental Toxicology and Chemistry,* Vol. 18, No. 5, pp. 873-878. **(Johnson et al. 1999, ER ID 63115.1)**

LANL (Los Alamos National Laboratory), July 1993. "RFI Workplan for Operable Unit 1082," Los Alamos National Laboratory Report LA-UR-93-1196, July 1, 1993, Los Alamos, New Mexico. **(LANL 1993, ER ID 20948.1)**

LANL (Los Alamos National Laboratory), July 1994. "RFI Workplan for Operable Unit 1082, Addendum 1, Final Draft," Los Alamos National Laboratory Report LA-UR-94-1580, July 1, 1994, Los Alamos New Mexico. **(LANL 1994, ER ID 39440.1)**

LANL (Los Alamos National Laboratory), February 1995. "TA-16 Material Disposal Area-P Closure Plan, Revision 0," Los Alamos National Laboratory Closure Plan, Los Alamos, New Mexico. **(LANL 1995, ER ID 58713.1)**

LANL (Los Alamos National Laboratory), July 1995. "Statement of Work (Formerly called Requirements Document) – Analytical Support (RFP Number 9-XS1-Q4257), Revision 2, July 1995," Los Alamos National Laboratory Report, Los Alamos, New Mexico. **(LANL 1995, ER ID 49738.1)**

LANL (Los Alamos National Laboratory), September 1997. "RFI Report for Potential Release Sites at TA-16, 11-012(A, B), 13-003(A), 16-006(C, D), 16-010(A), 16-021(A), 16-026(C, D, V), 16-028(A), 16-030(G), Field Unit 3," ER Project RFI Report LA-UR-97-3072, Los Alamos, New Mexico. **(LANL 1997, ER ID 62539.1)**

LANL (Los Alamos National Laboratory), September 1998. "RFI Report for Potential Release Site 16-021(C), Volume 1 of 3, September 1, 1998," ER Project RFI Report, LA-UR-98-4101, Los Alamos, New Mexico. **(LANL 1998, ER ID 59891.3)**

LANL (Los Alamos National Laboratory), April 1999. "Corrective Action Units, Summary Table Annual Unit Audit," Cover letter and Table, EM/ER:99-103. **(LANL 1999, ER ID 63175.1 and 63175.2).**

LANL (Los Alamos National Laboratory), May 1999. "Closure Plan for Flash Pad TA-16-387," Los Alamos National Laboratory Closure Plan, Los Alamos, New Mexico. **(LANL 1999, ER ID 63547).**

McDonald, E., and R. Ryti, March 1996. "Background Geochemistry of Soils and Colluvium at MDA-P," Los Alamos National Laboratory Report LA-UR-96-1092, Los Alamos, New Mexico. **(McDonald and Ryti 1996, ER ID 54827.1)**

McLin, S., August 18, 1989. "Vadose Zone Monitoring Observations at the TA-16 Area P Landfill," Los Alamos National Laboratory Report, Los Alamos New Mexico. **(McLin 1989, ER ID 11718.1)**

Rivera-Dirks, C. and R. Conrad, October 1995. "TA-16 S-Site Burning Grounds ESH-19, Waste Site Studies Soil Sampling Project Summary Report," Los Alamos, New Mexico. (**Rivera-Dirks and Conrad 1995, ER ID 63137.1**)

Ryti, R., and P. A. Longmire, September 1998. "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory, September 22, 1998," Los Alamos, New Mexico. **(Ryti and Longmire, ER ID 59730.2)**

Warren R., and E. McDonald, August 1997. "Baseline Geochemistry of Coil and Bedrock Tshirege Member of the Bandelier Tuff at MDA-P," Los Alamos National Laboratory Report LA-13330-MS, Los Alamos, New Mexico. **(Warren and McDonald, ER ID 59180.1)**

Attachment 1

Review of Existing Data Collected in the Area of MDA P

REVIEW OF EXISTING DATA COLLECTED IN THE AREA OF MDA P

Results of Field Surveys and Field Analyses

Field surveys within the operational area defined for MDA P closure activities have revealed the presence of high explosive (HE) fragments of visible size. Although a comprehensive sweep of the operational area has not been performed, the project remedial engineer reports that chunks of HE have been discovered in surface soil in every region of the operational area where a search has been conducted. The extent of this HE contamination beyond the operational area has not been established.

In July of 1996 the ESH-19 Waste Site Studies Team conducted field surveys of the relatively level upper surface of MDA P (Dye 1996, 55227.1, memorandum to Ken Bostick). The surveys were conducted on a 30 X 30 foot grid using a portable XRF spectrometer for metals, and both an ESP-1 meter (beta/gamma) and a Violinist III meter (low energy gamma) for radionuclides. The results demonstrated XRF spectrometer's usefulness for measuring elevated concentrations of metals, particularly barium. The radionuclide results did not indicate gross radiological contamination at MDA P. The Violinist measurements from the MDA P survey are consistent with background levels established during surveys taken at other technical areas at the Laboratory. The ESP-1 measurements included some surface soil beta/gamma measurements which field personnel noted were slightly above LANL background values in the northern and eastern sections of MDA P. According to the memo, the "background levels at LANL using the ESP-1 meters average around 250 cpm". The MDA P beta/gamma measurements averaged around 250 cpm with a standard deviation of about 90 cpm. No firm conclusion can be drawn regarding whether the few larger readings recorded in the survey represent radiation present above background levels without further information regarding the variability of background measurements. However, all fixed laboratory analyses for samples collected within the MDA P cluster have indicated that there is no radionuclide contamination.

Description and Results of Previous Sampling Campaigns

The following data sources are associated with previous sampling efforts for the PRSs within the MDA P cluster, background locations proximal to MDA P, and sampling in Cañon de Valle. The set of all sampling locations within the MDA P cluster and proximal background locations are presented in Figure 1 of the SAP document. The figure displays all locations without individual identifiers to give the impression of the coverage from past sampling efforts, both in terms of number of samples and distribution of locations. The locations associated with separate sampling campaigns will be identified in plots in this attachment to assist discussion of the data sets. Sample results for inorganics above Laboratory-wide background values and detected organics are summarized in tables identified below. The data are reviewed to identify analytes for inclusion in confirmatory sampling and to provide input into selection of confirmatory sampling locations. All the tables containing data summaries are included at the end of this attachment.

Background and Baseline Areas:

- Soil samples documented in the MDA P Background Report (McDonald et.al., 1996, 54827.1),
- Soil and tuff samples documented in the MDA P Baseline Report (Warren et.al., 1997, 59180.1),
- Soil samples collected to characterize background during the 1994 investigation documented in the MDA P Closure Plan (LANL 1995, 58713)

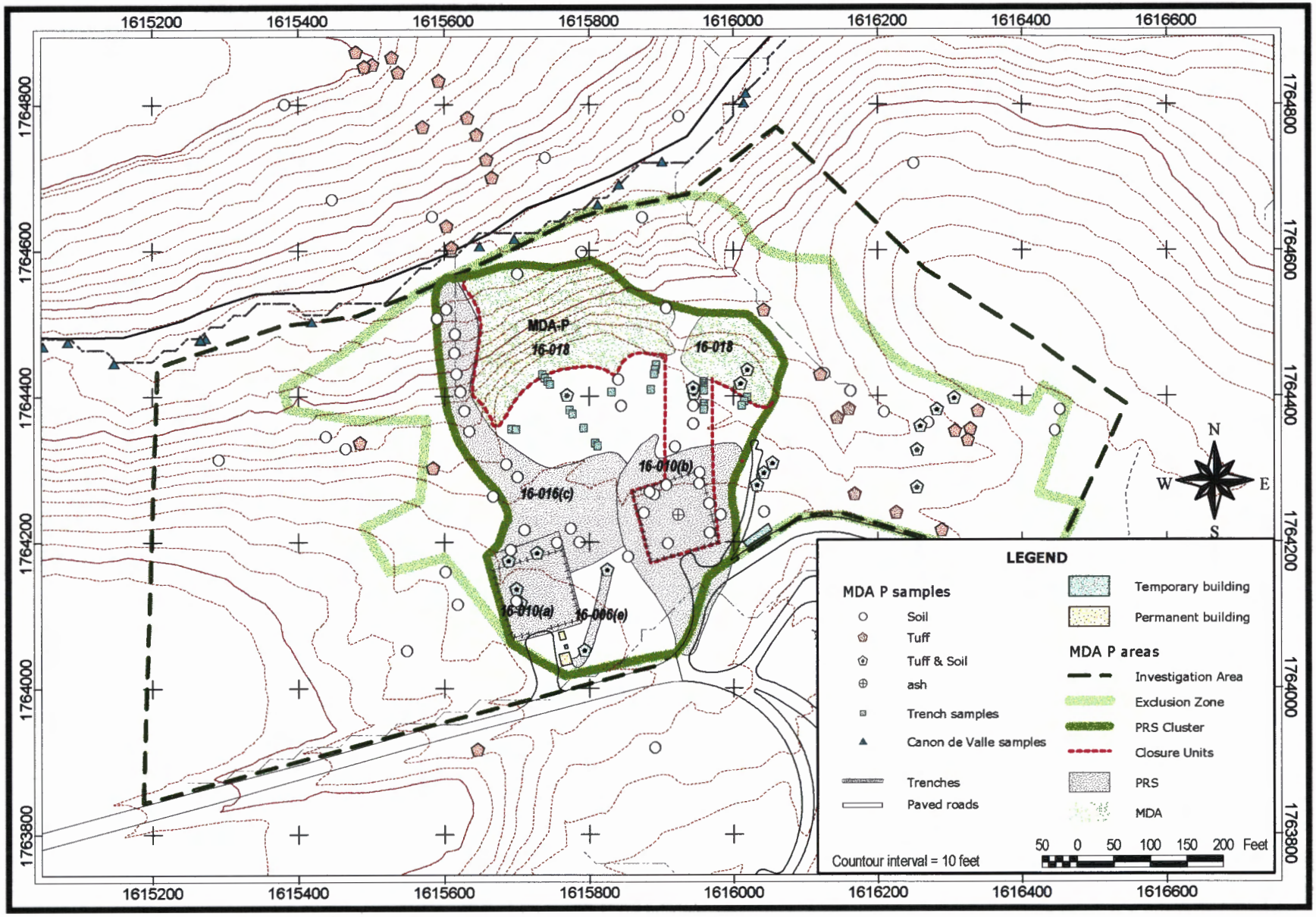


Figure 1. Sampling locations in MDA P area.

- Soil samples collected in 1998 to characterize chemical concentrations in areas to be used for waste handling during MDA P closure activities (unpublished),

MDA P Waste Pile area:

- Borehole soil and tuff samples collected in 1988 during an effort to establish a vadose zone monitoring system at MDA P (McLin 1988, 11718; MDA P Closure Plan (LANL 1995, 58713.1, pp. 3-1 through 3-4 and Appendix D)),
- Surface soil samples collected in 1994 from within and along the northern margin of MDA P waste pile (1994 Data summarized in the MDA P Closure Plan (LANL 1995, 58713, pp. 3-2 and 3-5 through 3-8)),
- MDA P 1997 Phase I exploratory trench samples taken to characterize the waste pile in the lobes of MDA P (unpublished),

Additional PRS areas within the MDA P cluster:

- Soil samples collected in 1995 to support permitting of Flash Pad TA-16-387(PRS 16-010(b)) (Dirks-Rivera and Conrad 1995, ER ID 63137.1),
- Soil and tuff samples collected in 1995 to identify the nature and extent of contamination due to barium nitrate storage associated with PRS 16-016(c), and Flash Pad TA-16-386 (PRS 16-010(a)) [included in TA-16 RFI Report (LANL 1997, 62539.1),
- Soil and tuff samples collected in 1995 at the septic system (PRS 16-006(e)) as Phase I sampling for future inclusion in a TA-16 RFI report (unpublished),

Cañon de Valle drainage channel:

- 1994 surface sediment and unfiltered water samples from Cañon de Valle (1994 Data summarized in the MDA P Closure Plan (LANL 1995, 58713.1, pp. 3-2 and 3-5 through 3-8)),
- 1996 surface sediment and water samples collected for the Cañon de Valle Sampling Report (Dye and Childs 1997, 58712.1, draft report),
- 1997/1998 sediment and surface water samples collected for the 260 Outfall RFI Report (LANL 1998, 59891.3),
- 1998 storm water runoff from interceptor trenches below MDA P waste pile (unpublished).

Background and Baseline Areas:

The sampling locations for the four investigations conducted in background and baseline areas in the vicinity of MDA P are shown in Figure 2. The results for the individual data sets are presented in summary form in Table 1.1-1 through Table 1.1-4 below.

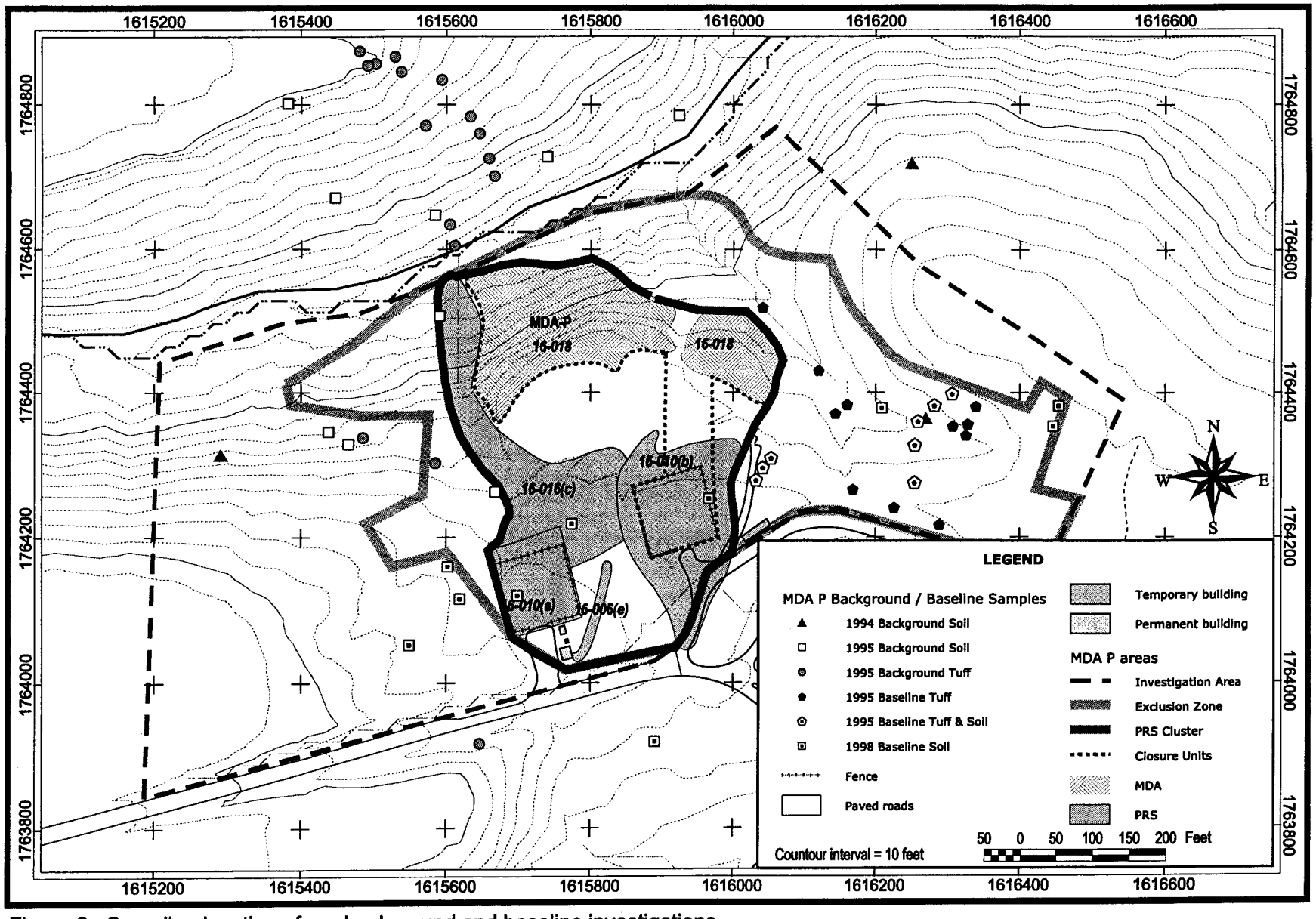


Figure 2. Sampling locations from background and baseline investigations.

Table 1.1-1. Inorganic Chemicals in soil media from MDA P background and baseline samples

		1994 Background Soil (mg/kg)[1]				1995 Background Soil (mg/kg)[2]				1995 Baseline Soil (mg/kg)[3]				1998 Baseline Soil (mg/kg)[4]				TCLP Leachate (mg/L)[5]		
Analyte	Soil BV	freq of detects	concentration range	freq >BV	range >BV	freq of detects	concentration range	freq >BV	range >BV	freq of detects	concentration range	freq >BV	range >BV	freq of detects	concentration range	freq >BV	range >BV	TV	freq>TV	range>TV
Aluminum	29200	3/3	6900-8500	0/3		55/55	1560-27500	0/55		12/12	4070-10700	0/12		10/10	3540-18600	0/10				
Antimony	0.83	0/3	nd[7]			4/14	[0.1]-0.13	0/14		0/12	[0.1]	0/12		0/10	0.21-0.82	0/10				
Arsenic	8.17	3/3	2.9-3.3	0/3		14/14	0.36-0.82	0/14		12/12	2.3-4.1	0/12		10/10	2.9-6.5	0/10		5	0/10	
Barium	295	3/3	110-940	2/3	410-940	14/14	34.4-249	0/14		12/12	56.1-1680	7/12	480-1680	10/10	61.4-14600	7/10[6]	465-14600	100	2/10[7]	153-302
Beryllium	1.83	3/3	0.45-0.56	0/3		14/14	0.37-0.8	0/14		12/12	0.4-0.88	0/12		10/10	0.44-1.5	0/10				
Cadmium	0.4	0/3	nd			0/14	[0.1]	0/14		0/12	[0.1]	0/12		3/10	0.02-0.84	1/10[b]	0.84	1	0/10	
Calcium	6120	3/3	1500-2300	0/3		55/55	340-5470	0/55		12/12	1080-2950	0/12		10/10	493-2520	0/10				
Chloride	231	NR[a]				NR				12/12	9.2-47.4	0/12		NR						
Chromium	19.3	3/3	5.5-7.2	0/3		55/55	1-14.1	0/55		12/12	2.8-7.6	0/12		10/10	4.8-9.1	0/10		5	0/10	
Cobalt	8.64	3/3	4.1-6.7	0/3		14/14	1.5-4.3	0/14		12/12	1.3-2.6	0/12		10/10	2.1-6.6	0/10				
Copper	14.7	3/3	4.4-6.2	0/3		55/55	0.83-12.6	0/55		12/12	3.2-10.7	0/12		10/10	3.7-35.9	1/10[6]	35.9			
Iron	21500	2/3	7600-9300	0/3		55/55	5930-21900	1/55	21900	12/12	8460-13100	0/12		10/10	7180-16600	0/10				
Lead	22.3	3/3	18-21	0/3		14/14	5.3-14.1	0/14		12/12	4-18.9	0/12		10/10	6.8-34.9	1/10[6]	34.9	5	0/10	
Magnesium	4610	3/3	1200-1400	0/3		55/55	276-4300	0/55		12/12	731-1610	0/12		10/10	900-2110	0/10				
Manganese	671	3/3	280-290	0/3		55/55	74.9-679	1/55	679	12/12	104-303	0/12		10/10	127-322	0/10				
Mercury	0.1	0/3	0-0	0/3		NR				3/12	[0.02]-0.03	0/12		1/10	0.05-0.11	1/10[6]	0.11	0.2	0/10	
Nickel	15.4	3/3	3.3-5	0/3		55/55	0.88-11.7	0/55		12/12	2.8-5.8	0/12		10/10	3.4-7.7	0/10				
Potassium	3460	3/3	1200-1300	0/3		14/14	894-1460	0/14		12/12	1050-1900	0/12		10/10	949-2080	0/10				
Selenium	1.52	0/3	nd			5/14	[0.2]-0.77	0/14		12/12	0.94-1.7	3/12	1.6-1.7	10/10	0.28-0.55	0/10		1	0/10	
Silver	1	1/3	3.5	1/3	3.5	1/14	[0.4]-0.47	0/14		11/12	[0.1]-8.8	2/12	2.6-8.8	5/10	0.03-22.6	1/10[6]	22.6	5	0/10	
Sodium	915	3/3	140-290	0/3		14/14	47.7-123	0/14		12/12	431-690	0/12		10/10	63.1-226	0/10				
Sulfate	293	NR				NR				12/12	7.2-99.4	0/12		NR						
Tantalum	0.3	NR				0/14	[0.1]	0/14		0/12	[0.1]	0/12		NR						
Thallium	0.73	0/3	nd			10/14	[0.1]-0.2	0/14		11/12	[0.1]-0.57	0/12		10/10	0.47-1.3	3/10	1.1-1.3			
Thorium	14.6	NR				14/14	2.5-5.7	0/14		12/12	3.5-5.8	0/12		NR						
Uranium	1.82	NR				14/14	0.35-2.5	1/14	2.5	12/12	0.44-2.6	1/12	2.6	NR						
Vanadium	39.6	3/3	8.6-12	0/3		14/14	5.5-15.4	0/14		12/12	5.6-13.3	0/12		10/10	11.1-21.9	0/10				
Zinc	48.8	3/3	21-37	0/3		14/14	21.4-44.8	0/14		12/12	30.9-52.1	1/12	52.1	10/10	11.8-899	2/10[b]	67.6-899			

[1] This is a summary of results. Complete sample results reported in MDA P Closure Plan (LANL 1995, 58713.1)

[2] This is a summary of results. Complete sample results reported in (McDonald et al. 1996, 54827.1)

[3] This is a summary of results. Complete sample results reported in (Warren et al. 1997, 59180.1))

[4] This is a summary of results. Complete sample results reported in Attachment 2, Table 2.2-1

[5] This is a summary of results. Complete sample results reported in Attachment 2, Table 2.2-2

Abbreviations used in table:
BV: Laboratory-wide background value (Ryti et al. 1998, 59730)
nd: data reported as not detected.
NR:not requested
TV: threshold value (RCRA threshold for TCLP extraction)

Comments:
[6] Largest concentration from location just east of 387 Burn Pad (see Figure 2)
The 3 locations with barium concentrations<BV are those southwest of exclusion zone.
[7] Largest concentration within 386 Burn Pad fence; 2nd largest just east of 387 Burn Pad (see Figure 2)

Table 1.1-2. Inorganic Chemicals in tuff media from MDA P background and baseline samples

		1995 Background tuff (mg/kg)[1]				1995 Baseline tuff (mg/kg)[2]			
Analyte	Upper QBT BV	freq of detects	concentration range	freq >BV	range >BV	freq of detects	concentration range	freq >BV	range >BV
Aluminum	7340	23/23	1910-20900	3/23	7550-20900	19/19	3330-7030	0/19	
Antimony	0.5	0/23	[0.1]	0/23		0/19	[3.3]	0/19	
Arsenic	2.79	23/23	0.33-6.6	1/23	6.6	19/19	2-11.6	14/19	2.8-11.6
Barium	46	23/23	13.4-139	3/23	48.4-139	19/19	27.6-738	11/19	27.6-738
Beryllium	1.21	23/23	0.22-1.2	0/23		19/19	0.32-1.5	1/19	1.5
Cadmium	1.63	22/23	[0.2]-1.5	0/23		0/19	[0.1]	0/19	
Calcium	2200	23/23	199-2230	1/23	2230	19/19	425-1550	0/19	
Chloride	94.6	23/23	4.2-465	2/23	101-465	19/19	3.3-49.9	0/19	
Chromium	7.14	23/23	0.62-12.8	1/23	12.8	19/19	0.79-6.6	0/19	
Cobalt	3.14	23/23	8.2-75.8	23/23[3]	8.2-75.8[3]	18/19	[0.6]-2	0/19	
Copper	4.66	23/23	0.7-6.2	2/23	5.7-6.2	19/19	1.4-6.4	1/19	6.4
Iron	14500	23/23	5250-19500	1/23	19500	19/19	8330-15300	1/19	15300
Lead	11.2	23/23	1.8-9.5	0/23		19/19	2.9-513	2/19	15.7-513
Magnesium	1690	23/23	149-2820	2/23	2720-2820	19/19	171-1880	1/19	1880
Manganese	482	23/23	107-752	1/23	752	19/19	174-448	0/19	
Mercury	0.1	NR				16/19	[0.02]-0.06	0/19	
Nickel	6.58	23/23	0.83-8.4	4/23	6.6-8.4	19/19	2-6.5	0/19	
Potassium	3500	23/23	560-4720	1/23	4720	19/19	883-3430	0/19	
Selenium	0.3	3/23	-0.2-0.21	0/23		15/19	[0.2]-0.59	13/19	0.31-0.59
Silver	1	3/23	-0.4-0.4	0/23		0/19	[0.1]	0/19	
Sodium	2770	23/23	531-2790	1/23	2790	19/19	620-2270	0/19	
Sulfate	157	23/23	1.5-1430	3/23	352-1430	19/19	3-71	0/19	
Thallium	1.1	8/23	-0.1-0.49	0/23		18/19	[0.2]-0.86	0/19	
Thorium-TOTAL	22.9	23/23	9.2-14.2	0/23		19/19	10.3-13.8	0/19	
Uranium-TOTAL	5.79	23/23	2.3-3.4	0/23		19/19	2.6-3.5	0/19	
Vanadium	17	23/23	2.5-21.2	1/23	21.2	19/19	2.9-12.5	0/19	
Zinc	63.5	23/23	20.1-65.6	1/23	65.6	19/19	37.7-356	1/19	356

[1] This is a summary of results. Complete background sample results reported in (McDonald et al. 1996, 54827.1)

[2] This is a summary of results. Complete baseline sample results reported in (Warren et al. 1997, 59180.1))

[3] Cobalt results are "spurious from contaminant introduced by pulverizeing in tungsten carbide shatterbox" per Baseline Report (Warren et al. 1997, 59180.1, p. 23).

Abbreviations used in table
BV: Laboratory-wide background value (Ryti et al. 1998, 59730)
NR:not requested
TOTAL: using HF acid digestion
General Comments:
Concentrations greater than BVs in Background and Baseline tuff (Warren et al. 1997, 59180.1, figure 5, table 14, sections 8 and 10 (pp.24-25,33-43)).
General Causes: (background locations) weathering, hydrologically transmissive zone, (baseline locations) contamination.

Table 1.1-3. Detected Organic Chemicals in soil media from MDA P background and baseline samples

		1998 Baseline data[1]				
Suite	Analyte (ppm)	freq of detects	concentration range (ppm)	range of detects (ppm)	associated[2] EQL/EDL (ppm)	blank concentration(s)[3] (ppm)
SVOCs	Bis(2-ethylhexyl)phthalate	5/10	0.039-[0.44]	0.039 J - 0.340 J	0.390-0.440	0.33 U
	Di-n-butylphthalate	1/10	0.053-[0.44]	0.053 J	0.400	0.33 U
	Fluoranthene	1/10	0.022-[0.44]	0.022 J	0.400	0.33 U
	Methylphenol[4-]	1/10	0.036-[0.44]	0.036 J	0.440	0.33 U
	Pyrene	1/10	0.023-[0.44]	0.023 J	0.400	0.33 U
HE	HMX	1/10	[2.2]-2.2	2.200	2.200	2.2 U
	trinitrotoluene[2,4,6-] TNT	2/10	[0.2]-0.28	0.210-0.280	0.200	0.2 U
VOCs	Trichlorofluoromethane	5/10	0.002-[0.008]	0.002-0.003	0.006-0.008	0.005 U
Herb	2,4,5-T	1/10	[0.019]-0.056	0.056	0.021	0.017 U
PCB	Aroclor-1254	1/10	[0.038]-0.065	0.065	0.039	0.033 U
Dioxin	Total TCDD	1/10	[0.00002]-0.0001	0.0001 J	0.00009	0.00002 U, 0.00005 U

[1] This is a summary of results. Complete sample results reported in Attachment 2, Table 2.2-3.

[2] associated EQL, these are the laboratory's EQLs for the detected concentrations listed in range of detects column, where
EQL: estimated quantitation limit
EDL: estimated detection limit

[3] EQL reported for the blanks

qualifiers:
U=not detected; value in table is the EQL; concentration (if analyte present) is less than the EQL.
J indicates an estimated value. The analyte is present but the sample result<EQL and >IDL.
IDL instrument detection limit (lower estimate based on water media, rather than sample media)

Table 1.1-4. Gamma-emitting Radionuclides from MDA P background and baseline samples

Soil Samples taken from 1998 Baseline locations and analyzed by gamma spectroscopy[1].

Analyte	FV/BV[2] (pCi/g)	freq of detects	concentration range (pCi/g)	freq>FV/BV	range>FV/BV (pCi/g)
Primary rads[3]	**FV**				
Americium-241	0.013	1/10	[-0.26]-0.15	1/10	0.15
Cesium-134		0/10	[-0.02]-[0.12]	0/10	
Cesium-137	1.65	4/10	[-0.02]-0.13	0/10	
Cobalt-60		0/10	[-0.08]-[0.05]	0/10	
Europium-152		0/10	[-0.38]-[0.71]	0/10	
Ruthenium-106		0/10	[-0.65]-[0.47]	0/10	
Sodium-22		0/10	[-0.07]-[0.07]	0/10	
Uranium-235	0.20	0/10	[-0.17]-[0.17]	0/10	
Natural DQ rads[4]	**BV**				
Potassium-40	36.8	10/10	18.88-33.8	0/10	

[1] This is a summary of results. Complete sample results reported in Attachment 2, Table 2.2-4.

[2] FV=fallout value; BV=background value; taken from (Ryti et al. 1998, 59730.2)

[3] Primary rads=analytes in the gamma spectroscopy suite evalueate as potential historical contaminants; and which require no administrative qualification during the ER Project baseline validation procedure.

[4] Natural rad=primordial radionuclide which is reliably measure by gamma spectroscopy

DQ data quality

Background soil and colluvium data - (McDonald et al., 1996, 54827.1) - In 1995, a total of 55 samples were collected by the ER Project and analyzed for inorganic chemicals to characterize natural background elemental concentrations in soil and colluvium in support of the closure plan for MDA P. These samples were taken from the north- and south-facing slopes of Cañon de Valle in the vicinity of the MDA P waste piles where contamination was not expected. Soils were sampled in vertical profiles from 9 locations. The distributions of concentrations for MDA P background are consistent with Laboratory-wide background distributions. The reported concentrations were less than the Laboratory-wide background values (BVs) with the exception of a single result each for iron, manganese, and uranium. The reported concentrations above BVs for iron, manganese and uranium were within the range of concentrations from Laboratory-wide background samples.

Even though the barium concentrations were below BVs, the report noted that barium was detected at larger concentrations in the surface horizon compared to concentrations in the underlying soil horizons at eight of the nine locations. The report summary concluded this indicates "that local contamination of soils by wind-blown Ba (probably from burning pits) has occurred" (McDonald et al., 1996, 54827.1, page 31).

Baseline soil and tuff data, background tuff data (Warren et al. 1997, 59180.1) – In 1995 and 1996, twelve soil samples and 19 bedrock tuff samples were collected by the ER Project and analyzed for inorganic chemicals to provide a baseline chemical characterization of two areas within the MDA P cluster, namely an area south and east of the east lobe of MDA P and an area directly east of the TA-16-387 Burn Pad. A third area outside of the MDA P cluster but in the general vicinity of MDA P was sampled. That area is located near building TA-16-340. Background tuff samples were collected from the north- and south-facing slopes of Cañon de Valle in the vicinity of MDA P where contamination was not expected (reported in the MDA P Baseline paper (Warren et al. 1997, 59180.1) and in Broxton et al. (1996, 54948.1)). Elevated concentrations of inorganics in MDA P background tuff samples were attributable to natural causes including extreme weathering and hydrologically transmissive zones as documented in the MDA P Baseline paper (Warren et al. 1997, 59180.1, section 7.1, pages 23-25).

Baseline soil concentrations were compared to Laboratory-wide and MDA P background soil concentrations. Baseline tuff results were compared to Laboratory-wide tuff background and to MDA P tuff background samples. No metal concentrations were greater than Laboratory-wide BVs from samples collected at the area outside the MDA P cluster. Barium soil concentrations in areas within the MDA P cluster were generally two to five times greater than the MDA P background and Laboratory-wide background concentrations (range of 480 to 1680 ppm). Surficial tuff samples in locations south and east of MDA P displayed elevated barium concentrations attributed to wind-borne contamination, possibly originating from MDA P or one of the flash pads. A single exposed baseline tuff sample collected east of the east lobe of MDA P yielded elevated concentrations for barium, lead, arsenic, beryllium, and zinc. Tuff samples collected east of the TA-16-387 Flash Pad from beneath fill material displayed elevated barium concentrations at half the concentration measured in the associated fill material.

1994 Background samples – Surface soil samples were collected in 1994 to characterize the area along the north side of the MDA P waste pile (LANL 1995, 58713). Additional surface soil samples were collected at three locations thought to be representative of background, one to the west of MDA P and two to the east of MDA P. The background samples were analyzed for total metals, HE, SVOCs, nitrates, gross alpha, gross beta, and gross gamma radiation. Nitrates were detected at low concentrations in background samples; HE, SVOCs, gross alpha, gross beta, and gamma were not detected. One of three background samples (located southeast of MDA P) had a barium concentration (940 mg/kg) greater than the LANL background value (295 mg/kg); all other inorganic analytes exhibited concentrations less than Laboratory-wide background values for all samples.

1998 Baseline samples - In August 1998, ten samples were collected to characterize baseline concentrations from areas within the exclusion zone intended for operational use during the closure of the waste pile. Elevated levels of HMX and TNT were detected at 2.2 ppm (detection limit = 2.2 ppm) and 0.28 ppm (detection limit=0.2 ppm), respectively. Metals were analyzed using both the standard nitric acid extraction for site characterization and the toxic characteristic leaching procedure (TCLP) extraction for waste characterization. The TCLP extraction threshold was exceeded for barium (threshold of 100 mg/L, two exceedences with a maximum of 302 mg/L). Nitric-acid leachable barium concentrations exceeded the Laboratory-wide BV in seven out of ten samples; the three locations southwest of the exclusion zone had concentrations smaller than the BV. The sample location directly east of the TA-16-387 Pad had concentrations of several metals (barium, cadmium, copper, lead, silver, and zinc) greater than BVs. One dioxin (total TCDD at 0.1 ppb, estimated quantitation limit (EQL) of 0.09 ppb), one herbicide (2,4,5-T at 0.056 ppm, EQL=0.021 ppm) and one PCB (aroclor-1254 at 0.065 ppm, EQL=0.039 ppm) were detected at or above their estimated quantitation limits. All detected volatiles and semivolatiles were reported below their associated estimated quantitation limits, indicating that the actual concentrations are too low to accurately quantify. Analysis for radionuclides by gamma spectroscopy indicated that activity levels were within background with one possible exception: americium-241 was detected in one sample (location south of the MDA P cluster) at 0.381 pCi/g. However, the value of 0.013 pCi/g from atmospheric fallout that is considered background was based on samples analyzed by alpha spectroscopy; analysis by gamma spectroscopy is less reliable (more variable) at low activity levels.

The 1998 Baseline sample results have not been included in a formal report. Results for all metal analytes, the detected organics, and the primary radionuclides evaluated in the gamma spectroscopy suite are presented in Attachment 2, Tables 2.2-1, 2.2-2, 2.2-3 and 2.2-4. Accompanying the tables is a figure showing individual sample locations identified by number.

MDA P waste pile areas:

The sampling locations for the three investigations conducted in the immediate area surrounding and extending into the MDA P waste piles are shown in Figure 3. The results for the individual data sets are presented in summary form in Table 1.2-1 through Table 1.2-4 below.

1988 McLin data - Borehole soil and tuff samples were collected in 1988 during an effort to establish a vadose zone monitoring system at MDA P (McLin 1989, 11718; summarized in the MDA P Closure Plan (LANL 1995, 58713)). Thirteen boreholes were "drilled through the waste pile and into the underlying tuff". Current understanding of location of the waste pile debris line indicates that only two of the boreholes penetrated the waste pile at locations in the east lobe and one location was along the margin of or just south of the east lobe of MDA P. The remainder of the boreholes were drilled through the berm of soil/fill that covered the area south of the waste piles. Within an area beneath the berm the timber that had been cleared to construct the flash pads was burned. There is a layer of ash that measures from one to three feet deep overlaying the original forest litter and soil. The borehole logs concur with current understanding. Borehole logs of the matrix recovered from the cores that did not penetrate the waste pile record a topsoil layer containing various combinations of clay/sand/tuff overlying a layer that "looks like cover-fill material"; no waste material is mentioned for these boreholes except to state that "waste (was) not apparent." In two of the boreholes the logs record "fragments of charcoal", evidence of the burned timber. The logs for boreholes that penetrated the east lobe included documentation with "black burn debris inclusions" which "tests positive for explosive compounds using field test kit" and "sand with burn debris inclusions" which is most likely sand removed from the surface of the flash pads and disposed in the east lobe. The borehole logs also record "black sandy waste with (barium) crystalline stringers" and "fragments

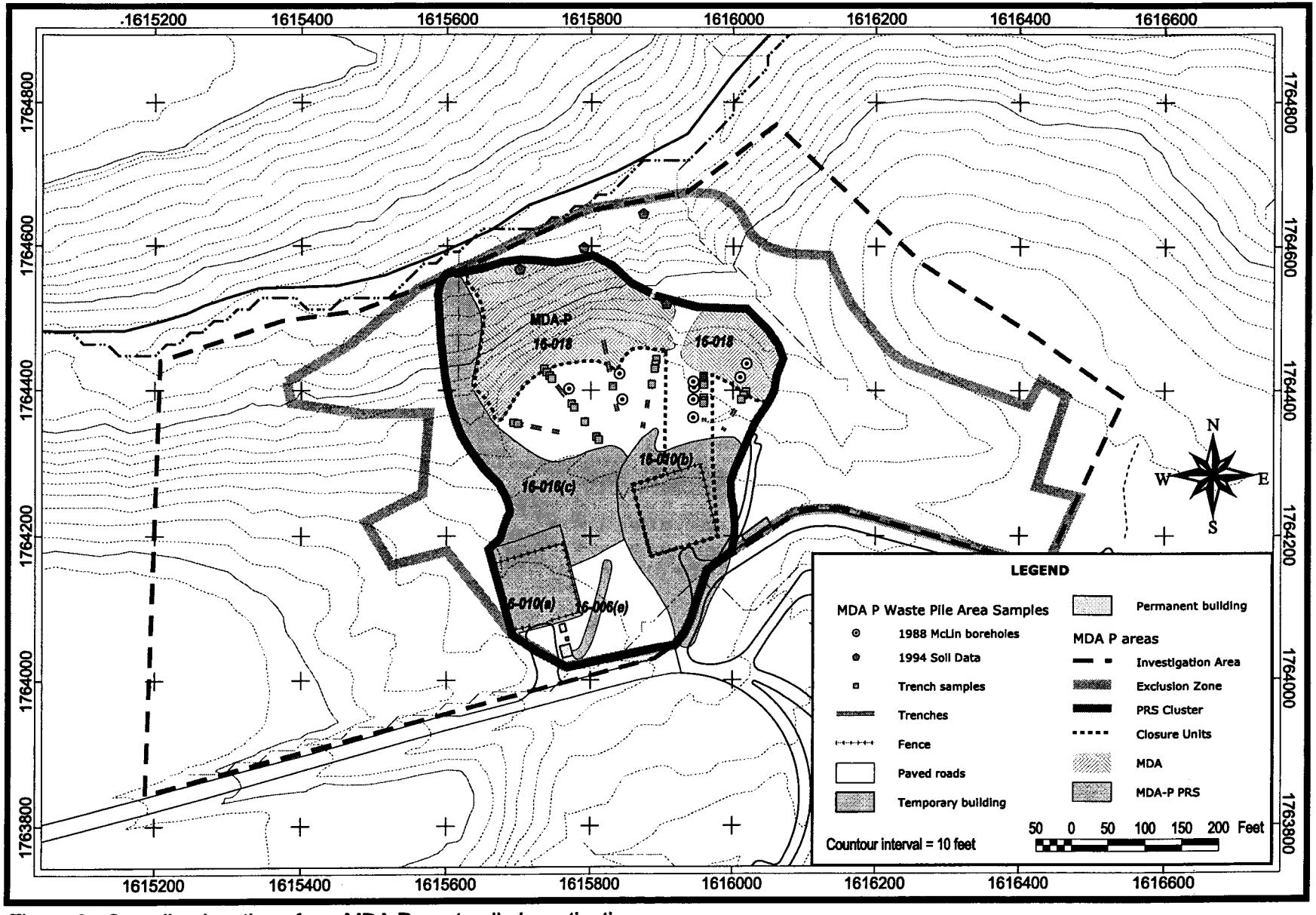


Figure 3. Sampling locations from MDA P waste pile investigations.

Table 1.2-1. Inorganic Chemicals in soil media from MDA P waste pile area samples

		1994 MDA P Soil (mg/kg)[1]				1997 Exploratory Trench Soil[2] TCLP leachate (mg/L)			1988 McLin Borehole Soil[3] EP toxicity concentrations (mg/L)		
Analyte	Soil BV	freq of detects	concentration range	freq >BV	range >BV	TV (mg/	freq>TV	range>TV	EPTV	freq>EPTV	range>EPTV
Aluminum	29200	4/4	5400-8900	0/4							
Antimony	0.83	1/4	0.4-0.4	0/4							
Arsenic	8.17	4/4	1.9-3.8	0/4		5	0/27				
Barium	295	4/4	630-38000	4/4	630-38000	100	9/27	112-2290	100	10/29	687-18110
Beryllium	1.83	4/4	0.34-0.59	0/4							
Cadmium	0.4	3/4	0.51-1.2	3/4	0.51-1.2	1	0/27				
Calcium	6120	4/4	1400-5700	0/4							
Chromium	19.3	4/4	4.6-26	1/4	26	5	0/27				
Cobalt	8.64	3/4	2.3-4.3	0/4							
Copper	14.7	4/4	5.4-200	3/4	31-200						
Iron	21500	4/4	7800-15000	0/4							
Lead	22.3	4/4	11-37	3/4	36-37	5	1/27	5.21			
Magnesium	4610	4/4	1100-1400	0/4							
Manganese	671	4/4	250-390	0/4							
Mercury	0.1	2/4	0.08-0.13	1/4	0.13	0.2	0/27				
Nickel	15.4	4/4	2.2-8.3	0/4							
Potassium	3460	4/4	800-1300	0/4							
Selenium	1.52	1/4	0.7-0.7	0/4		1	0/27				
Silver	1	2/4	2.1-6.8	2/4	2.1-6.8	5	0/27				
Sodium	915	4/4	150-350	0/4							
Thallium	0.73	1/4	0.3-0.3	0/4							
Vanadium	39.6	4/4	8.3-11	0/4							
Zinc	48.8	4/4	30-320	3/4	49-320						

[1] This is a summary of results. Complete sample results reported in MDA P Closure Plan (LANL 1995, 58713.1)

[2] This is a summary of results. Complete sample results reported in Attachment 2, Table 2.1-1

[3] This is a summary of results. Complete sample results reported in MDA P Closure Plan (LANL 1995, 58713.1)

BV: Laboratory-wide background value (Ryti et al. 1998, 59730)

TV: threshold value (RCRA threshold for TCLP extraction)

EPTV: threshold value (regulatory EP toxicity level)

Table 1.2-2. Inorganic Chemicals in tuff media from MDA P waste pile area samples

	1988 McLin Borehole Tuff[1] EP toxicity concentrations (mg/L)			
Analyte	EPTV	concentration range	freq>EPTV	range>EPTV
Barium	100	[5]-229.3	1/17	229.3

[1] This is a summary of results. Complete sample results reported in MDA P Closure Plan (LANL 1995, 58713.1)
EP: EPA Extraction procedure (EP) toxicity test
EPTV: threshold value (regulatory EP toxicity level)

Table 1.2-3. Detected Organic Chemicals for MDA P waste pile area samples

		1997 Exploratory Trench Soil[1]			
Suite	Analyte	freq of detects	concentration range (ppm)	range of detects (ppm)	associated* EQL/EDL (ppm)
SVOCs	Anthracene	10/27	49-3400	49-3400	330-430
	Bis(2-ethylhexyl)phthalate	12/27	53-5200	53-5200	290-430
	Di-n-butylphthalate	3/27	37-[450]	37-53	330-410
	Phenanthrene	3/27	84-[450]	84-110	330-410
	Pyrene	1/27	64-[450]	64	370
HE	2,4-Dinitrotoluene	5/27	39-470	39-470	330-410
	2,6-Dinitrotoluene	2/27	140-[450]	140-180	330-410
	HMX	4/27	[2200]-[110000]	3300-44000	2200-44000
	RDX	11/27	[980]-940000	1300-940000	990-50000
	PETN	2/27	[970]-4900	1100-4900	1000
	Trinitrobenzene[1,3,5-]	1/27	[250]-[13000]	11000	4900
	trinitrotoluene[2,4,6-] TNT	11/27	[250]-120000	1300-120000	250-13000
VOCs	Acetone	1/27	[2]-120	120	26
	Toluene	7/27	2-[7]	2-4	5-6
	Trichloroethane[1,1,1-]	4/27	[5]-7	6-7	6
	Trichlorotrifluoroethane	7/27	1-[7]	1-5	5-6
	Xylenes (total)	1/27	2-[7]	2	6
PCB	Aroclor-1260	1/27	[37]-[2000]	180 J	37
Pest	2,4-D	1/27	[24]-190	190 B	110
	alpha-Chlordane	2/27	[1.8]-[100]	1.9-4.4	4.4
	Dalapon	2/27	[120]-1300	750-1300	500-610
	Endrin aldehyde	1/27	[3.7]-[200]	11 J	3.7
	gamma-BHC (Lindane)	1/27	[3.7]-[200]	10 J	3.7
	gamma-Chlordane	2/27	[1.8]-[100]	2.6-4.1	1.9
Dioxin	Total HxCDD	2/27	[0.02]-1.1	0.08-1.1	0.04-0.09
	Total HxCDF	2/27	[0.01]-1.7	0.08-1.7	0.02-0.08
	Total PeCDD	1/27	[0.02]-0.56	0.56	0.05
	Total PeCDF	3/27	[0.01]-1.3	0.37-1.3	0.04-0.05
	Total TCDD	1/27	[0.01]-0.51	0.51	0.02
	Total TCDF	3/27	[0.01]-2.3	1.2-2.3	0.02-0.04

1988 McLin Soil[2]		freq of detects	concentration range (ppm)	range of detects
HE	HE (Total) % soluble weight	24/24	0.04-77	0.04-77
	HMX	19/24	[0]-2582	5-2582
	RDX	19/24	[0]-4133	1-4133
	TNT	16/24	[0]-7869	1-7869
	DNT	0/24	[0]	

1994 MDA P Area Soil results[3]		freq of detects	concentration range (ppm)	range of detects
HE	HMX	2/3	[nd]-13.5	8.8-13.5

[1] This is a summary of results. Complete sample results reported in Attachment 2, Table 2.1-1

[2] This is a summary of results. Complete sample results reported in MDA P Closure Plan (LANL 1995, 58713.1)

[3] This is a summary of results. Complete sample results reported in MDA P Closure Plan (LANL 1995, 58713.1)

Abbreviations used in table:
nd=sample(s) reported as "not detected" (no EQL reported)
EQL=estimated quantitation limit
EDL=estimated detection limit
*associated EQL, these are the laboratory's EQLs for the detected concentrations listed in range of detects column

Table 1.2-4. Gamma-emitting Radionuclides from MDA P waste pile area samples

Soil Samples taken from 1997 Exploratory Trenches and analyzed by gamma spectroscopy[1].

Analyte	FV/BV[2] (pCi/g)	freq of detects	concentration range (pCi/g)	freq>FV/BV
Primary rads[3]	**FV**			
Americium-241	0.013	0/27	[-0.498]-[0.1801]	DL > FV (1/27)
Cesium-134		0/27	[-0.034]-[0.065]	0/27
Cesium-137	1.65	4/27	[-0.035]-0.060	0/27
Cobalt-60		0/27	[-0.057]-[0.049]	0/27
Europium-152		0/27	[-0.199]-[0.687]	0/27
Ruthenium-106		0/27	[-0.388]-[0.421]	0/27
Sodium-22		0/27	[-0.069]-[0.074]	0/27
Uranium-235	0.2	0/27	[-0.207]-[0.428]	0/27
Natural rads[4]	**BV**			
Potassium-40	36.8	27/27	19.96-33.93	0/27

[1] This is a summary of results. Complete sample results reported in Attachment 2, Table 2.1-3

[2] FV=fallout value; BV=background value; taken from (Ryti et al. 1998, 59730.2)

[3] Primary rads=analytes in the gamma spectroscopy suite evalueate as potential historical contaminants; and which require no administrative qualification during the ER Project baseline validation procedure.

[4] Natural rad=primordial radionuclide which is reliably measure by gamma spectroscopy

DQ data quality

of charcoal and tuff" and barium "crystals." The report refers to the crystals as barium oxide (BaO) but does not document analyses done to determine the barium speciation.

Five of the boreholes were sampled for total HE, HMX, RDX, TNT, and DNT from core sections of the matrix above the tuff. HE was detected in four out of five boreholes. The largest concentrations of HMX (2582 ppm), RDX (4133 ppm), TNT (7869 ppm), DNT (none detected), total HE (1.68% soluble weight) were observed in the boreholes that penetrated the east lobe of the MDA P waste pile. Of the three boreholes to the south or west, one borehole had no detected HE; the other two boreholes exhibited HE at concentrations from two to three orders of magnitude lower than those into the east lobe.

Six of the borehole cores were sampled at multiple depths and analyzed for barium using the EPA extraction-procedure (EP) toxicity test. All samples from the three boreholes to the west exhibited barium concentrations less than the detection limit of 5 mg/L. Numerous samples from boreholes to the east exhibited concentrations greater than the regulatory EP toxicity level of 100 mg/L. Along the margin of the east lobe barium was abundant in the surface sample (18114.4 mg/L) but dropped to 12.3 mg/L in the next core section (two feet deeper), tapered off to below detection limits (<5 mg/L) in the deeper soil, and was not detected in tuff samples. The report states that "at least some of the barium has been mobilized by infiltrating precipitation, and has penetrated to a depth of approximately 19 feet, or at least six feet below the landfill bottom." However, the data suggest that the shallow tuff is a relatively good barrier to barium transport because infiltration is limited in terms of resultant concentrations. In one of the boreholes that penetrated the east lobe, the barium concentration in the soil/waste sample directly above the tuff is 2048.5 mg/L. The tuff concentrations are two orders of magnitude lower (6.5 to 17.8 mg/L) at a depth of one to two feet into the tuff. The other borehole into the east lobe has the largest barium concentration in a tuff sample (229.3 mg/L), which is the only concentration above the EP toxicity level of 100 mg/L. The maximum concentration occurs three feet into the tuff, the first tuff depth that was analyzed, so it would be reasonable to assume that the tuff above this depth was above the EP toxicity level. The concentrations in the three one-foot core segments immediately below range from 14.8 mg/L to 23.4 mg/L. In both boreholes through the east lobe barium appears to have penetrated to at least six feet into the tuff. However, where barium was analyzed in tuff, the largest tuff barium concentration was between one to three orders of magnitude lower than the concentration in the soil/waste sample directly above them.

The degree of penetration into tuff is apparently affected by tuff properties. The borehole logs record that the tuff sampled from these boreholes was non-welded. The hydraulic conductivity in the shallow unwelded tuff is affected by moisture content or degree of saturation. Unsaturated tuff (as seen in other wells further south) had hydraulic conductivity from three to six orders of magnitude below their saturated value. The tuff beneath the waste pile has significantly greater moisture content than those beyond the waste pile, and moisture content increased with the thickness of the overlying materials. When the barium contaminated debris and soil within the waste pile are removed during closure, it is expected that barium penetration into the tuff will be reduced or cease and movement within the shallow tuff will be reduced along with moisture content. There are several densely welded tuff units deeper below the waste pile that are less penetrable than the unwelded tuff.

Lysimeters installed to monitor the vadose zone that were positioned beneath the soil/waste-tuff contact failed to produce any water. The four lysimeters located within MDA P produced minimal amounts of water during routine sampling over a nine month period. The barium concentrations in the seven water samples of sufficient volume ranged from 1.1 to 37.8 mg/L, and averaged 9.23 mg/L.

<u>1994 surface soil investigation</u> – Four surface soil samples were collected in 1994 to characterize the area along the north side of the MDA P waste pile (LANL 1995, 58713). Two samples were collected

along the northern boundary of the waste pile and two from a shallow gully down gradient of the waste pile. The samples were analyzed for total metals, HE, nitrates, gross alpha, gross beta, and gross gamma radiation. HE and nitrates were detected in the samples; gross alpha, beta, and gamma radiation was not detected. Barium, chromium, copper, lead, mercury, and zinc concentrations were detected above Laboratory-wide background values (BVs). All four samples had barium concentrations greater than BVs (maximum 38000 mg/kg).

Phase I Exploratory Trench Data - In November and December of 1997, 27 soil/fill samples were taken from six trenches located south of MDA P and extending into the waste pile. The purpose of the sampling was twofold: to confirm the location of the leading edge of the waste pile prior to excavation activities, and to characterize the waste within the pile. The samples were analyzed for metals (using TCLP), SVOCs, HE, VOCs, and gamma-emitting radionuclides. RCRA thresholds for TCLP extraction were exceeded for barium (threshold of 100 mg/L; eight exceedences with a maximum of 2,290 mg/L) and lead (threshold of 5 mg/L with a single exceedence of 5.2 mg/L). All exceedences occurred along the northern edge in trenches that extended into the east lobe of MDA P; the concentrations decreased with depth and with distance from the waste pile. Samples analyzed for high explosives had detectable quantities of 2,4-dinitrotoluene (5 samples with a maximum of 0.47 ppm), 2,6-dinitrotoluene (2 samples with a maximum of 0.18 ppm), HMX (4 samples with a maximum of 44 ppm), RDX (11 samples with a maximum of 940 ppm), PETN (2 samples with a maximum of 4.9 ppm), 1,3,5-trinitrobenzene (1 sample with 11 ppm), and 2,4,6-trinitrotoluene (11 samples with a maximum of 120 ppm). Other than one small detect of HMX, all detected HE occurered along the northern edge in trenches that extended into the east lobe of MDA P. One PAH (anthracene), two phthalates (bis(2-ethylhexyl)phthalate and di-n-butylphthalate), one PCB (Aroclor-1260), several pesticides/herbicides (endrin aldehyde, 2,4-D, alpha-chlordane, dalapon, and gamma-chlordane) and several dioxins (Total HxCDD, Total HxCDF, Total PeCDD, Total PeCDF, Total TCDD, Total TCDF) were detected infrequently at low concentrations in trench samples. The dioxins /herbicides are not baseline validated by the ER project. Analysis for radionuclides by gamma spectroscopy indicated that activity levels were within background. All detected VOCs were reported at or below their associated estimated quantitation limits (EQLs) with the exception of methylene chloride, a common laboratory contaminant.

Data from the trenches have not been included in a formal report. Results for all metal analytes, the detected organics, and the primary radionuclides evaluated in the gamma spectroscopy suite are presented in Attachment 2, Tables 2.1-1, 2.1-2, and 2.1-3. Accompanying the tables is a figure identifying sample locations within the trenches.

Additional PRS areas within the MDA P cluster:

The sampling locations for the ER Project investigations conducted within the MDA P cluster at the TA-16-387 Flash Pad and at the individual PRSs within consolidated PRS 16-016(c)-99 (namely the TA-16-386 Flash Pad [16-010(a)], the barium nitrate pile [16-016(c)] and the septic system [16-006(e)]) are identified in Figure 4. The results for the individual data sets are presented in summary form in Table 1.3-1 through Table 1.3-4 below.

TA-16-387 Flash Pad, PRS 16-010(b) –The surface soil in the immediate vicinity of Flash Pad TA-16-387 was characterized in July 1995 in support of Part B permit application (Rivera-Dirks and Conrad 1995, ER ID 63137.1). Fifteen surface soil samples were collected and submitted for fixed laboratory analyses. Nine samples were collected from within the fence around the flash pad (including one sample of source term ash and one replicate sample), and six samples were collected near the pad along potential migration pathways for surface water runoff or air deposition. All samples were analyzed for metals, and

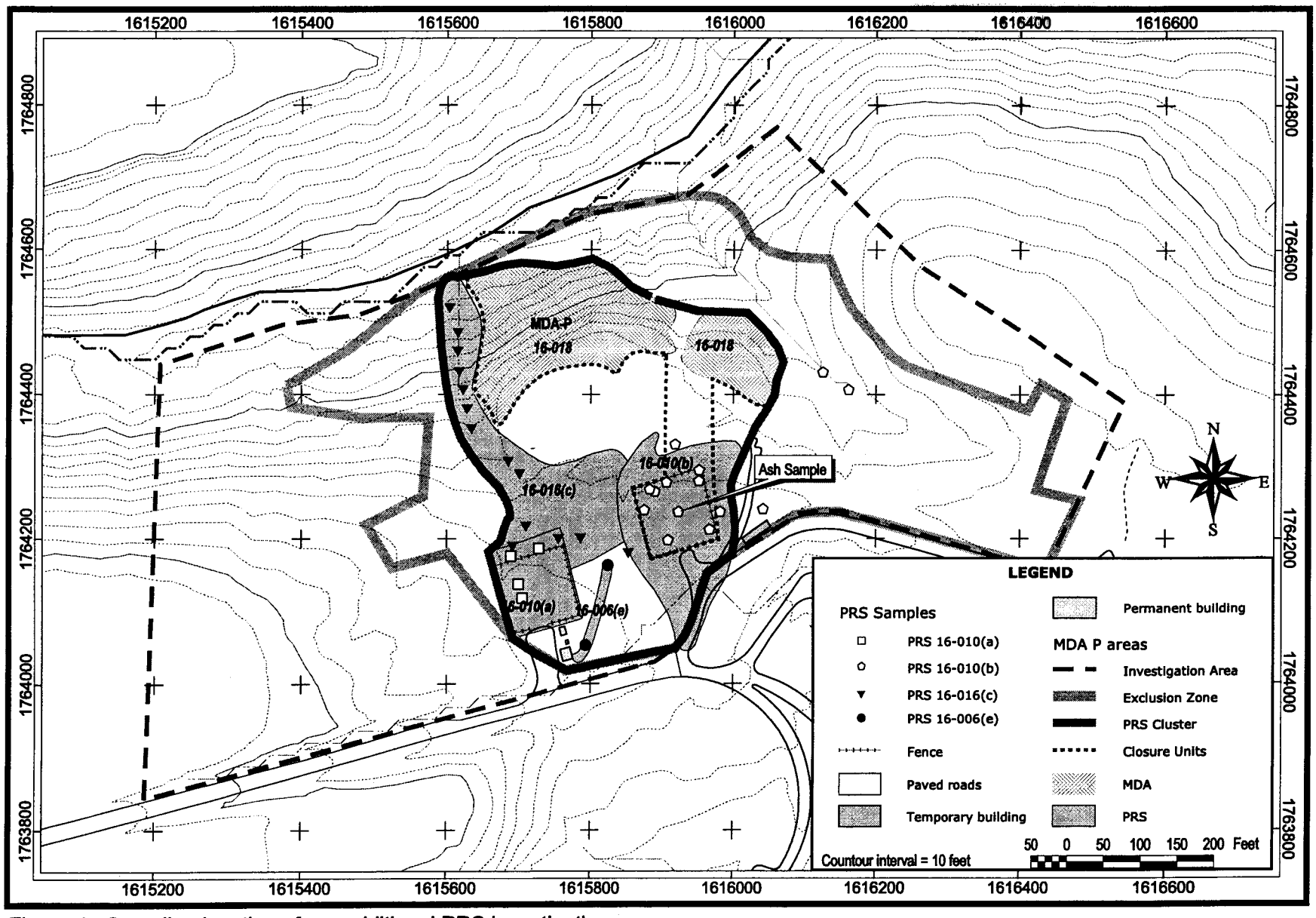


Figure 4. Sampling locations from additional PRS investigations.

Table 1.3-1. Inorganic Chemicals in soil media from MDA P cluster PRS samples

		PRS 16-006e (septic system)[1]				PRS 16-016c, 16-010a (Barium Nitrate Pile area)[2]				PRS 16-016b (387 Burn Pad)[3]				
Analyte	Soil BV	freq of detects	concentration range (mg/kg)	freq >BV	range >BV	freq of detects	concentration range (mg/kg)	freq >BV	range >BV (mg/kg)	freq of detects	concentration range (mg/kg)	freq >BV	range >BV (mg/kg)	source ash
Aluminum	29200	2/2	7360-14400	0/2		22/22	3790-16000	0/22		NR				
Antimony	0.83	0/2	[5.8]-[6.1]	2/2	DL>BV	0/22	[5.02]-[8.53]	22/22	DL>BV	0/13	[0.25]	0/13		11.4
Arsenic	8.17	2/2	1.6-2.9	0/2		21/22	[0.939]-3.78	0/22		13/13	1-4	0/13		230
Barium	295	2/2	92.3-102	0/2		22/22	60.8-28800	20/22	827-28800	13/13	260-24000	13/14	330-24000	2200
Beryllium	1.83	2/2	0.96-1.2	0/2		19/22	[0.43]-1.28	0/22		13/13	0.058-0.9	0/13		1.1
Cadmium	0.4	0/2	[0.58]-[0.61]	2/2	DL>BV	2/22	[0.502]-0.937	22/22	0.518-0.937; DL>BV	7/13	[0.4]-2.1	8/13	0.52-2.1; DL>BV	160
Calcium	6120	2/2	1760-2290	0/2		22/22	359-3420	0/22		NR				
Chromium	19.3	2/2	6.7-10.7	0/2		22/22	4.13-41.2	1/22	41.2	13/13	4.1-16	0/13		650
Cobalt	8.64	2/2	2.9-4.3	0/2		22/22	1.47-114	1/22	114	NR				
Copper	14.7	2/2	4.9-6.8	0/2		22/22	2.77-21.1	1/22	21.1	NR				
Cyanide	0.5	0/2	[1.2]	2/2	DL>BV	0/22	[1.03]-[1.73]	22/22	DL>BV	NR				
Iron	21500	2/2	10500-16500	0/2		22/22	7290-18700	0/22		NR				
Lead	22.3	2/2	8.3-9.9	0/2		22/22	7.29-1650	11/22	27.7-1650	13/13	5.95-622	7/13	23.6-622	8230
Magnesium	4610	2/2	1510-1990	0/2		22/22	637-1880	0/22		NR				
Manganese	671	2/2	249-292	0/2		22/22	159-971	2/22	954-971	NR				
Mercury	0.1	2/2	[0.05]-[0.06]	0/2		7/22	[0.05]-0.104	1/7	0.104	12/13	[0.05]-0.3	3/13	0.1-0.3	<0.05
Nickel	15.4	2/2	6-8.1	0/2		22/22	2.98-8.34	0/22		8/13	[2]-9.5	0/13		96
Potassium	3460	2/2	1320-1790	0/2		22/22	695-1740	0/22		NR				
Selenium	1.52	2/2	[0.29]	0/2		0/22	[0.255]-[0.422]	0/22		9/13	[0.3]-0.4	0/13		2
Silver	1	2/2	[0.58]-[0.61]	0/2		0/22	[0.502]-[0.853]	0/22		3/13	[1]-5.8	6/14	2.4-5.8; DL>BV	140
Sodium	915	2/2	451-510	0/2		22/22	295-802	0/22		NR				
Thallium	0.73	2/2	[0.23]-0.41	0/2		5/22	[0.204]-0.41	0/22		7/13	[0.25]-0.75	1/13	0.75	<1.24
Uranium	1.82	NR				22/22	7.8-25.4	0/22		6/6	0.25-1.36	0/6		
Vanadium	39.6	2/2	15.7-18	0/2		18/18	1.43-3.52	15/18	1.88-3.52	NR				
Zinc	48.8	2/2	23.8-37	0/2		22/22	24.3-121	5/22	57-121	NR				

[1] This is a summary of results. Complete sample results available by request.

[2] This is a summary of results. Complete sample results reported in (LANL 1997, ER ID 62539.1)

[3] This is a summary of results. Complete sample results reported in (LANL 1995, XXXXX)

BV: Laboratory-wide background value (Ryti et al. 1998, 59730)

DL: detection limit

DL>BV: nondetect(s) with reported detection limits>BV

Table 1.3-2. Inorganic Chemicals in tuff media from MDA P cluster PRS samples

Analyte	Upper QBT BV	PRS 16-006e (septic system) Tuff[1] freq of detects	concentration range (mg/kg)	freq >BV	range>BV (mg/kg)
Aluminum	7340	2/2	2450-4020	0/2	
Antimony	0.5	0/2	[0.52]-[0.63]	2/2	DL>BV
Arsenic	2.79	1/2	[0.55]-1.4	0/2	
Barium	46	2/2	30.6-37	0/2	
Beryllium	1.21	2/2	0.69-0.76	0/2	
Cadmium	1.63	0/2	[0.52]-[0.63]	0/2	
Calcium	2200	2/2	989-1150	0/2	
Chromium	7.14	2/2	7.1-10.7	1/2	10.7
Cobalt	3.14	1/2	[1.3]-1.4	0/2	
Copper	4.66	2/2	1.6-2.6	0/2	
Cyanide	0.5	0/2	[1]-[1.3]	2/2	DL>BV
Iron	14500	2/2	11200-11700	0/2	
Lead	11.2	2/2	2-4.8	0/2	
Magnesium	1690	2/2	831-996	0/2	
Manganese	482	2/2	228-285	0/2	
Mercury	0.1	0/2	[0.05]-[0.06]	0/2	
Nickel	6.58	2/2	3-3.3	0/2	
Potassium	3500	2/2	748-770	0/2	
Selenium	0.3	0/2	[0.26]-[0.32]	1/2	DL>BV
Silver	1	0/2	[0.52]-[0.63]	0/2	
Sodium	2770	2/2	490-698	0/2	
Thallium	1.1	0/2	[0.22]-[0.26]	0/2	
Vanadium	17	2/2	8-9.5	0/2	
Zinc	63.5	2/2	32.1	0/2	

[1] This is a summary of results. Complete sample results available by request.
BV: Laboratory-wide background value (Ryti et al. 1998, 59730)
DL: detection limit
DL>BV: nondetect(s) with reported detection limits>BV

Table 1.3-3. Detected Organic Chemicals from MDA P cluster PRS samples

		Barium nitrate pile area[1]					Septic system[2]			387 Burn Pad[3]		
		16-016(c), 16-010(a) soil			16-010(a) tuff		16-006(e) soil & tuff			16-010(b) soil/ash[4]		
Suite	Analyte	freq of detects	range of detects (ppm)	soil & tuff EDL (ppm)	freq of detects	range of detects (ppm)	freq of detects	range of detects (ppm)	soil & tuff EDL (ppm)	freq of detects	range of detects (ppm)	EDL (ppm)
SVOCs	Acenaphthene	1/22	6.5	0.34-0.57	0/8		0/4			0/10		
	Anthracene	1/22	10	0.34-0.57	0/8		0/4			0/10		
	Benzo(a)anthracene	2/22	0.13-27	0.34-0.57	0/8		0/4			0/10		
	Benzo(a)pyrene	2/22	0.15-23	0.34-0.57	0/8		0/4			0/10		
	Benzo(b)fluoranthene	2/22	0.18-32	0.34-0.57	0/8		0/4			0/10		
	Benzo(g,h,i)perylene	2/22	0.072-12	0.34-0.57	0/8		0/4			0/10		
	Benzo(k)fluoranthene	2/22	0.07-11	0.34-0.57	0/8		0/4			0/10		
	Benzoic Acid	4/22	0.078-0.19	3.4-38	0/8		0/4			1/10 (ash)	0.160J	
	Bis(2-ethylhexyl)phthalate	9/22	0.49-5.6	0.34-3.8	1/8	0.13	0/4			0/10		
	Chrysene	2/22	0.18-36	0.34-0.57	0/8		0/4			0/10		
	Dibenzo(a,h)anthracene	1/22	3.3	0.34-0.57	0/8		0/4			0/10		
	Dibenzofuran	1/22	4	0.34-0.57	0/8		0/4			0/10		
	Dichlorobenzene[1,2-]	0/22			0/8		0/4			1/10 (ash)	0.230J	
	Dichlorobenzene[1,3]	0/22			0/8		0/4			1/10 (ash)	0.094J	
	Diethylphthalate	1/22	1.2	0.34-0.57	1/8	0.041	1/4	0.12	0.35-0.49	0/10		
	Di-n-butylphthalate	14/22	0.05-14	0.34-3.8	0/8		0/4			0/10		
	Di-n-octylphthalate	0/22		0.34-3.8	1/8	0.042	0/4			0/10		
	Fluoranthene	2/22	0.3-56	0.34-0.57	0/8		0/4			0/10		
	Fluorene	1/22	6.1	0.34-0.57	0/8		0/4			0/10		
	Indeno(1,2,3-cd)pyrene	2/22	0.077-14	0.34-0.57	0/8		0/4			0/10		
	Methylnaphthalene[2-]	1/22	2.1	0.34-0.57	0/8		0/4			1/10 (ash)	0.110J	
	Naphthalene	1/22	4.9	0.34-0.57	0/8		0/4			1/10 (ash)	0.420J	
	Phenanthrene	2/22	0.16-47	0.34-0.57	0/8		0/4			0/10		
	Phenol	0/22			0/8		0/4			1/10 (ash)	1.1	
	Pyrene	2/22	0.25-44	0.34-0.57	0/8		0/4			0/10		
	Total Petroleum Hydrocarbon	NR			NR		NR			5/5	0.013-0.510	
HE	Amino-2,6-dinitrotoluene[4-]	1/22	0.261	0.084-0.146	0/8		0/4			6/10	.094-1.38	0.091-0.13
	Amino-4,6-dinitrotoluene[2-]	1/22	0.184	0.077-0.123	0/8		0/4			5/10	0.124-1.12	0.077-0.13
	dinitrotoluene[2,4-]	0/22			0/8		0/4			1/10	0.074	0.056-0.13
	HMX	3/22	0.231-0.667	0.1620.266	0/8		0/4			7/10	0.417-22.2	0.166-0.17
	nitrobenzene	0/22			0/8		0/4			1/10	0.357	.09-0.13
	RDX	5/22	0.256-912	0.174-0.279	0/8		0/4			7/10	0.775-11.5	0.175-0.179
	trinitrobenzene[1,3,5-]	0/22			0/8		0/4			3/10	0.199-2.74	0.084-0.09
	trinitrotoluene[2,4,6-] TNT	0/22			0/8		0/4			4/10	0.185-9.89	0.089-0.092
VOCs	Acetone	NR			NR		2/4	0.006-0.012	0.010-0.023	0/8		
	Toluene	NR			NR		0/4			1/8 (ash)	0.006	0.005
	Benzene	NR			NR		0/4			1/8 (ash)	0.016	0.005
	Ethylbenzene	NR			NR		NR			1/8 (ash)	0.004J	0.005

[1] This is a summary of results. Complete sample results reported in (LANL 1997, ER ID 62539.1)

[2] This is a summary of results. Complete sample results available by request.

[3] This is a summary of results. Complete sample results reported in (LANL 1995, XXXXX)

EDL: estimated detection limit

NR:not requested

soil & tuff EDL: EDLs reported for all non-detects (soil & tuff) for the listed analyte

[4] ash: detects in ash samples are indicated by note in column titled freq of detects

Table 1.3-4. Gamma-emitting Radionuclides from MDA P cluster PRS samples

Soil and tuff[1] samples taken from PRS 16-006(e) septic system and analyzed by gamma spectroscopy.

Analyte	FV/BV[2] (pCi/g)	freq of detects	concentration range (pCi/g)	freq>FV/BV
Primary rads[3]	**FV**			
Americium-241	0.013	0/4	[-0.119]-[0.03]	DL > FV (1/4)
Cesium-137	1.65	0/4	[-0.17]-[0.05]	0/4
Cobalt-60		0/4	[-0.031]-[0.027]	0/4
Europium-152		0/4	[0.03]-[0.137]	0/4
Ruthenium-106		0/4	[-0.65]-[0.47]	0/4
Sodium-22		0/4	[-0.07]-[0.07]	0/4
Natural DQ rads[4]	**BVs (soil/tuff)**			
Potassium-40	36.8 / 35.7	4/4	23.1-33.6	0/4

[1] Soil and tuff results are summarized together because all results are qualified as nondetected or have acitivites less than BVs
This is a summary of results. Complete sample results available by request.

[2] FV=fallout value; BV=background value; taken from (Ryti et al. 1998, 59730.2)

[3] Primary rads=analytes in the gamma spectroscopy suite evalueate as potential historical contaminants;
and which require no administrative qualification during the ER Project baseline validation procedure.

[4] Natural rad=primordial radionuclide which is reliably measure by gamma spectroscopy
DQ data quality

approximately two-thirds of the samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), high explosives (HE), total uranium (U), and total petroleum hydrocarbons (TPH). Elevated concentrations of barium (13,000 ppm), cadmium (2.1 ppm), and lead (622 ppm) were detected on and around the flash pad (locations exclude the source term ash sample, and the samples collected from a sediment trap furthest from the flash pad, south of the east lobe). One sample from a runoff channel within the fenced area contained VOCs that were later attributed to analytical laboratory contamination. No SVOCs were detected. The HE analyses yielded significant concentrations of HMX (19 ppm), RDX (12 ppm), and TNT (10 ppm). Uranium concentrations were at or below background. The highest total petroleum hydrocarbon (TPH) concentration was 280 ppm. One of two sediment trap samples collected in the drainage to Cañon de Valle (southeast of the eastern lobe of MDA P) contained elevated barium (24,000 ppm) and HMX (22.2 ppm).

PRSs 16-010(a) and 16-016(c), Barium Nitrate Pile area – In March 1995, a Phase 1 sampling campaign was conducted in accordance with the December 1994 Revision to the RFI Work Plan for OU 1082 to support a baseline risk assessment in the barium nitrate pile area. A field-randomized 20 ft grid was used to collect barium, HE, and radiation field screening data. The sampling grid extended over PRS 16-010(a) Flash Pad TA-16-386 and into PRS 16-016(c). Surface soil samples from the locations of the five highest barium readings were submitted for fixed laboratory analyses. The drainage channel was field screened for barium, HE and radiation at points every 30 feet (for a distance of 210 feet beginning at a point to the west of MDA P near the confluence with Cañon de Valle and extending southward towards the barium nitrate pile source) to check for off-SMWU migration. Surface soil samples were taken in the center of the drainage at 30-foot intervals and submitted for fixed laboratory analysis. A total of 22 samples were collected from the grid and drainage transect laid out at this site, including three sub-surface samples collected from a 2 ft depth and 19 surface samples. Analytical results indicate several metals, particularly barium and lead, above soil background values and detected PAHs, and HEs. The highest barium and lead concentrations were 28,800 ppm and 1,650 ppm, respectively. In addition 912 ppm RDX was found in a surface soil sample down drainage from Flash Pad TA-16-386. Elevated PAHs were found in many samples, with the highest concentration in a subsurface sample 270 ft down drainage. Total uranium was found at a maximum of 3.52 ppm. At four locations in the flash pad area samples of tuff were taken at 2-3 foot and 5-6 foot depths. These samples yielded elevated barium (ranging from 966 to 3,370 ppm) and chromium (ranging from 15.6 to 36.9 ppm). The concentrations of barium in the tuff were less than half the concentrations found in the associated surface soil sample. The concentrations of chromium in tuff samples were more than double the concentrations found in the associated surface soil samples, which is inconsistent with the barium results and with expectations based on the site model.

PRS 16-006(e), septic system – In September 1995, two boreholes were drilled at the proximal and distal end of the septic system, PRS 16-006(e). The proximal hole was drilled near the septic tank, and the distal hole was drilled approximately 75 feet down the drain line from the tank. Additional samples were planned for the septic system outfall and its drainage channel, but were not collected because the outfall and drainage channel could not be located. The field team concluded that the outfall and drainage channel may have been obliterated during the construction of the asphalt drainage that diverts run-off away from the MDA P. It is also possible that the drain field angled to the northwest from the septic tank rather than to the northeast. The borehole cores were screened for VOCs, HE, and radiation. A soil sample and tuff sample were collected at each of the two locations described above. Analytes for the four samples were metals, organic chemicals and gamma-emitting radionuclides. No detected metal result was above the related LANL-wide background value. Two organic chemicals (acetone and diethylphthalate) were detected at low concentrations. No compound containing high explosives was detected in any samples. No radionuclides were detected with the exception of naturally-occurring potassium-40. The reported activities for potassium-40 were less than the LANL-wide background value.

Cañon de Valle drainage channel:

The sampling locations for the three investigations of surface sediments and surface water conducted within Cañon de Valle are displayed in Figure 5. Also included are the locations of MDA P, MDA R and the 260 Outfall, the three areas that have been identified as contributing contaminants into the drainage channel. The sampling locations for the investigation of storm water runoff immediately around MDA P, are identified in Figures 6. The results for the data sets are presented in summary form in Table 1.4-1 through Table 1.4-5 below.

1994 Cañon de Valle investigation – Sediment and unfiltered water samples were collected at locations within the stream channel of Cañon de Valle, including three sampling locations upstream of the waste pile to represent locations unaffected by MDA P, and three locations below and downstream of the waste pile that represent locations potentially affected by MDA P (LANL 1995, 58713). The primary contaminants identified included barium at concentrations consistently above background levels, and HE at moderate concentrations (TNT in one sediment sample, and RDX in all water samples). The sediment and unfiltered water samples were analyzed for VOCs, SVOCs, total metals, HE, nitrates, gross alpha, gross beta, and gamma. HE and nitrates were detected in the water and sediment; VOCs, SVOCs, gross alpha, gross beta, and gamma were not detected. The detected HE constituents were: one detect of TNT (1.8 mg/kg) in a sediment sample, and detects of RDX in all unfiltered water samples (ranging from 133 to 180 µg/L). The following inorganics were detected above [current] BVs in sediment samples [listed in LANL background document (Ryti et al., 1998, 59730.2)]: barium, cobalt, copper, lead, nickel and selenium in both upstream and downstream samples; cadmium, mercury and vanadium in upstream samples; manganese and zinc in downstream samples. Barium was detected at high concentrations (>3000 µg/L) in all unfiltered water samples. The following inorganics were also detected in unfiltered water samples [there are currently no BVs for water samples]: aluminum, calcium, iron, potassium, magnesium, sodium, antimony, selenium, and vanadium. The remaining inorganics (arsenic, beryllium, cadmium, cobalt, chromium, copper, lead, manganese, mercury, nickel, silver, thallium, and zinc) were never detected in the unfiltered water samples. The report summary concluded that (1) the data clearly demonstrate the presence of another source of contamination upstream from MDA P, (2) the data were not sufficient to estimate the portion of the contamination due to MDA P.

1996 Cañon de Valle investigation – Surface sediment and water samples were collected in 1996 in support of the closure plan activities for MDA P and for the site characterization of Cañon de Valle outlined in the Work Plan for Operable Unit 1082 (LANL 1994, 20948.1 and 39440.1) (reported in Dye and Childs 1997, 58712.1). The 6000-foot section of Cañon de Valle from approximately 2800 feet upgradient of MDA P to approximately 2500 feet downgradient of MDA P receives storm water runoff from two material disposal units (MDA P and MDA R) and an outfall for a high explosives machining facility (building 260 outfall, PRS 16-021(c)). Two automatic samplers, one upstream from MDA P and one adjacent to MDA P, each collected a single 24-hour composite sample the day after a large storm event (1.8 inches). The samples were split resulting in one fraction that was filtered with a 0.45 micron filter and a second fraction that was not filtered. The filtered samples were analyzed for TAL metals, and the unfiltered samples were analyzed for TAL metals, total uranium, HE, VOCs, SVOCs and total suspended solids (TSS). Twenty-one grab samples (twenty samples and one field replicate) of surface water were taken at 20 locations, starting downstream of MDA P and continuing upstream past the 260 outfall to MDA R. Surface sediment samples were collected at the same locations as the grab water samples, plus some additional locations that continued upstream past MDA R. A total of thirty-one sediment samples (thirty samples and one field replicate) were collected from thirty locations along Cañon de Valle spanning a 6000-foot segment of Cañon de Valle. The sediment samples were analyzed for TAL metals, HE, SVOCs, nitrate/nitrite, and gamma spectrometry analyses. The grab water samples were analyzed for the

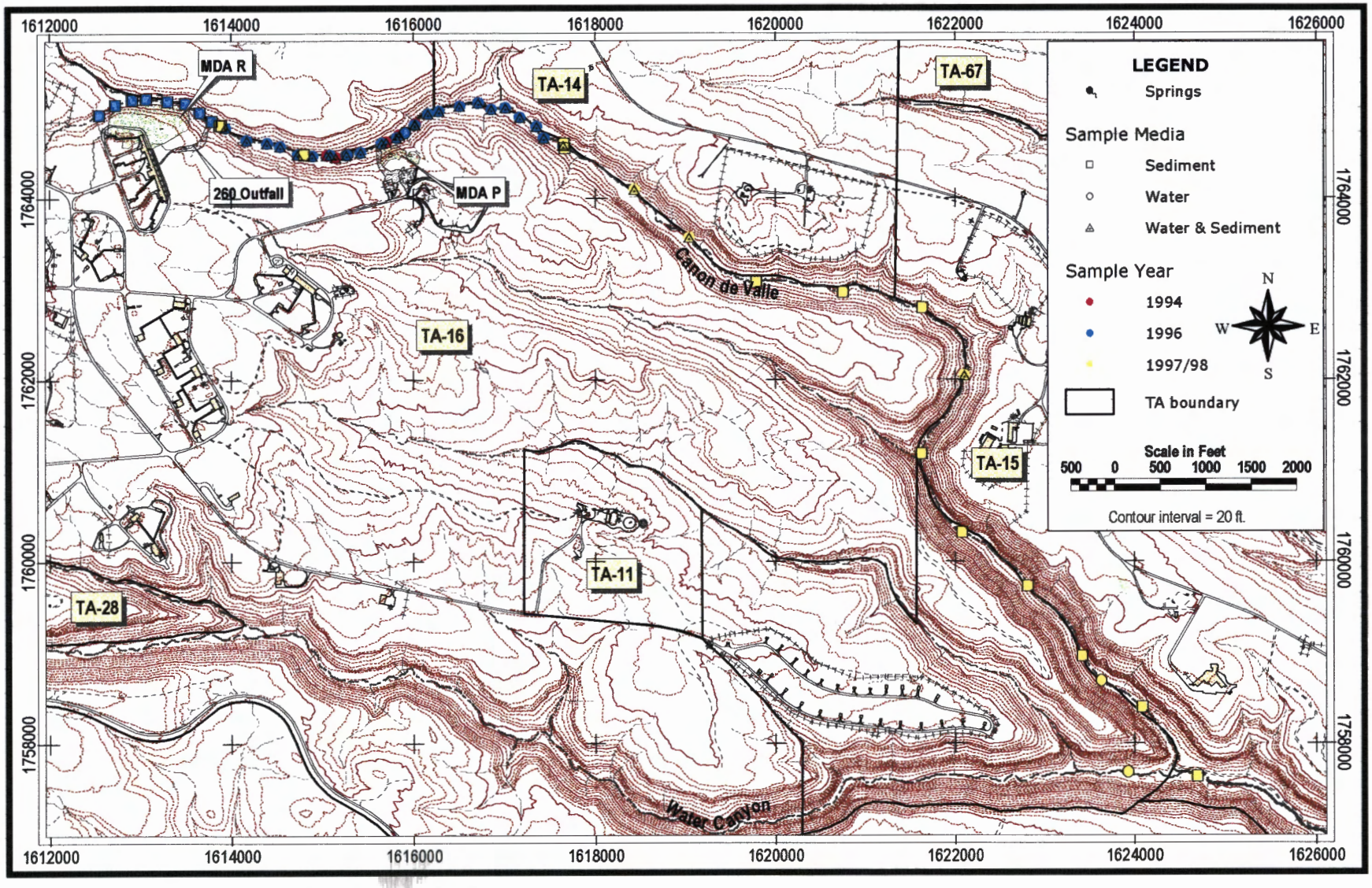


Figure 5. Sampling locations from Canon de Valle Investigations.

Figure 6

TA-16 MDA P Site Drainage Map

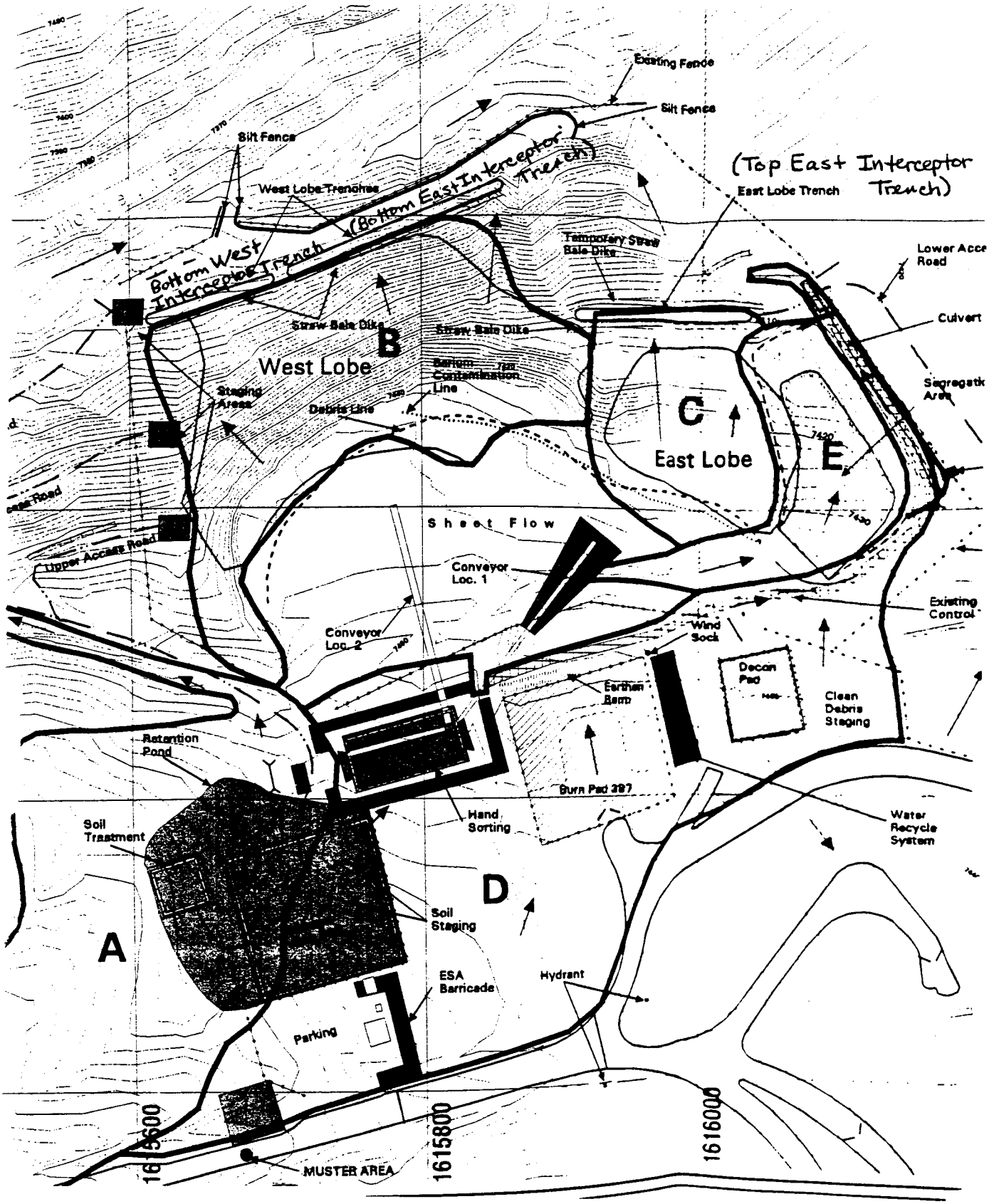


Table 1.4-1. Inorganics in Cañon de Valle Sediments Upstream and Downstream of MDA P.

This summary separates the data results by location upstream and downstream of MDA P[1].

		Downstream from MDA P				Upstream from MDA P			
Analyte	**BV (mg/kg)**	**Number of Analyses**	**Number of Detects**	**Concentration Range (mg/kg)**	**Frequency of Detects Above BV**	**Number of Analyses**	**Number of Detects**	**Concentration Range (mg/kg)**	**Frequency of Detects Above BV**
Aluminum	15400	31	31	910-12000	0/31	24	24	2850-12000	0/24
Antimony	0.83	31	0	[0.2-22]	DL > BV (20/31)	24	0	[0.2-1.4]	DL > BV (10/24)
Arsenic	3.98	31	18	0.97-7.2	2/31 (plus 4 DL > BV)	23	7	[2.1]-11	1/23 (plus 5 DL > BV)
Barium	127	31	31	55-14300	29/31	24	24	6.3-40300	23/24
Beryllium	1.31	31	5	[0.16]-1.1	0/31	24	7	[0.17]-0.99	0/24
Cadmium	0.4	31	4	[0.05]-1.3	3/31 (plus 9 DL > BV)	24	4	[0.06]-0.51	1/24
Calcium	4420	31	31	300-4220	0/31	24	24	680-6060	1/24
Chromium, Total	10.5	31	29	1.1-10	0/31	24	24	2.6-17.8	2/24
Cobalt	4.73	31	29	1.1-23.9	9/31	24	24	2.3-14.7	17/24
Copper	11.2	31	29	[1.4]-53.1	11/31	24	24	3.4-99.8	15/24
Cyanide, Total	0.82	28	2	0.28-[2.9]	1/28 (plus 7 DL > BV)	21		[0.2-1.5]	DL > BV (2/21)
Iron	13800	31	31	2500-14800	3/31	24	24	6900-22000	1/24
Lead	19.7	31	31	3.8-50.1	11/31	24	24	11.1-129	16/24
Magnesium	2370	31	31	140-2000	0/31	24	24	420-2040	0/24
Manganese	543	30	30	120-1910	5/30	24	24	152-1460	4/24
Mercury	0.1	31	6	[0.015]-0.39	4/31 (plus 10 DL > BV)	24	9	[0.03]-0.22	5/24
Nickel	9.38	31	26	[2]-19.4	7/31 (plus 1 DL > BV)	24	24	4.9-305	18/24
Nitrate + Nitrite		13	6	0.5-4.8		18	8	0.5-7.7	
Potassium	2690	31	31	210-1910	0/31	24	23	399-1510	0/24
Selenium	0.3	31	2	[0.3]-2.2	2/31 (plus 27 DL > BV)	24	9	[0.3]-3	9/24 (plus 14 DL > BV)
Silver	1	31	14	0.25-5.6	7/31 (plus 12 DL > BV)	24	16	[0.21]-15.1	13/24
Sodium	1470	31	29	27-748	0/31	24	23	[66.6]-230	0/24
Thallium	0.73	31	4	[0.04]-7.1	4/31 (plus 12 DL > BV)	24	7	[0.2]-3.6	6/24 (plus 15 DL > BV)
Uranium	6.99	14	14	1.051-3.91	0/14	17	17	1.61-3.49	0/17
Vanadium	19.7	31	31	0.53-26.5	2/31	24	24	8.2-54.2	5/24
Zinc	60.2	31	31	13-117	4/31	24	24	19.2-69.1	2/24

[1] Complete sample results are reported in the 260 Outfall RFI report (LANL 1998, ER ID 59891.3)

Table 1.4-2. HE in Cañon de Valle Sediments Upstream and Downstream of MDA P.

This summary separates the data results by location upstream and downstream of MDA P[1].

	Downstream from MDA P				Upstream from MDA P			
ANALYTE	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Concentration Range of Detects (mg/kg)	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Concentration Range of Detects (mg/kg)
Amino-2,6-dinitrotoluene[4-]	28	6	[0.085]-[2.5]	0.14-0.517	21	13	[0.085]-0.908	0.14-0.908
Amino-4,6-dinitrotoluene[2-]	14	1	[0.082]-0.555	0.555	17	5	[0.082]-1.02	0.494-1.02
Dinitrobenzene[1,3-]	31	0	[0.08-1.2]		24	0	[0.081-0.63]	
Dinitrotoluene[2,4-]	31	0	[0.062-1.2]		24	0	[0.062-0.63]	
Dinitrotoluene[2,6-]	31	0	[0.081-1.3]		24	0	[0.081-0.65]	
HMX	31	10	[0.162]-170	0.96-170	24	9	[0.164]-43.5	1-43.5
Nitrobenzene	31	0	[0.085-1.3]		24	1	[0.085-0.65]	0.088
Nitrotoluene[2-]	31	0	[0.146-2.5]		24	0	[0.147-0.63]	
Nitrotoluene[3-]	31	1	[0.176]-[2.5]	0.354	24	0	[0.177-0.63]	
Nitrotoluene[4-]	31	0	[0.178-7.4]		24	0	[0.179-1.5]	
RDX	31	3	[0.16]-42	2.48-42	24	10	[0.16]-5.88	0.201-5.88
Tetryl	31	0	[0.093-3.7]		24	0	[0.093-1.6]	
Trinitrobenzene[1,3,5-]	31	1	[0.078]-[1.2]	0.114	24	0	[0.078-0.63]	
Trinitrotoluene[2,4,6-]	31	4	[0.088]-[1.2]	0.111-0.54	24	6	[0.088]-[1.8]	0.099-1.35

[1] Complete sample results are reported in the 260 Outfall RFI report (LANL 1998, ER ID 59891.3)

Table 1.4-3. Inorganics in Cañon de Valle Surface Water Samples

This summary separates the data results by location upstream and downstream of MDA P[1].

	Downstream from MDA P				Upstream from MDA P			
Analyte	Number of Analyses	Number of Detects	Concentration Range (µg/l)	Concentration Range of Detects (µg/l)	Number of Analyses	Number of Detects	Concentration Range (µg/l)	Concentration Range of Detects (µg/l)
Aluminum	36	24	51.6-13600	51.6-13600	19	18	[100]-4110	120-4110
Antimony	36	2	2-[50]	2-3	19	2	[2]-[20.2]	3-4
Arsenic	36	2	[1.6]-24	5-24	19	1	[1.6]-15	5.6
Barium	36	36	99-6490	99-6490	19	19	630-6520	630-6520
Beryllium	36	2	[0.1]-4	0.14-4	19	1	[0.1]-4	0.12
Cadmium	36	1	[0.3]-[5]	3.9	19	2	[0.3]-5.2	3.6-5.2
Calcium	36	35	1770-18000	1770-18000	19	19	15800-19600	15800-19600
Chromium	36	3	[0.5]-[70]	3.8-10	19	1	[0.5]-[70]	4.3
Cobalt	36	1	[0.43]-[20]	5.3	19	0	[0.4-20]	
Copper	36	4	[0.5]-20	3.2-20	19	2	[0.5]-[20]	4.6-8.1
Cyanide	22	1	[3.8]-[14]	9.3	11	1	[3.8]-12.3	12.3
Iron	36	25	[40]-[12000]	60-7340	19	14	99.4-4470	99.4-4470
Lead	36	12	1-23	1-23	19	5	1.2-16	2-16
Magnesium	36	26	[2900]-5360	3600-5360	19	16	4820-5890	4820-5890
Manganese	36	19	[2.4]-2200	6.5-2200	19	10	[3.2]-359	7-359
Mercury	36	0	[0.02-6.5]		19	1	[0.02]-[0.8]	0.03
Nickel	36	17	1.6-18000	1.6-18000	19	9	1.5-[49.6]	1.5-8.6
Potassium	36	35	1000-4000	1000-4000	19	19	2500-3910	2500-3910
Selenium	35	0	[1.8-34]		20	3	[1.8]-[34]	3
Silver	35	1	[0.67]-[40]	1	19	0	[0.67-40]	
Sodium	36	27	[500]-24300	4900-24300	19	18	19200-24000	19200-24000
Thallium	36	1	[2]-[68]	7.4	19	1	[2]-[68]	2.9
Uranium	16	14	0.09-0.36	0.09-0.36	11	10	0.16-0.57	0.16-0.57
Vanadium	36	8	[1.2]-10.4	1.7-10.4	19	5	[1.3]-[10]	2.1-9.3
Zinc	36	10	[0.4]-[70]	8.6-40	20	6	[2.4]-33	8.2-33

[1] Complete sample results are reported in the 260 Outfall RFI report (LANL 1998, ER ID 59891.3)

Table 1.4-4. HE in Cañon de Valle Surface Water Samples

This summary separates the data results by location upstream and downstream of MDA P[1].

	Downstream from MDA P				Upstream from MDA P			
Analyte	Number of Analyses	Number of Detects	Concentration Range (µg/l)	Concentration Range of Detects (µg/l)	Number of Analyses	Number of Detects	Concentration Range (µg/l)	Concentration Range of Detects (µg/l)
Amino-2,6-dinitrotoluene[4-]	24	23	0.054-12	0.054-12	11	9	0.39-53.2	13.6-53.2
Amino-4,6-dinitrotoluene[2-]	19	17	0.049-27	0.095-27	9	9	11.1-43.2	11.1-43.2
Dinitrobenzene[1,3-]	31	0	[0.048-20]		17	0	0.048-20	
Dinitrotoluene[2,4-]	31	13	0.036-29	0.04-0.075	17	8	0.083-29	0.083-0.324
Dinitrotoluene[2,6-]	31	0	0.048-47		17	0	0.048-47	
HMX	31	23	0.209-160	0.209-160	17	9	1.7-160	41.3-160
Nitrobenzene	31	2	0.051-32	0.50-0.53	17	0	0.051-32	
Nitrotoluene[2-]	30	12	0.088-60	0.169-1.2	17	7	0.088-60	0.281-2.28
Nitrotoluene[3-]	30	0	0.104-40		17	0	0.105-40	
Nitrotoluene[4-]	30	0	0.096-43		17	0	0.106-43	
RDX	31	23	0.324-500	0.324-500	17	9	0.87-818	272-818
Tetryl	31	0	0.055-20		17	0	0.055-20	
Trinitrobenzene[1,3,5-]	31	0	0.047-37		17	1	0.047-37	0.207
Trinitrotoluene[2,4,6-]	31	6	0.05-35	0.06-1.8	17	8	0.114-35	0.114-7.41

[1] Complete sample results are reported in the 260 Outfall RFI report (LANL 1998, ER ID 59891.3)

Table 1.4-5. Inorganics and HE in Interceptor Trench Water Samples (Storm Water Runoff)

MDA P Lobe	east lobe	west lobe	west lobe	
MDA P Interceptor Trench	Top East	Bottom East	Bottom West	
Sample ID	0816-98-0078	0816-98-0079	0816-98-0080	
pH	6.8	6.7	6.6	
INORGANICS	CONCENTRATION (µg/L)			TV (µg/L)
Aluminum	344	310	239	
Antimony	3.5 (U)	3.5 (U)	3.5 (U)	
Arsenic	2.8 (U)	40.4	32.4	5000
Barium	8070	331	201	100000
Beryllium	0.1 (U)	0.1 (U)	0.1 (U)	
Cadmium	0.4 (U)	0.4 (U)	0.4 (U)	1000
Calcium	5980	5660	5040	
Chromium	2.1 (B)	13.2	22.1	5000
Cobalt	2.2 (B)	0.7 (U)	0.74 (B)	
Copper	7 (B)	47.8	48.3	
Iron	1380	1680	1520	
Lead	1.7 (U)	1.7 (U)	1.7 (U)	5000
Magnesium	980 (B)	717 (B)	1180 (B)	
Manganese	172	143	155	
Mercury	0.1 (U)	0.1 (U)	0.1 (U)	200
Nickel	2 (B)	3 (B)	2.2 (B)	
Potassium	26700	40000	78800	
Selenium	3.6 (U)	3.6 (U)	3.6 (U)	1000
Silver	0.5 (U)	0.5 (U)	0.5 (U)	5000
Sodium	20200	17500	35500	
Thallium	2.8 (U)	6.3 (B)	3.6 (B)	
Vanadium	0.72 (B)	1.2 (B)	1.2 (B)	
Zinc	22.5	23.1	35.4	
Cyanide	5 (U)	5 (U)	5 (U)	
HE COMPOUND	CONCENTRATION (µg/L)			
HMX	6.6	1.7 (U)	1.7 (U)	
RDX	33 (E)	0.87 (U)	0.87 (U)	
1,3,5-Trinitrobenzene	0.2 (U)	0.2 (U)	0.2 (U)	
1,3-Dinitrobenzene	0.2 (U)	0.2 (U)	0.2 (U)	
Nitrobenzene	0.2 (U)	0.2 (U)	0.2 (U)	
Tetryl	0.58 (U)	0.58 (U)	0.58 (U)	
Amino-DNTs	0.39 (U)	0.39 (U)	0.39 (U)	
2,4,6-Trinitrotoluene	0.2 (U)	0.2 (U)	0.2 (U)	
2,6-Dinitrotoluene	0.2 (U)	0.2 (U)	0.2 (U)	
2,4-Dinitrotoluene	0.2 (U)	0.2 (U)	0.2 (U)	
2-Nitrotoluene	NR	0.78 (U)	0.78 (U)	
4-Nitrotoluene	NR	2.3 (U)	2.3 (U)	
3-Nitrotoluene	NR	0.78 (U)	0.78 (U)	
PETN	1.6 (U)	NR	NR	

TV=threshold value=toxicity characteristic metals regulatory limit
EQL=estimated quantitation limit; IDL=instrument detection limit
laboratory qualifiers:
U=not detected; value in table is the EQL; concentration (if analyte is present) is less than the EQL.
B the reported value was less than the EQL but greater than the IDL.
E the concentration of the analyte exceeded the calibration range of the analytical instrument.

same suites plus VOCs. The primary COPCs identified in the Cañon de Valle report were barium and the HE compounds RDX, HMX, and TNT. For barium, maximum concentrations of 6.7 mg/L in water and 40,000 mg/kg in sediment were detected. The maximums for HE components included RDX at 818 µg/L in unfiltered water and 5.88 mg/kg in sediment, HMX at 160 µg/L in unfiltered water and 170 mg/kg in sediment, and TNT at 7.41 µg/L in unfiltered water and 1.35 mg/kg in sediment. No radionuclides were identified as COPCs in the report. Two VOCs (acetone and methylene chloride) and two SVOCs (2,6-dinitrotoluene and bis(2-ethylhexyl)phthalate) were detected sporadically in water samples at low concentrations (equal to or below the associated estimated quantitation limits (EQLs)). Four SVOCs in were detected in sediment samples; three ((benzoic acid, bis(2-ethylhexyl) phthalate, diethylphthalate) were detected sporadically at low concentrations, and di-n-butylphthalate was detected in 29 samples at concentrations ranging from 0.8 to 10 mg/kg. In the report, the di-n-butylphthalate was attributed to an "unknown source" since it "has not been used with HE formulations at TA-16".

1997/1998 Cañon de Valle investigation - During 1997 and early 1998, in support of Phase II sampling for the 260 Outfall RFI report, additional surface water and sediment samples were collected in Cañon de Valle. Sediment samples were collected from eighteen locations, including twelve centerline drainage channel and six overbank sediment samples. The overbank samples were collected to augment samples previously collected in Cañon de Valle from three areas that had been identified as having elevated barium concentrations. A geomorphic survey was conducted at those areas along the north and south banks of the channel to locate areas of fine-grained sediments deposited during historic flooding events. Four of the overbank locations were from two areas upstream of MDA P, and the other two are from an area about 2500 feet downstream of MDA P. The twelve centerline drainage channel sediment samples were taken from beyond the range of the 1996 sampling locations at 1000-foot intervals, beginning about 5025 feet downstream of MDA P and terminating at the first point beyond the confluence with Water Canyon. Filtered and unfiltered water samples were taken from one location within Water Canyon just above the confluence with Cañon de Valle and seven additional locations within Cañon de Valle, including one location upstream of MDA P and six locations downstream of MDA P. The 260 Outfall RFI report reviewed and assessed all the Cañon de Valle sediment and surface water data from the 1994, 1996 and 1997/1998 campaigns. The following text is taken from the summary of the alluvial system investigation for the 260 Outfall RFI (LANL 1998, 59891.3 Volume 1 of 3).

> Barium is the most abundant inorganic COPC in sediments. For the surface samples, barium ranges from 6.3 mg/kg to 40300 mg/kg. Other inorganics above the BVs include arsenic, cadmium, chromium, cobalt, copper, lead, manganese, mercury, selenium, silver, vanadium, zinc, and possibly antimony and cyanide. These are generally less than two times the BVs. Several types of HE were found at concentrations greater than the detection limits: the amino-dinitrotoluenes, HMX, nitrobenzene, 3-nitrotoluene, RDX, trinitrobenzene (TNB), and TNT. The two HE that were highest in abundance and concentration were HMX and RDX. Their maxima were 170 mg/kg and 42 mg/kg, respectively. The highest RDX value comes from an overbank sample collected approximately 6200 feet below the 260 outfall/Cañon de Valle confluence [approximately 4500 feet downgradient of MDA P]. Two significant non-HE organics were detected: bis(2-ethylhexyl)phthalate and di-n-butylphthalate.
>
> [For surface water samples] Filtered/unfiltered pairs were collected in 1994 and 1997/98; primarily unfiltered samples were collected in 1996. The differences in concentration between the filtered and unfiltered samples are small.
>
> [There is no NMED-approved background data set for surface water, but collection of such a data set is ongoing. In the 260 Outfall RFI report the reviewers compare] the TA-16 surface water data set to a

preliminary surface water data set consisting of surface waters that issue from the Los Alamos Canyon and Pajarito Canyon A statistical test was used to determine whether the TA-16 data set was greater than this background data set.

The inorganics carried forward as COPCs in (surface) waters were: antimony, barium, calcium, chromium, lead, magnesium, manganese, mercury, nickel, potassium, sodium, vanadium, and zinc. Barium appears to be the most abundant COPC in this list, with concentrations ranging from (99 µg/L to 6490 µg/L in surface water). As in the sediments, HE appears to be the other major contaminant in Cañon de Valle water, The HE identified were the amino-dinitrotoluenes, HMX, nitrobenzene, 2-nitrotoluene, RDX, TNB, and TNT. RDX is the HE highest in concentration, with a maximum concentration of 818 µg/L in surface water. Very few of the non-HE organics exceeded their estimated quantitation limits (EQLs) in water.

When considering Cañon de Valle from Peter Seep to the confluence with Water Canyon, the data suggest that all contaminants decrease in concentration downgradient. However, when looking at the upper canyon is smaller scale, many of the COPC abundances fluctuate. These fluctuations could be attributed to contaminant sources other than the TA-16-260 outfall, larger sediment packages where COPCs accumulate, or temporal variability.

The Cañon de Valle data were reviewed and assessments performed to support the 260 Outfall RFI report. The review of the data for the purposes of this report would not disagree with any of the conclusions in the 260 Outfall RFI report. Instead, summary tables in this attachment (Table 1.4-1 and 1.4-2) are presented to compare the concentrations of analytes upstream of MDA P to those downstream of MDA P. It is assumed that MDA P has contributed to the contamination in the water course. The intent is to identify any constituents that might be solely attributable to MDA P rather than the collective set of PRSs that drain into Cañon de Valle. The summary tables confirm what has been concluded in previous reports on the Cañon de Valle data. The list of constituents and concentration levels for those constituents are not significantly different upstream and downstream of MDA P.

Storm Water runoff from MDA P – A series of interceptor trenches were constructed between MDA P and Cañon de Valle. The trenches collect run-off from MDA P and prevent potentially contaminated water from discharging directly into Cañon de Valle (see site map with trenches in Figure 6). The trenches are managed under the Storm Water Pollution Prevention (SWPP) Plan developed for MDA P (LANL 1999, ER ID 63399) as required for permitting of a National Pollutant Discharge Elimination System (NPDES) sampler. The SWPP Plan applies to discharges of storm water from the operational areas at the clean closure of the waste pile at MDA P. As storm water accumulates in the three interceptor trenches, it is pumped into 20,000-gallon tanks, in discreet volume "batches". Each trench has an individually designated tank, to support separate sample analysis of each trench. This procedure allows time for particulates to settle out of the water prior to sampling. To support the proper on-site management of the storm water, it will be analyzed for hazardous constituents described in the MDA P Site Closure Plan (primarily HE constituents and metals), in addition to parameters listed 20NMAC 6.2 Section 3103 (A). If the analytical results of the water indicate that it does not exceed the maximum concentration of contaminants for the toxicity characteristic, then the water will be re-applied to the landfill for dust suppression as described in the SWPP.

A water sample from each of the trenches was collected in December 1998 and analyzed for metals, HE, SVOCs, pesticides and gamma-emitting radionuclides. The samples might be expected to contain both storm water runoff and on-site leachate. All measured concentrations of metals were at least 2-3 orders of magnitude lower than the regulatory limits. In fact, the concentrations were within the range of

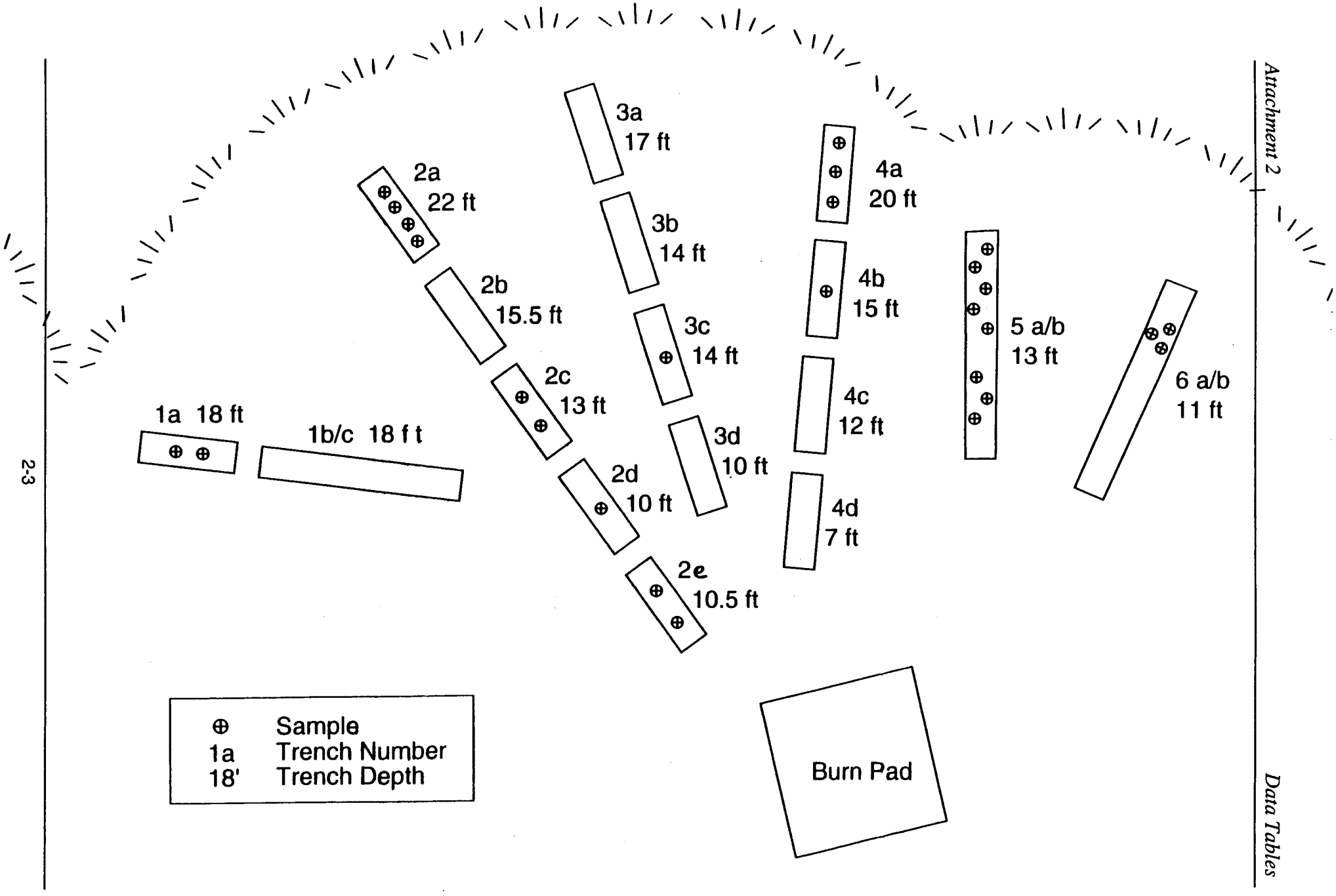
concentrations seen in Cañon de Valle surface water samples both upstream and downstream of MDA P with few exceptions. The barium concentration from the trench below the east lobe of MDA P and the concentrations of three industrial metals (chromium, copper and arsenic) from the trenches below the west lobe of MDA P were larger than seen in Cañon de Valle surface water samples, but not significantly larger . The only detected HE compounds (HMX and RDX) were well below 1% of sample mass. No pesticides or VOCs were reported above detection limits. The few SVOCs had concentrations less than twice the estimated quantitation limits, well below the regulatory limits. The gamma spectroscopy results were all nondetects or detected at concentrations just above the minimum detectable activity. The water was not characteristically hazardous. It was determined to be suitable for re-application to the landfill for dust suppression. The results for metals and HE compounds for all three trenches are reported in Table 1.4-5.

Attachment 2

Data Tables

Attachment 2, Section 2.1, Data from 1997 Exploratory Trenches.

The location of the 1997 Exploratory trenches within the MDA P investigation area are shown on Figure 3 of Attachment 1. The trenches are numbered from 1 to 6 proceeding from west to east. The sections of trenches are lettered from a to (a maximum of) e (depending on the trench) from north to south. A schematic drawing of the arrangement of trenches and trench sections is shown on the following page. The sample results identified by trench location are shown in Tables 2.1-1 through 2.1-3 for viewer reference.



MDA-P Exploratory Trench Excavation and Sampling

Table 2.1-1 1997 Exploratory Trench TCLP Metal results

		TV (µg/L)	Arsenic 5000	Barium 100000	Cadmium 1000	Chromium 5000	Lead 5000	Mercury 200	Selenium 1000	Silver 5000	
Sample ID	Trench	Depth (ft)	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pH
0816-97-0024	1a	4-6	53.6	3420	3.8 U	6.7	22.7 U	0.1 U	42.6 U	5 U	8.3
0816-97-0025	1a	14.5	30.6 U	1450	10.5	5.8	22.7 U	0.1 U	42.6 U	5 U	8
0816-97-0020	2a	15	61.4	2040	3.8 U	3.1 U	47.7	0.1 U	42.6 U	5 U	8.2
0816-97-0021	2a	6	49	1850	3.8 U	3.1 U	38.8	0.1 U	42.6 U	5 U	8
0816-97-0022	2a	2	40.4	910	87.6	7.2	462	0.1 U	42.6 U	5 U	8
0816-97-0023	2a	22	31.2	1300	3.8 U	3.1 U	22.7 U	0.1 U	42.6 U	5 U	7.2
0816-97-0029	2c	4	38	1270	3.8 U	3.1 U	22.7 U	0.1 U	42.6 U	5 U	8
0816-97-0030	2c	13	30.6 U	1230	3.8 U	3.1 U	22.7 U	0.1 U	42.6 U	5 U	7.5
0816-97-0028	2d	4	30.6 U	1080	3.8 U	3.4	22.7 U	0.1 U	42.6 U	5 U	6.8
0816-97-0026	2e	3-4	30.6 U	1330	3.8 U	7	22.7 U	0.1 U	42.6 U	5 U	6.8
0816-97-0027	2e	7-10	44.7	1030	3.8 U	14.6	22.7 U	0.1 U	43.5	5 U	7
0816-97-0019	3c	9	30.6 U	1350	3.8 U	4.1	22.7 U	0.15	42.6 U	5 U	7.5
0816-97-0015	4a	4-6	34.5	11000	3.8 U	3.1 U	22.7 U	0.1 U	42.6 U	5 U	8.2
0816-97-0016	4a	10-15	30.6 U	124000	3.8 U	3.5	22.7 U	0.1 U	42.6 U	5 U	8.5
0816-97-0017	4a	20	30.6 U	5850	3.8 U	3.1 U	22.7 U	0.1 U	42.6 U	5 U	7.8
0816-97-0018	4b	13-15	37.5	2930	3.8 U	3.3	22.7 U	0.1 U	42.6 U	5 U	7.6
0816-97-0031	5a	3	30.6 U	2290000	4.8	11.7	2130	0.64	42.6 U	47.6	8.5
0816-97-0033	5a	13	42.5	10700	6	11.3	48.7	0.1 U	42.6 U	5 U	8.1
0816-97-0034	5a	9	49.3	613000	4	8	60.5	0.38	42.6 U	5 U	8.4
0816-97-0039	5a	3	30.6 U	1690000	6.3	9.8	5210	0.92	48.8	78.5	8.4
0816-97-0041	5a	8	30.6 U	662000	10.6	8.2	573	0.27	42.6 U	5 U	8.4
0816-97-0032	5b	4	40.3	112000	3.8 U	6.4	22.7 U	0.1 U	42.6 U	5 U	8.3
0816-97-0035	5b	8	59	3410	8.7	5.9	158	1.5	42.6 U	5 U	7.5
0816-97-0040	5b	5	30.6 U	22600	3.8 U	5.1	22.7 U	0.1 U	42.6 U	5 U	8.3
0816-97-0042	6a	8	30.6 U	589000	4.7	5.4	107	0.44	42.6 U	10.8	8.2
0816-97-0037	6a Dup	8	30.6 U	612000	16.1	8.5	214	0.31	42.6 U	5 U	8.2
0816-97-0038	6a MS	8	30.6 U	731000	4.9	5.5	84.1	0.24	42.6 U	5 U	8

TCLP=toxic characteristic leaching procedure
TV=TCPL threshold value
EQL estimated quantitation limit

qualifiers:
U=not detected; value in table is the EQL.

Table 2.1-2 1997 Exploratory Trench Detected Organic results

			HE (µg/kg)							VOCs (µg/kg)		
Sample ID	Trench	Depth (ft)	1,3,5-Trinitrobenzene	2,4,6-Trinitrotoluene	HMX	PETN	RDX	2,4-Dinitrotoluene	2,6-Dinitrotoluene	1,1,1-Trichloroethane	Acetone	Toluene
0816-97-0024	1a	4-6	250 U	250 U	2200 U	1000 U	1000 U	370 U	370 U	6 U	20 U	6 U
0816-97-0025	1a	14.5	250 U	250 U	2200 U	1000 U	1000 U	380 U	380 U	6 U	14 U	6 U
0816-97-0020	2a	15	250 U	250 U	2200 U	1000 U	1000 U	380 U	380 U	6 U	9 U	6 U
0816-97-0021	2a	6	250 U	250 U	2200 U	1000 U	1000 U	380 U	380 U	6 U	24 U	6 U
0816-97-0022	2a	2	250 U	250 U	3300	1000 U	1000 U	370 U	370 U	6 U	22 U	6 U
0816-97-0023	2a	22	250 U	250 U	2200 U	1000 U	1000 U	380 U	380 U	6 U	22 U	6 U
0816-97-0029	2c	4	250 U	250 U	2200 U	1000 U	1000 U	400 U	400 U	6 U	5 U	6 U
0816-97-0030	2c	13	250 U	250 U	2200 U	1000 U	990 U	410 U	410 U	6 U	15 U	6 U
0816-97-0028	2d	4	250 U	250 U	2200 U	1000 U	990 U	450 U	450 U	7 U	16 U	7 U
0816-97-0026	2e	3-4	250 U	250 U	2200 U	1000 U	1000 U	420 U	420 U	6 U	9 U	6 U
0816-97-0027	2e	7-10	250 U	250 U	2200 U	1000 U	990 U	380 U	380 U	6 U	24 U	6 U
0816-97-0019	3c	9	250 U	250 U	2200 U	980 U	980 U	400 U	400 U	6 U	8 U	6 U
0816-97-0015	4a	4-6	250 U	1300	2200 U	980 U	980 U	400 U	400 U	7 B	16 U	6 U
0816-97-0016	4a	10-15	250 U	4000	2200 U	990 U	2000	410 U	410 U	6 BJ	20 U	6 U
0816-97-0017	4a	20	250 U	250 U	2200 U	1000 U	1000 U	430 U	430 U	6 BJ	24 U	4 J
0816-97-0018	4b	13-15	250 U	250 U	2200 U	1000 U	1000 U	430 U	430 U	7 B	120 B	2 J
0816-97-0031	5a	3	13000 U	120000	110000 U	4900	940000	190	140	5 U	45 U	2 J
0816-97-0033	5a	13	1200 U	6100	11000 U	990 U	35000	390 U	390 U	6 U	24 U	2 J
0816-97-0034	5a	9	12000 U	27000	110000 U	990 U	110000	430 U	430 U	5 U	19 U	3 J+
0816-97-0039	5a	3	11000	95000	43000	1100	300000	470	180	6 U	26 U	6 U
0816-97-0041	5a	8	5000 U	32000	44000 U	1000 U	44000	39	330 U	6 U	14 U	6 U
0816-97-0032	5b	4	250 U	250 U	2200 U	1000 U	1300	410 U	410 U	5 U	20 U	2 J
0816-97-0035	5b	8	250 U	250 U	2200 U	980 U	980 U	410 U	410 U	5 U	20 U	2 J
0816-97-0040	5b	5	250 U	2600	2200 U	1000 U	9300	330 U	330 U	6 U	24 U	6 U
0816-97-0042	6a	8	2500 U	11000	22000	1000 U	69000	330 U	330 U	6 U	26 U	6 U
0816-97-0037	6a Dup	8	2400 U	23000	21000 U	970 U	75000	65	330 U	6 U	24 U	6 U
0816-97-0038	6a MS	8	5000 U	47000	44000	1000 U	100000	120	330 U	6 U	26 U	6 U

Dup=field duplicate sample
MS=Matrix Spike
EQL estimated quantitation limit
IDL instrument detection limit (lower estimate based on water media, rather than sample media)

qualifiers:
U=not detected; value in table is the EQL.
U,SV4 U-qualifier added during LANL baseline validation for reason SV4 (sample result>EQL and < 5 x multiple of result in blank)
J indicates an estimated value. The analyte is present but the sample result<EQL and >IDL.
J+ indicates an estimated value, possibly biased high.
J- indicates an estimated value, possibly biased low.
B the analyte was found in the associated method blank as well as in the sample
BJ (B and J)

Table 2.1-2 1997 Exploratory Trench Detected Organic results (continued)

			VOCs (µg/kg)		Herbicide (µg/kg)		Pesticide/PCB (µg/kg)						Dioxin (µg/kg)					
Sample ID	Trench	Depth (ft)	Trichlorotrifluoroethane	Xylenes (total)	2,4-D	Dalapon	alpha-Chlordane	Aroclor-1260	Endosulfan II	Endrin aldehyde	gamma-BHC (Lindane)	gamma-Chlordane	Total HxCDD	Total HxCDF	Total PeCDD	Total PeCDF	Total TCDD	Total TCDF
0816-97-0024	1a	4-6	6 U	6 U	190 B	560 U	4.4	37 U	3.7 U	3.7 U	1.9 U	4.1	0.08 U	0.04 U	0.05 U	0.04 U	0.02 U	0.02 U
0816-97-0025	1a	14.5	6 U	6 U	110 U	570 U	1.9	38 U	3.8 U	3.8 U	1.9 U	2.6	0.04 U	0.02 U	0.02 U	0.01 U	0.02 U	0.01 U
0816-97-0020	2a	15	6 U	6 U	110 U	570 U	1.9 U	38 U	3.8 U	3.8 U	1.9 U	1.9 U	0.04 U	0.03 U	0.02 U	0.04 U	0.02 U	0.02 U
0816-97-0021	2a	6	6 U	6 U	120 U	580 U	1.9 U	38 U	3.8 U	3.8 U	1.9 U	1.9 U	0.15 U	0.17 U	0.31 U	0.1 U	0.07 U	0.05 U
0816-97-0022	2a	2	6 U	6 U	110 U	550 U	1.8 U	180 J-	11 J-	10 J-	1.8 U	1.8 U	1.1	1.7	0.56	1.3	0.51	1.7
0816-97-0023	2a	22	6 U	6 U	120 U	580 U	1.9 U	38 U	3.8 U	3.8 U	1.9 U	1.9 U	0.05 U	0.04 U	0.08 U	0.03 U	0.04 U	0.02 U
0816-97-0029	2c	4	6 U	6 U	120 U	600 U	2 U	40 U	4 U	4 U	2 U	2 U	0.05 U	0.02 U	0.06 U	0.02 U	0.02 U	0.02 U
0816-97-0030	2c	13	6 U	6 U	120 U	1300	2 U	41 U	4.1 U	4.1 U	2 U	2 U	0.03 U	0.01 U	0.02 U	0.02 U	0.01 U	0.02 U
0816-97-0028	2d	4	7 U	7 U	130 U	670 U	2.2 U	45 U	4.5 U	4.5 U	2.2 U	2.2 U	0.04 U	0.02 U	0.04 U	0.06 U	0.02 U	0.02 U
0816-97-0026	2e	3-4	6 U	6 U	120 U	620 U	2.1 U	42 U	4.2 U	4.2 U	2.1 U	2.1 U	0.04 U	0.03 U	0.1 U	0.06 U	0.07 U	0.02 U
0816-97-0027	2e	7-10	6 U	6 U	110 U	570 U	1.9 U	38 U	3.8 U	3.8 U	1.9 U	1.9 U	0.03 U	0.03 U	0.06 U	0.02 U	0.02 U	0.01 U
0816-97-0019	3c	9	6 U	6 U			2 U	40 U	4 U	4 U	2 U	2 U	0.03 U	0.02 U	0.03 U	0.02 U	0.02 U	0.01 U
0816-97-0015	4a	4-6	6 U	6 U	24 U	120 U	2 U	40 U	4 U	4 U	2 U	2 U	0.03 U	0.02 U	0.04 U	0.03 U	0.01 U	0.05 U
0816-97-0016	4a	10-15	6 U	6 U	25 U	120 U	2 U	41 U	4.1 U	4.1 U	2 U	2 U	0.03 U	0.01 U	0.03 U	0.03 U	0.03 U	0.01 U
0816-97-0017	4a	20	6 U	2 J	26 U	130 U	2.1 U	43 U	4.3 U	4.3 U	2.1 U	2.1 U	0.03 U	0.01 U	0.05 U	0.03 U	0.02 U	0.03 U
0816-97-0018	4b	13-15	6 U	6 U	26 U	130 U	2.1 U	43 U	4.3 U	4.3 U	2.1 U	2.1 U	0.03 U	0.02 U	0.03 U	0.03 U	0.01 U	0.02 U
0816-97-0031	5a	3	3 J	5 U	120 U	610 U	100 U	2000 U	200 U	200 U	100 U	100 U	0.08	0.04 U	0.04 U	0.04 U	0.03 U	0.02 U
0816-97-0033	5a	13	5 J	6 U	120 U	580 U	1.9 U	39 U	3.9 U	3.9 U	1.9 U	1.9 U	0.02 U	0.01 U	0.06 U	0.03 U	0.04 U	0.01 U
0816-97-0034	5a	9	1 J+	5 U	130 U	650 U	11 U	220 U	22 U	22 U	11 U	11 U	0.03 U	0.03 U	0.06 U	0.02 U	0.03 U	0.01 U
0816-97-0039	5a	3	6 U	6 U	100 U	500 U	42 U	830 U	83 U	83 U	42 U	42 U	0.08 U	0.06 U	0.05 U	0.37	0.01 U	1.2
0816-97-0041	5a	8	4 J	6 U	100 U	500 U	21 U	420 U	42 U	42 U	21 U	21 U	0.03 U	0.08	0.04 U	0.85	0.02 U	2.3
0816-97-0032	5b	4	5 U	5 U	120 U	610 U	2 U	41 U	4.1 U	4.1 U	2 U	2 U	0.02 U	0.03 U	0.02 U	0.02 U	0.02 U	0.01 U
0816-97-0035	5b	8	1 J	5 U	120 U	610 U	2 U	41 U	4.1 U	4.1 U	2 U	2 U	0.03 U	0.02 U	0.03 U	0.03 U	0.02 U	0.02 U
0816-97-0040	5b	5	6 U	6 U	100 U	750	2 U	40 U	4 U	4 U	2 U	2 U	0.03 U	0.03 U	0.02 U	0.03 U	0.03 U	0.02 U
0816-97-0042	6a	8	6 U	6 U	100 U	500 U	10 U	210 U	21 U	21 U	10 U	10 U	0.04 U	0.03 U	0.06 U	0.03 U	0.03 U	0.02 U
0816-97-0037	6a Dup	8	4 J	6 U	100 U	500 U	10 U	210 U	21 U	21 U	12	10 U	0.04 U	0.04 U	0.03 U	0.02 U	0.02 U	0.02 U
0816-97-0038	6a MS	8	3 J	6 U	100 U	500 U	21 U	410 U	41 U	41 U	21 U	21 U	0.03 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U

Dup=field duplicate sample
MS=Matrix Spike
EQL estimated quantitation limit
IDL instrument detection limit (lower estimate based on water media, rather than sample media)

qualifiers:
U=not detected; value in table is the EQL.
U,SV4 U-qualifier added during LANL baseline validation for reason SV4 (sample result>EQL and < 5 x multiple of result in blank)
J indicates an estimated value. The analyte is present but the sample result<EQL and >IDL.
J+ indicates an estimated value, possibly biased high.
J- indicates an estimated value, possibly biased low.
B the analyte was found in the associated method blank as well as in the sample

Table 2.1-3 1997 Exploratory Trench Radiochemical by Gamma Spectroscopy[1]

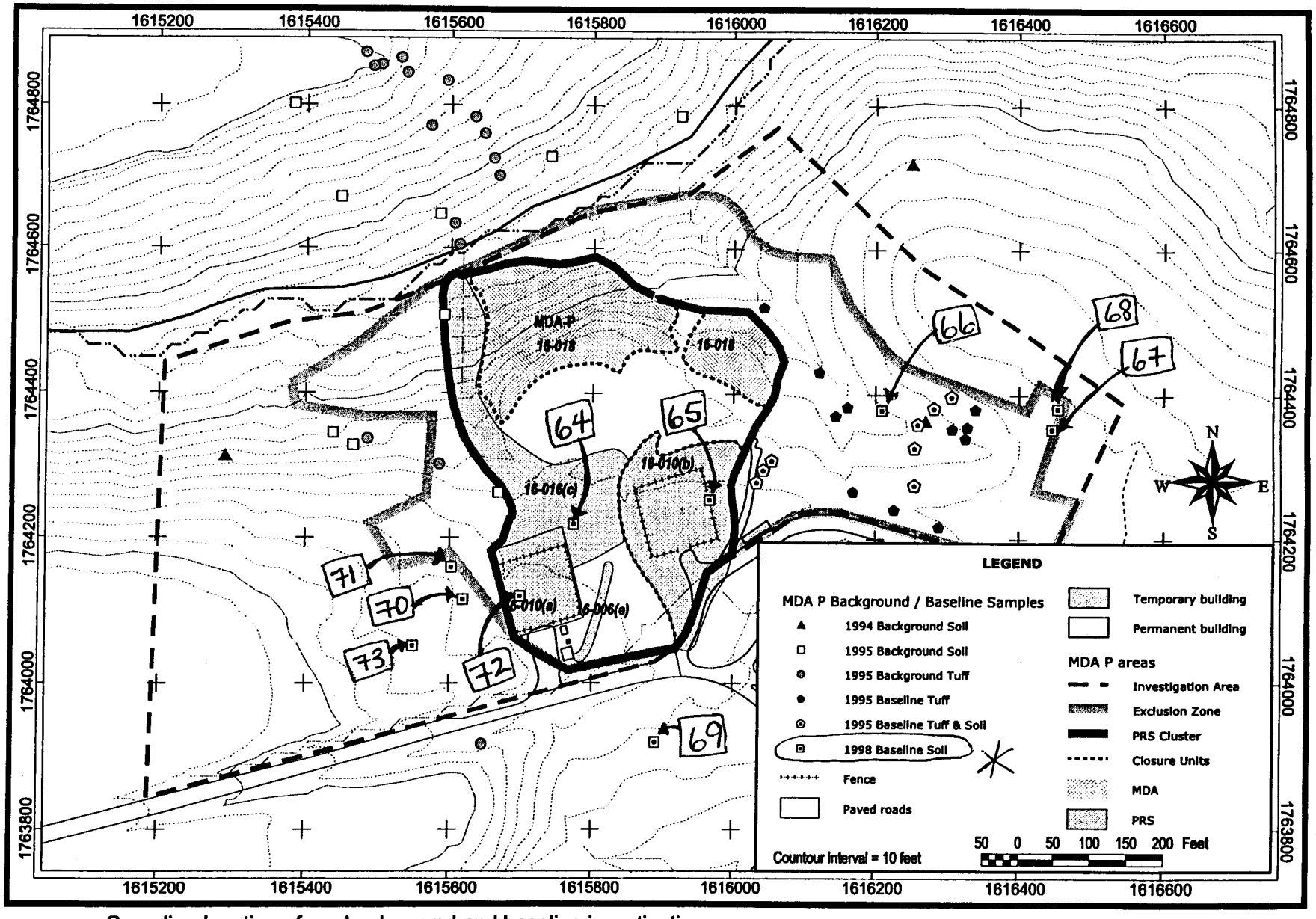
Sample ID	Trench	Depth (ft)	Americium-241 pCi/g	Cesiums-134 pCi/g	Cesium-137 pCi/g	Cobalt-60 pCi/g	Europium-152 pCi/g	Lead-212 pCi/g	Lead-214 pCi/g	Potassium-40 pCi/g	Ruthenium-106 pCi/g	Sodium-22 pCi/g	Uranium-235 pCi/g
0816-97-0024	1a	4-6	-0.062 U	0.020 U	-0.006 U	0.0067 U	-0.167 U	1.784	1.066	21.76	0.028 U	0.009 U	-0.207 U
0816-97-0025	1a	14.5	0.054 U	0.027 J	-0.006 U	-0.0113 U	0.048 U	1.192	0.970	22.58	-0.236 U	0.035 U	0.223 U
0816-97-0020	2a	15	-0.027 U	-0.017 U	0.121	-0.0252 U	0.221 U	0.943	0.803	24.96	0.148 U	-0.020 U	0.206 U
0816-97-0021	2a	6	0.017 U	0.048 J	0.060 U	0.0062 U	-0.108 U	1.221	0.636	28.21	0.051 U	-0.070 U	0.087 U
0816-97-0022	2a	2	-0.008 U	0.016 U	0.147	-0.0244 U	0.146 U	1.131	0.664	25.35	0.038 U	-0.013 U	-0.046 U
0816-97-0023	2a	22	-0.121 U	0.013 U	0.373	-0.0212 U	0.159 U	1.213	0.524	23.93	0.178 U	-0.017 U	0.063 U
0816-97-0029	2c	4	-0.498 U	0.059 J	-0.003 U	-0.0323 U	0.274 J	1.236	0.856	31.06	0.170 U	-0.004 U	0.007 U
0816-97-0030	2c	13	0.107 U	0.011 U	0.021 U	-0.0323 U	0.203 U	1.223	1.099	20.21	0.300 U	-0.042 U	-0.018 U
0816-97-0028	2d	4	-0.295 U	-0.034 U	0.012 U	0.0001 U	0.094 U	1.488	0.651	30.06	-0.028 U	0.007 U	0.310 J
0816-97-0026	2e	3-4	0.044 U	0.034 U	-0.023 U	-0.0380 U	0.342 U	1.134	0.439 J	28.75	-0.210 U	-0.020 U	0.031 U
0816-97-0027	2e	7-10	-0.116 U	0.018 U	-0.033 U	-0.0136 U	0.092 U	1.572	0.742	28.5	-0.086 U	0.011 U	0.266 U
0816-97-0019	3c	9	0.031 U	0.050 J	0.285	-0.0573 U	0.146 U	1.431	1.021	23.22	0.086 U	0.074 J	0.428 J
0816-97-0015	4a	4-6	0.045 U	0.044 U	-0.011 U	0.0114 U	-0.139 U	1.225	0.729	25.61	0.242 U	0.016 U	-0.100 U
0816-97-0016	4a	10-15	-0.221 U	0.011 U	-0.010 U	0.0161 U	0.037 U	1.123	0.541	29.44	-0.073 U	-0.009 U	-0.019 U
0816-97-0017	4a	20	-0.002 U	0.065 J	0.008 U	-0.0012 U	0.178 U	1.403	1.402	32.98	-0.388 U	-0.018 U	-0.019 U
0816-97-0018	4b	13-15	0.181 U	-0.020 U	-0.014 U	0.0052 U	0.500 J	1.803	0.754	19.96	-0.295 U	0.031 U	0.001 U
0816-97-0031	5a	3	-0.265 U	-0.014 U	0.014 U	0.0123 U	-0.038 U	1.294	1.018	28.14	-0.132 U	0.014 U	0.128 U
0816-97-0033	5a	13	0.098 U	-0.002 U	-0.014 U	-0.0118 U	0.014 U	1.371	0.677	28.04	0.146 U	-0.018 U	-0.099 U
0816-97-0034	5a	9	-0.147 U	0.001 U	-0.032 U	-0.0526 U	0.048 U	1.279	0.644	27.15	-0.079 U	-0.006 U	0.061 U
0816-97-0039	5a	3	-0.009 U	-0.023 U	0.016 U	-0.0009 U	0.165 U	0.977	0.718	22.26	-0.107 U	-0.014 U	0.048 U
0816-97-0041	5a	8	-0.211 U	-0.014 U	0.002 U	0.0355 U	0.687 J	1.633	0.639 J	33.93	0.386 U	-0.016 U	-0.043 U
0816-97-0032	5b	4	-0.123 U	0.031 U	0.007 U	-0.0357 U	0.328 U	1.493	0.816	32.69	-0.017 U	-0.038 U	-0.063 U
0816-97-0035	5b	8	0.040 U	0.001 U	0.028 U	0.0230 U	-0.027 U	1.699	0.707	23.06	0.247 U	0.004 U	-0.028 U
0816-97-0040	5b	5	-0.123 U	0.024 U	-0.020 U	0.0487 U	0.061 U	2.143	0.624	23.15	0.345 U	0.022 U	-0.171 U
0816-97-0042	6a	8	-0.415 U	-0.016 U	-0.035 U	0.0451 U	-0.199 U	1.636	0.702	28.59	0.421 U	-0.006 U	0.293 U
0816-97-0037	6a Dup	8	-0.382 U	-0.012 U	-0.028 U	-0.0123 U	-0.103 U	1.057	0.774	29.66	0.234 U	0.003 U	0.097 U
0816-97-0038	6a MS	8	-0.132 U	0.000 U	-0.007 U	0.0140 U	-0.012 U	1.138	0.805	28.16	0.360 U	0.023 U	0.286 U

[1]primary and naturally occurring gamma-emitting radiochemicals
Dup=field duplicate sample
MS=Matrix Spike

qualifiers:
U=not detected; value in table is the instrument reading.
J indicates an estimated value.

Attachment 2, Section 2.2, Data from 1998 Baseline Locations.

The individual sample locations for the 1998 Baseline sampling campaign are identified by number on the figure on the following page. The numbers correspond to the last two digits on the sample ID. The sample results are listed in Tables 2.2-1 through 2.2-4 along with the same identifiers shown in the figure for viewer reference.



Sampling locations from background and baseline investigations.

1998 Baseline samples identified by last 2 digits of Sample ID

Table 2.2-1 1998 Baseline Target Analtye List Metal results

Sample ID	Map ID	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Cadmium mg/kg	Calcium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Iron mg/kg
0816-98-0064	64	6640	0.32 UJ	3.9 P	770	0.6	0.02 U	1600	5.6	4.3	6.2	10300
0816-98-0065	65	7880	0.82 UJ	4.2 P	7900	0.63	0.84	1820	7.9	4.4	35.9	10800
0816-98-0066	66	5670	0.42 UJ	3.6 P	465	0.81	0.02 U	2460	5.9	2.1 B	8.3	11300
0816-98-0067	67	6600	0.22 UJ	3.7 P	678	0.6	0.03 U	2390	5	3.3	6.1	9080
0816-98-0068	68	5140	0.28 UJ	2.9 P	491	0.48	0.02 U	1510	4.8	3.6	5.9	7390
0816-98-0069	69	7740	0.21 UJ	4.1 P	512	0.74	0.02 U	2470	6.3	2.7 B	6	11800
0816-98-0070	70	8470	0.27 UJ	3.4 P	136	1.3	0.03 U	2520	5.9	2.3 B	6.7	11100
0816-98-0071	71	8850	0.35 UJ	3.7 P	168	0.78	0.07 B	1640	8.1	4.6	6.4	12800
0816-98-0072	72	18600	0.4 UJ	6.5 P	14600	1.5	0.22 B	493	9.1	6.6	9.5	16600
0816-98-0073	73	3540	0.26 UJ	2.9 P	61.4	0.44	0.02 U	1150	5.2	5.4	3.7	7180

Sample ID	Lead mg/kg	Magnesium mg/kg	Manganese mg/kg	Mercury mg/kg	Nickel mg/kg	Potassium mg/kg	Selenium mg/kg	Silver mg/kg	Sodium mg/kg	Thallium mg/kg	Vanadium mg/kg	Zinc mg/kg
0816-98-0064	17.6	1130	321 P	0.06 U	4.2	1140	0.55	0.03 U	143 B	1.3	15.1	34.1
0816-98-0065	34.9	1180	185 P	0.11 B	4.7	1340	0.38	22.6	190 B	0.48	13.9	899
0816-98-0066	15.9	1240	265 P	0.07 U	4.2	1130	0.5	0.89	146 B	0.57	12.2	43.3
0816-98-0067	16.2	1180	283 P	0.06 U	4.3	1150	0.29 B	0.12 B	139 B	0.47 B	11.4	28.8
0816-98-0068	16.4	1040	322 P	0.05 U	3.9	995	0.39	0.22 B	103 B	0.68	11.1	25.5
0816-98-0069	14	1550	231 P	0.06 U	5.3	1570	0.34	0.09 B	136 B	0.7	13.6	35.6
0816-98-0070	6.8	1920	136 P	0.06 U	6.6	1560	0.35	0.03 U	226 B	0.47 B	12.3	26.2
0816-98-0071	10.4	1830	179 P	0.05 U	5.8	1530	0.33	0.03 U	198 B	0.73	21.9	24.7
0816-98-0072	13.4	2110	127 P	0.07 U	7.7	2080	0.33	0.03 U	220 B	1.1	19.6	67.6
0816-98-0073	8.1	900	241 P	0.05 U	3.4	949	0.28	0.03 U	63.1 B	0.49	16.3	11.8

EQL=estimated quantitation limit

qualifiers:
U=not detected; value in table is the EQL; concentration (if analyte present) is less than the EQL.
J indicates an estimated value.
UJ=not detected and the value in table is an estimate of the EQL.
P review data; duplicate analysis was not within laboratory control limits (possible sample heterogeneity).
B the reported value was less than the EQL but greater than the IDL.

Table 2.2-2 1998 Baseline TCLP metal results

		Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver	pH
TV (µg/L)		**5000**	**100000**	**1000**	**5000**	**5000**	**200**	**1000**	**5000**	
Sample ID	Map ID	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
0816-98-0064	64	38.1 U	692.0	12.4	5.6 U	37.2 U	0.1 UJ	44.0 U	4.6 UJ	7.2
0816-98-0065	65	38.1 U	153000.0	13.8	5.6 U	37.2 U	0.1 UJ	44.0 U	4.6 UJ	7.6
0816-98-0066	66	39.2	3630.0	4.0 U	9.2	37.2 U	0.1 UJ	44.0 U	4.6 UJ	7.0
0816-98-0067	67	38.1 U	4100.0	4.0 U	5.6 U	37.2 U	0.1 UJ	44.0 U	4.6 UJ	6.6
0816-98-0068	68	38.1 U	3910.0	4.0 U	5.6 U	37.2 U	0.1 UJ	44.0 U	4.6 UJ	6.6
0816-98-0069	69	38.1 U	3650.0	4.5	5.6 U	37.2 U	0.1 UJ	44.0 U	4.6 UJ	6.8
0816-98-0070	70	38.1 U	2350.0	4.0 U	10.8	37.2 U	0.1 UJ	44.0 U	4.6 UJ	7.0
0816-98-0071	71	38.1 U	2200.0	4.0 U	9.6	59.5	0.1 UJ	44.0 U	4.6 UJ	7.4
0816-98-0072	72	38.1 U	302000.0	4.0 U	5.9	50.8	0.1 UJ	44.0 U	4.6 UJ	6.6
0816-98-0073	73	38.1 U	844.0	4.0 U	5.6 U	37.2 U	0.1 UJ	44.0 U	4.6 UJ	7.0

TCLP=toxic characteristic leaching procedure
TV=TCPL threshold value
EQL=estimated quantitation limit

qualifiers:
U=not detected; value in table is the EQL.
UJ=not detected and the value in table is an estimate.

Table 2.2-3 1998 Baseline Detected Organic Chemical results

		VOC (µg/kg)	SVOC (µg/kg)					HE (µg/kg)		PCB (µg/kg)	DIOXIN (µg/kg)	Herbicide (µg/kg)
Sample ID	Map ID	Trichlorofluoromethane	4-Methylphenol	bis(2-Ethylhexyl)phthalate	Di-n-butylphthalate	Fluoranthene	Pyrene	2,4,6-Trinitrotoluene	HMX	Aroclor-1254	Total TCDD	2,4,5-T
0816-98-0064	64	6 U	400 U	340 J	53 J	22 J	23 J	200 U	2200 U	40 U	0.06 U	20 U
0816-98-0065	65	2 J	390 U	59 J	390 U	390 U	390 U	200 U	2200	65	0.1 J	20 U
0816-98-0066	66	2 J	36 J	240 J	440 U	440 U	440 U	280	2200 U	44 U	0.04 U	22 U
0816-98-0067	67	3 J	410 U	410 U	410 U	410 U	410 U	200 U	2200 U	41 U	0.03 U	21 U
0816-98-0068	68	7 U	410 U	410 U	410 U	410 U	410 U	210 J	2200 U	41 U	0.02 U	56
0816-98-0069	69	6 U	420 U	39 J	420 U	420 U	420 U	200 U	2200 U	42 U	0.03 U	21 U
0816-98-0070	70	6 U	440 U	440 U	440 U	440 U	440 U	200 U	2200 U	44 U	0.02 U	22 U
0816-98-0071	71	2 J	380 U	380 U	380 U	380 U	380 U	200 U	2200 U	38 U	0.03 U	19 U
0816-98-0072	72	2 J	440 U	100 J	440 U	440 U	440 U	200 U	2200 U	44 U	0.03 U	22 U
0816-98-0073	73	8 U	380 U	380 U	380 U	380 U	380 U	200 U	2200 U	38 U	0.03 U	19 U

EQL=estimated quantitation limit

qualifiers:
U=not detected; value in table is the EQL.
J indicates an estimated value. The analyte is present but the sample result<EQL and >IDL.

Table 2.2-4 1998 Baseline Radiochemicals by Gamma Spectroscopy[1]

Sample ID	Map ID	Americium-241 pCi/g	Cesiums-134 pCi/g	Cesium-137 pCi/g	Cobalt-60 pCi/g	Europium-152 pCi/g	Lead-212 pCi/g	Lead-214 pCi/g	Potassium-40 pCi/g	Ruthenium-106 pCi/g	Sodium-22 pCi/g	Uranium-235 pCi/g
0816-98-0064	64	0.15 U	0.00 U	0.11 U	0.05 U	-0.06 U	1.32	0.81	31.35	-0.01 U	-0.04 U	0.03 U
0816-98-0065	65	0.08 U	0.01 UJ	0.13 UJ	0.01 UJ	-0.09 UJ	1.32	0.88	29.69	-0.29 U	0.07 U	0.17 U
0816-98-0066	66	-0.11 U	-0.02 U	1.53	-0.05 U	0.03 U	1.22	1.10	33.78	0.16 U	0.06 U	0.14 U
0816-98-0067	67	0.00 U	0.00 U	1.21	-0.01 U	0.17 U	1.33	0.62	30.19	0.47 U	-0.03 U	0.01 U
0816-98-0068	68	0.00 U	-0.02 U	1.24	-0.06 U	0.71 U	1.58	0.95	27.73	-0.05 U	-0.02 U	-0.05 U
0816-98-0069	69	0.38 J	0.11 U	0.91	0.05 U	-0.15 U	1.54	0.61 J	33.8	-0.65 U	0.04 U	-0.17 U
0816-98-0070	70	-0.15 U	0.04 U	0.05 U	-0.06 U	0.22 U	1.3	1.13	27.73	-0.26 U	-0.07 U	0.11 U
0816-98-0071	71	0.03 U	-0.01 U	-0.02 U	-0.06 U	0.03 U	1.29	0.45	20.67	-0.15 U	-0.03 U	-0.03 U
0816-98-0072	72	-0.26 U	0.03 U	0.00 U	-0.08 U	-0.38 U	2.29	1.15	31.48	0.08 U	-0.05 U	-0.07 U
0816-98-0073	73	-0.15 U	0.12 U	0.06 U	0.02 U	0.04 U	1.25	1.10	18.88	0.03 U	-0.03 U	0.05 U

[1] primary and naturally occurring gamma-emitting radiochemicals

qualifiers:
U=not detected; value in table is the instrument reading.
J indicates an estimated value.
UJ=not detected and the value in table is an estimate.

Attachment 3

VCA Plan for Remediation of Consolidated PRS 16-016(c)-99

Voluntary Corrective Action Plan for Remediation of Consolidated PRS 16-016(c)-99

1.0 INTRODUCTION

In February 1999, LANL's ER Project and NMED-HRMB agreed that a cluster of five PRSs would be concurrently cleaned up and/or closed and that they would be remediated to the same cleanup standard. This decision was based on two assumptions: (1) that within the five PRSs (one of which is MDA-P) the contaminants and/or waste materials are similar, and (2) that the boundaries of the PRS are not well defined and frequently overlap.

This cluster consists of five PRSs:

- consolidated PRS 16-016(c)-99 which, in turn, contains the following three PRSs, which were originally listed in Table A of Module VIII of the Laboratory's Hazardous Waste Facility Permit:
  1. the TA-16-386 flash pad, PRS 16-010(a);
  2. the former barium nitrate pile, PRS 16-016(c); and
  3. an operational septic tank, PRS 16-006(e).
- the following two PRSs operating under Interim Status:
  1. MDA-P (PRS 16-018 at TA-16), currently undergoing RCRA closure; and
  2. the 387 burn pad [PRS 16-010(b)], a RCRA unit whose operations are terminating and which is being proposed for RCRA closure.

During discussions with NMED-HRMB, it was agreed

- that a VCA plan for consolidated PRS 16-016(c)-99 and a closure plan for PRS 16-010(b) be developed,
- that equipment from the ongoing closure operations taking place at MDA-P remain mobilized there to clean up these additional areas,
- that one set of preliminary remediation goals (PRGs) be developed for cleaning up all sites in the area, and
- that the scope of the Phase II SAP for MDA-P closure be expanded to include a confirmation sampling plan for verifying that PRGs had been achieved for each PRS.

The VCA plan for consolidated PRS 16-016(c)-99 is presented in this appendix. The plan documents how the former barium nitrate pile and the 386 flash pad will be cleaned up. Recent sampling of an operational septic tank [PRS 16-006(e)] suggests that it has received only sanitary waste and that it was erroneously identified as a Solid Waste Management Unit (SWMU) and placed on the Laboratory's HSWA Permit. In this plan, two supplemental samples are proposed. They are designed to confirm that the septic tank did

not receive hazardous constituents and to support a recommendation that PRS 16-006(e) be removed from the HSWA Permit. The procedure for sampling to confirm cleanup of the barium nitrate pile and the 386 flash pad is described in the main body of this report (the Phase II SAP).

2.0 SITE TYPE AND DESCRIPTION

2.1 Operational History

The high explosive (HE) Baratol is produced by adding barium nitrate to TNT. Barium nitrate was stored at the TA-16-386 flash pad from the 1950s through the 1970s, then transported to other areas in TA-16 for the production of Baratol. The boundaries of PRSs 16-010(a) and 16-016(c) overlap. The barium nitrate pile is believed to have been stored within, or near, that overlap area. Figure App. 3-1, a photograph taken in 1959, shows the barium nitrate pile to be in the northwest corner of flash pad 386.

2.2 PRS 16-010(a)

TA-16-386 is an inactive flash pad that was built in 1951 and is now used for storage. Potential contaminants at this site are thought to have originated from the former barium nitrate pile and from the burning of HE-contaminated material. It is not known how long this pad was used for burning. The pad is a rectangular, fenced, level region of bare soil approximately 215 × 180 ft. Any drainage from the pad would be to the north, toward Cañon de Valle, through PRS 16-016(c).

2.3 PRS 16-016(c)

The SWMU report (LANL 1990, 07512.1) suggests that the barium nitrate pile was located north of TA-16-386 during the late 1940s. Early air photographs (1948, early 1950s, and 1958) do not show clear evidence for the location of the pile, primarily because many of these photos were taken during the winter when snow was on the ground. Photographs taken in 1959 and 1965 show that the pile was within TA-16-386.

According to the OU 1082 work plan,

> A current burning ground employee states that the pile was within the confines of TA-16-386 during the late 1960s . . . and that it had been removed by the early 1970s. He describes the pile size as roughly two dump truck loads of material resembling a large pile of snow. The pile is not visible on air photos taken in 1974 and 1977, but is shown on an 1959 photo. (LANL 1993, 20948, p. 5-153)

The footprint for this PRS is approximately 0.85 acres. The PRS boundary nearest to Cañon de Valle is approximately 30 ft to the south. The site is on a steep north-facing slope and includes the barium storage area as well as a drainage into Cañon de Valle. The PRS's erosion matrix score, which was assessed according to SOP 2.01 (formerly AP 4.5), is 72, indicating soil erosion and surface water runoff potential are high.

Fig. App. 3-1

16-000481

2.4 PRS 16-006(e)

This PRS is a 385-gal. steel septic tank and outfall line supporting Building 16-389, a control and observation building for the TA-16 burning grounds. The tank and outfall were installed in 1963. In 1988, the outfall from the tank was plugged. The tank has been operated as a holding tank since that time. Engineering drawing C23443 shows that a toilet and wash basin in the restroom and a floor cleanout in the storage room of Building 16-389 were the only sources of wastewater connected to the septic tank. Process knowledge suggests that the liquid wastes introduced into this system were sanitary wastewater.

3.0 REGULATORY DRIVER AND RECORD

The proposed VCA will (1) fulfill the requirements of Module VIII by characterizing the nature and extent of contamination, and (2) implement the corrective action approach for accelerated cleanup as outlined in the Installation Work Plan (IWP) (LANL 1998, 62060.4). The IWP is revised annually as required by Module VIII. These accelerated cleanup activities will satisfy the regulatory requirements for completion of work at PRSs 16-010(a) and 16-016(c).

4.0 RATIONALE FOR PROPOSED REMEDIAL ACTION

Earth-moving and excavation equipment have been mobilized and are presently being used for the remediation and RCRA closure of MDA-P. In accordance with the NMED-approved MDA-P Closure Plan (LANL 1995, 58713), waste sampling, characterization, transport, and disposal procedures have been developed and are operating at MDA-P. Approved procedures have been developed and put in place to satisfy the waste-acceptance requirements of off-site waste-management facilities. Approved decontamination procedures for both large equipment (excavation and earth-moving) and small equipment (sampling tools and personal protective equipment) have been developed.

To enable the cleanup of consolidated PRS 16-016(c), the written agreements between the ER Project and Facility Management that describe remediation operations and the safety envelope of the remediation process can be modified relatively quickly and inexpensively. Significant savings will be realized by conducting this VCA using the trained personnel and the procedures implemented under the scope of work developed for closure of MDA-P.

Soil excavation and removal is proposed as the method of remediation. With the exception of PRS 16-006(e), which received sanitary wastewater, the HE- and inorganics-contaminated soils that will be remediated during cleanup of the consolidated PRS are similar to the soils being removed at MDA-P.

The proposed VCA will achieve a final remedy for the site.

5.0 PREVIOUS SITE CHARACTERIZATION

5.1 PRS 16-010(a)

In FY 1995, a sampling campaign was conducted at PRS 16-010(a). Sampling sites were selected from field-screening results on a 20- × 20-ft grid. The three sites with the highest barium concentrations were

located. Those samples with the highest positive screening results were submitted for fixed-laboratory analyses.

Two samples collected immediately south of PRS 16-016(c) yielded barium concentrations of 6680 mg/kg and 9580 mg/kg, respectively, exceeding the SAL of 5300 mg/kg. For two samples within the boundary of 16-016(c), organics analyses yielded concentrations of RDX and di-n-butyl-phthalate very near the EQLs.

The following recommendation was made to the AA in the RFI report for TA-16: "Since the PRSs overlap, it is recommended that the contaminated portion of 16-010(a) be administratively associated with 16-016(c)."

5.2 PRS 16-016(c)

In March 1995, an initial sampling campaign was conducted in accordance with the December 1994 revision of the RFI Work Plan for OU 1082 to support a baseline risk assessment. A field-randomized 20-ft grid was used to collect barium, HE, and radiation field-screening data. This sampling grid extended over PRS 16-010(a), flash pad 386, and into PRS 16-016(c). The map of the screening/sampling grid from the revision to the work plan is included in this VCA plan as Figure App. 3-2.

Using this grid, surface soil samples from the five highest barium readings were submitted for fixed-laboratory analyses. Locations of fixed-laboratory analysis samples are shown on the same map (Figure App. 3-2).

To check for potential off-SWMU migration of contaminants, the drainage channel was field-screened for barium, HE, and radiation at groups of three points (10 ft apart on a transect) every 30 ft downgradient for a distance of 210 ft. From the 210-ft point to Cañon de Valle, a distance of 150 ft, a surface sample was taken from the center of the drainage at each 30-ft interval.

A total of 18 samples were collected from the grid and drainage transect for fixed-laboratory analyses: 3 subsurface samples were collected (from a 2-ft depth) and 15 surface samples were collected. Analytical results showed several metals, particularly barium and lead, to be above soil BVs. The results also detected PAHs and HEs. The highest barium and lead concentrations were 28,800 ppm and 1650 ppm, respectively. In addition, 912 ppm of RDX was found in a surface sample downdrainage from flash pad 386. Elevated PAHs were found in many samples, with the highest abundance in a subsurface sample 270 ft downdrainage. Total uranium was found at a maximum of 3.52 ppm, which is above LANL's BV for uranium (1.82 ppm).

The highest barium, lead, and HE detections came from surface samples collected at the flash pad or at the top of the drainage, the area thought to have stored the barium nitrate. The average barium concentration for the five high sample analyses from this area is 11,010 ppm. Samples collected from 270 ft to 360 ft downgradient of the pad averaged 3442 ppm of barium. The barium concentrations for two surface samples collected at 390 ft and 420 ft downgradient were 986 ppm and 2420 ppm, respectively. The three subsurface samples contained an average of 2570 ppm of barium. The highest lead concentration was 1650 ppm. PAH detects were low and scattered. While concentrations do not monotonically decrease with distance downgradient from the source, they do decrease. Details of extent will be more fully defined during proposed excavation. Extent will be fully defined during verification and bounding sampling.

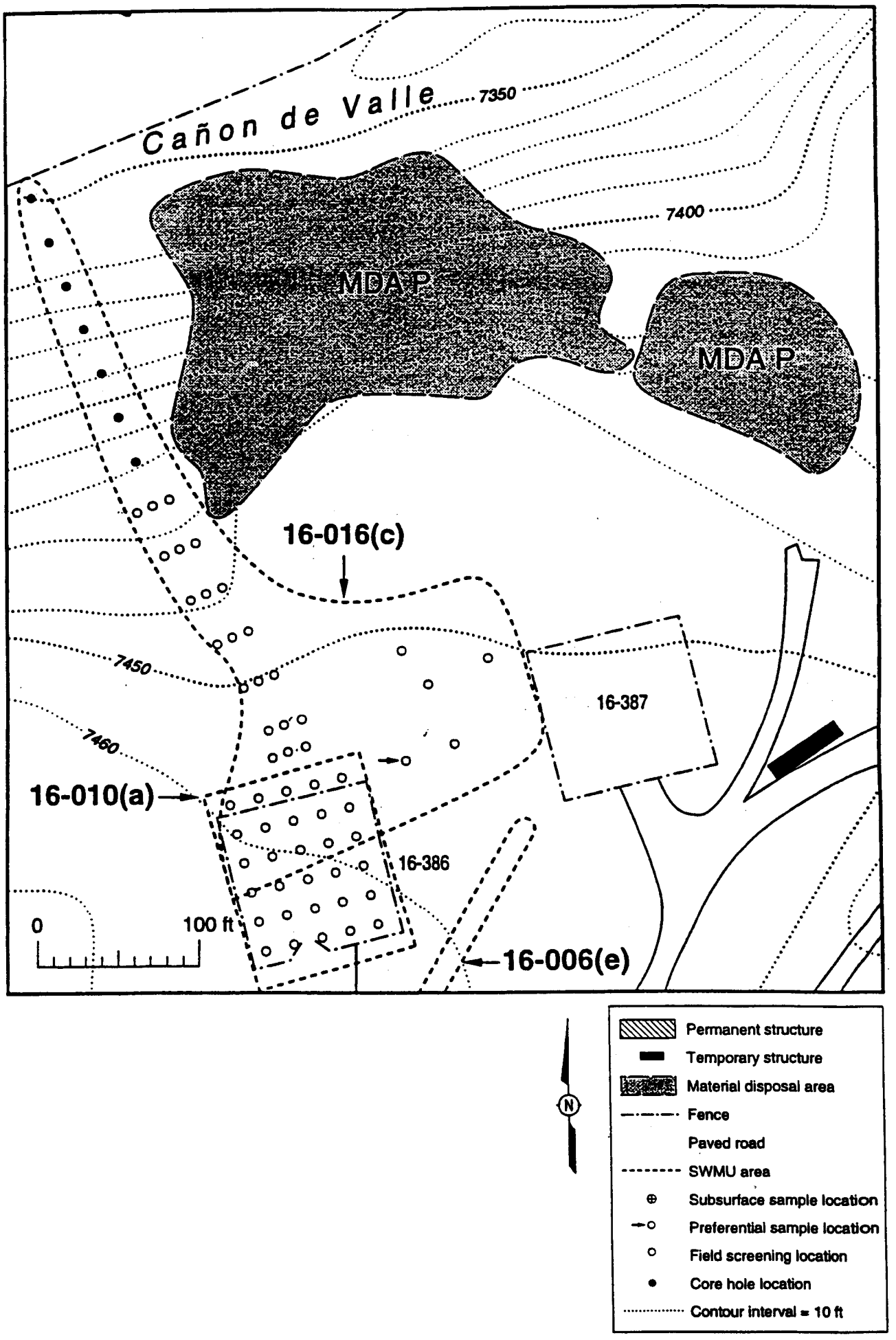

Cañon de Valle
7350
7400
MDA P
MDA P
16-016(c)
7450
7460
16-387
16-010(a)
16-386
0
100 ft
16-006(e)
N
Permanent structure
Temporary structure
Material disposal area
Fence
Paved road
SWMU area
Subsurface sample location
Preferential sample location
Field screening location
Core hole location
Contour interval = 10 ft
cARTography by A. Kron 11/2/94

Fig. App. 3-2

5.3 PRS 16-006(e)

On April 5, 1987, Los Alamos County issued a septic tank permit for the 16-385 tank. In 1988, the Laboratory plugged the outfall line from the septic tank and began operating the tank as a sanitary wastewater holding tank. In September 1995, the 16-385 tank was sampled as part of a survey for radioactivity in septic tanks at the Laboratory. Today the tank is operational and continues to be used as a holding tank for sanitary wastewater from the control building. The tank contents are periodically pumped for treatment at the Sanitary Wastewater System Consolidation (SWSC) centralized sanitary treatment plant.

The results of the September 1995 radioactivity sampling campaign at 16-006(e) are reported in "Radioactivity Measurements for Los Alamos National Laboratory's Permitted Septic Systems" (LANL 1997, 63133). Liquid and sludge samples were collected and analyzed for gross alpha, gross beta, gross gamma, and tritium. The screening levels used in the survey were 15, 50, 1000, and 20,000 pCi/l, respectively, for liquids and 2000 pCi/l for each in sludge. Detected radiation in these samples was below these screening levels.

In September 1995, ER Project field team personnel drilled two boreholes at the proximal and distal end of the septic system. At location 16-1335, near the septic tank, the team drilled to a depth of 9 ft; at location 16-1339, located approximately 75 ft down the drainline from the septic tank, the team drilled to a depth of 4.5 ft. At the two locations, field-screening for HE yielded positive results for the 1–2-ft interval at both locations and for the 3.5–4.5-ft interval at location 16-1339. Four samples were submitted for fixed-laboratory analysis: three from locations where HE-screening results were positive and one from the 8–9-ft interval at location 16-1335.

No metals were detected above BVs in the fixed-laboratory analyses; however, detection limits for antimony, cadmium, and cyanide were not as low as LANL BVs for these metals. Fixed-laboratory analyses yielded no detected HE and yielded detected concentrations of diethylphthalate and acetone that were below the estimated detection limits (EDLs). Barium concentrations detected below the LANL BV and the absence of detected HE suggest that the system did not contain HE. Analytical results from this sampling campaign are provided in Appendix 1 to this Phase II SAP.

In April 1998, the contents of the septic tank were sampled for analysis to confirm that the wastewater would meet the SWSC plant's waste-acceptance criteria. Barium was detected at 0.02 mg/l, and all other TCLP metals were below detection limits. All volatiles were below EDLs, except methyl-ethyl-ketone (detected at 5.6 ppb), a common laboratory contaminant. The waste profile form and analytical results are attached to this VCA plan (LANL 1999, 63132).

Analyses of the samples collected in and near septic tank 16-385 and near the drainline suggest that the tank has received sanitary wastewater.

A summary of the existing sampling and analytical results from field campaigns conducted by ER Project personnel is provided in Appendix 1.

6.0 BASIS FOR CLEANUP LEVELS

The PRGs proposed for PRS 16-016(c) are the same as those proposed in this Phase II SAP for MDA-P. Refer to the SAP for discussion of the development of the proposed cleanup levels. These cleanup levels are proposed to achieve a cleanup that is consistent for all PRSs proximal to MDA-P.

7.0 PROPOSED REMEDIAL ACTION

7.1 Conceptual Model Pathways for Residual Contamination

The barium nitrate pile was located in an area of steep drainages and canyon sides that are sparsely covered with grasses. Any potential contamination at this site is expected to be found in shallow surface soils and may have been transported by surface water runoff down the drainage. These assumptions are based on sampling data collected during Phase I sampling in March 1995 and on the site assessment made to determine the erosion matrix score of 72.

If contaminated soils remain in place, the primary mechanisms available for transport of contaminants from their current locations are (1) dissolution and transport in occasional surface water runoff from snowmelt and rainfall, (2) soil erosion, and (3) wind dispersion. Sufficient flow of surface water could carry contaminants to the stream in Cañon de Valle.

7.2 Supplemental Sampling

No supplemental sampling that requires fixed-laboratory analyses is anticipated for defining the extent of contamination from the barium nitrate pile. Sampling and field-screening will be done using x-ray fluorescence spectrometry for lead and barium contamination, and using D-Tech for HE contamination. These field-screening results will be used to direct the removal of contaminated soils. When field-screening results indicate that residual contamination is below 50% of the proposed MDA-P cleanup levels, excavation and soil removal at that location will be stopped on the presumption that the cleanup level has been achieved. If subsequent confirmation sampling does not verify that the cleanup level was achieved, additional "spot" cleanup may be performed, based on human health and ecological risk screening.

7.3 Site Restoration

Upon confirmation that PRGs have been achieved, this site will be recontoured to minimize erosion, then revegetated with indigenous grasses. After recontouring the site, an assessment will be made to determine where soils must be placed over exposed tuff to encourage germination and growth.

8.0 CONFIRMATORY SAMPLING

As stated in the introduction to this VCA plan, PRS 16-006(e) is an active septic/holding tank serviced under a standing work order with Johnson Controls, Inc.-Northern New Mexico (JCI-NNM). Contents of the tank are pumped into a tank truck for treatment at the Laboratory's SWSC centralized sanitary treatment plant. Samples collected during 1995 and 1998 indicate that the tank receives only sanitary wastewater. Two additional samples, taken from tank sludge and supernatant, will be analyzed to confirm

that the tank receives only sanitary waste. These samples will be analyzed for TAL metals. If analytical results confirm the absence of hazardous constituents, PRS 16-006(e) will be recommended for removal from the Laboratory's RCRA permit.

The sampling strategy and design developed in the SAP for MDA-P applies to the barium nitrate pile. Following the cleanup, confirmation/verification sampling with fixed-laboratory analyses will be conducted to

- identify the nature and define the extent of any residual contamination associated with the barium nitrate pile, and
- calculate spatially averaged contaminant concentrations across and beneath the location of the former barium nitrate pile and therefore to assess the potential human health and ecological effects associated with any residual contamination.

It should be noted that the achievement of cleanup levels will be confirmed by fixed-laboratory analyses.

9.0 WASTE MANAGEMENT

9.1 Estimated Types and Volumes of Waste

Wastes from the consolidated PRS will consist of soils contaminated with HE, HE derivatives, metals, and PAHs. The estimated volume of soils to be excavated at this PRS is 1000 yd^3.

9.2 Method of Management and Disposal

Waste soils excavated from the site will be managed together with other waste materials removed during the MDA-P remediation operations. Specific details of these operations are provided in the approved MDA-P Closure Plan, Section 6.2.4, Detailed Description of Removal of Waste Inventory [20 NMAC 4.1, Sections 265.112(b)(3) and (4)]. Soils are inspected and screened for purposes of waste classification before they are removed and transported to the segregated waste staging area, which is lined with high density poly-ehtylene (HDPE). Segregated wastes are contained within the staging area.

Wastes that are determined, through sampling and analysis, to be hazardous, will be stored within the MDA-P site boundary before being transported to an appropriate off-site facility for treatment, storage, or disposal.

Soils with metals levels above BVs but below PRGs, or with detected HE or SVOCs below PRGs, will be classified as industrial waste and disposed of at the industrial waste landfill at Rio Rancho, New Mexico.

While unlikely, any waste that is determined to be non-hazardous, low-level radioactive waste will be transported to TA-54, Area G, or to an appropriate off-site facility for treatment, storage, or disposal.

10.0 DECONTAMINATION OF EQUIPMENT

Equipment will be decontaminated according to the procedures stated in the approved MDA-P Closure Plan, Section 6.3, Decontamination Procedures [20 NMAC 4.1, Sections 265.112(b)(4) and 265.114].

11.0 PROPOSED SCHEDULE AND UNCERTAINTIES

The cleanup of the consolidated PRS has been scheduled to begin in late spring or early summer of 1999 and will take approximately 10 working days to complete. Confirmation sampling will begin upon completion of closure/cleanup operations within the MDA-P cluster of PRSs.

12.0 REFERENCES

LANL (Los Alamos National Laboratory), November 1990. "Solid Waste Management Units Report," Volumes I through IV, Los Alamos National Laboratory Report LA-UR-90-3400, prepared by International Technology Corporation under Contract 9-XS8-0062R-1, Los Alamos, New Mexico. (LANL 1990, 07512.1)

LANL (Los Alamos National Laboratory), July 1993. "RFI Work Plan for Operable Unit 1082," Los Alamos National Laboratory Report LA-UR-93-1196, Los Alamos, New Mexico. (LANL1993, 20948)

LANL (Los Alamos National Laboratory), February 1995. "Technical Area 16 Material Disposal Area P Closure Plan," Revision 0, Los Alamos, New Mexico. (LANL 1995, 58713)

LANL (Los Alamos National Laboratory), August 1997. "Radioactivity Measurements for Los Alamos National Laboratory's Permitted Septic Systems" Los Alamos National Laboratory Report LA-13326-MS, Los Alamos, New Mexico. (LANL 1997, 63133)

LANL (Los Alamos National Laboratory), September 1997. "RFI Report for Potential Release Sites at TA-16: 11-012(a,b); 13-003(a); 16-006(c,d); 16-010(a); 16-026(c,d,v); 16-028(a); 16-030(g)," Los Alamos National Laboratory Report LA-UR-97-3072, Los Alamos, New Mexico. (LANL 1997, 57078)

LANL (Los Alamos National Laboratory), November 1998. "Installation Work Plan for Environmental Restoration," Revision 7, Los Alamos National Laboratory Report LA-UR-98-4652, Los Alamos, New Mexico. (LANL 1998, 62060.4)

Waste Profile Form Processing Notification and Analytical Results for Septic Tank 16-385. Submitted to the ER Project Records Processing Facility on June 13, 1999. (LANL 1999, 63132)

Date: Tue, 28 Jul 1998 22:02:30 -0600 (MDT)
From: Waste Services <WSERVD@EM71.LANL.GOV>
To: afs@lanl.gov
Subject: WPF PROCESSING NOTIFICATION

(Please DO NOT email a reply to this computer generated message)
(Inquiries can be made at: 665-3454)

WASTE MANAGEMENT COORDINATOR

Name: AL STADELMAIER Group: ESAFM MS: C928

WASTE PROFILE FORM PROCESSING NOTIFICATION

Waste Services has received and is processing your Waste Profile Form. If clarification of the documentation is needed, then a Waste Services Team member will contact you or the Waste Generator.

The following reference number has been assigned to your Waste Profile Form. Any inquiries to Waste Services regarding this Waste Profile Form should reference this number. Inquiries should be directed to:

RIVERA, ROBERT at 665-6411

WPF Reference Number: ***** 29244 *****
WPF Logged in : 28-JUL-98
WPF Waste Location : TA 16 Building 000000 Room 0
Waste Generator : ROBERT F GARCIA
Waste Description : SEPTIC TANK #16-385 ANALYTICAL SAMPLE NUMBERS 98DS270, 98DS272, 98DS273, 98DS275, 98DS276

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WASTE PROFILE FORM

Contact (if other than given below)

For rapid processing complete all section in black or blue ink and mail to: EM-SWO at MS J595.
For assistance with completing this form, call EM-SWO at 5-4000.

Reference Number
(For EM-SWO Use Only)

Generator's Z Number	Waste Generator's Name (print)	WMC's Z Number	WMC's Name (print)
076386 (68)	Robert F. Garcia	095169	Albert Stadelmaier

Generator's Telephone	Generator's Mail Stop	Waste Generating Group	Waste Stream Techincal Area	Building	Room
7-6891	C-930	ESA-WMM	16	NA	NA

Waste Accumulation (Check only one)

- ☐ Satellite Accumulation Area — Site No.: ____
- ☐ Less-than-90-day Storage Area — Site No.: ____
- ☐ TSDF — Site No.: ____
- ☐ Universal Waste Storage Area — Site No.: ____
- ☐ None of the above

ER Use Only ☐ ER Site PRS #: ____

Method of Characterization (Check as many as apply)

☒ Analysis/Documents Attached

- ☒ Chemical / Physical Analysis — Sample # SEE BELOW
- ☐ Radiological Analysis — Sample # ____
- ☐ PCB Analysis — Sample # ____
- ☐ Acceptable Knowledge Documentation — Documentation # ____
- ☐ MSDS

Section 1 - Chemical and Physical Information

Waste Type (Check only one)

- ☐ Unused/Unspent Chemical (Complete all sections as appropriate)
- ☒ Process Waste/Spent Chemical/ other (Complete all of sections)
- ☐ "Green is Clean" Waste (Complete all sections as appropriate)

Waste Classes

Radiological Information

Was Waste Generated in a RCA ? ☐ Yes ☒ No

- ☒ Non-radioactive
- ☐ Radioactive
  - ☐ Low-Level
  - ☐ Transuranic

Wastewater Information

- ☒ Wastewater for SWSC (TA-46) (Complete Attachment 1)
- ☐ Wastewater for RLWTF (TA-50/TA-21) (CompleteAttachment 2)
- ☐ Wastewater for TA-16 (HE)

Classification Information

- ☒ Unclassified
- ☐ Classified/Sensitive

Waste Category (Check as many as apply)

- ☒ Inorganic
- ☐ Organic
- Volatile Organics ☐ < 500 ppm ☐ ≥ 500 ppm
- ☐ Solvent *
- ☐ Degreaser *
- ☐ Dioxin
- ☐ Electroplating
- ☐ Treated hazardous waste residue
- ☐ Explosive process
- ☐ Infectious/Medical
- ☐ Biological
- ☐ Beryllium
- ☐ Empty Container (See Instructions)
- ☐ Battery (See Instructions)
- Asbestos ☐ friable ☐ non-friable
- PCB Source Concentration
  - ☐ PCB < 50 ppm
  - ☐ PCB ≥ 50 - < 500 ppm
  - ☐ PCB ≥ 500 ppm
- ☐ Other (Describe below)

* Concentrations 10% or greater before use.

Waste Sources (Check only one)

Routine Waste

- ☐ Decon
- ☐ Material Processing/Production
- ☐ Research/Development/Testing
- ☐ Scheduled Maintenance
- ☐ Housekeeping - Routine
- ☐ Spill Cleanup - Routine
- ☒ Sampling - Routine Monitoring
- ☐ Other (Describe below)

Non-Routine Waste

- ☐ Abatement
- ☐ Construction/Upgrades
- ☐ Demolition
- ☐ Decon/Decom
- ☐ Investigation derived
- ☐ Orphan/Legacy
- ☐ Remediation/Restoration
- ☐ Repacking (Secondary)
- ☐ Unscheduled Maintenance
- ☐ Housekeeping - Non-routine
- ☐ Spill Cleanup - Non-routine
- ☐ UST - Non-petroleum
- ☐ UST - Petroleum
- ☐ Other (Describe below)

Waste Matrix (Check only one)

Gas

- ☐ ≤ 1.5 Atmosperes Pressure
- ☐ > 1.5 Atmosperes pressure
- ☐ Liquified compressed gas

Liquid

- ☐ Aqueous
- ☐ Non-aqueous
- ☒ Suspended Solids/aqueous
- ☐ Suspended Solids/non-aqueous

Solid

- ☐ Powder/Ash
- ☐ Solid
- ☐ Sludge
- ☐ Absorbed liqiud

Matrix Type (Check only one)

- ☐ Homogeneous
- ☒ Heterogeneous (Describe below)

Waste/Process Description (Chemical formulas may be used in this field)

Septic tank #16-385

Analytical sample numbers 98DS270, 98DS271, 98DS272, 98DS273, 98DS274, 98DS275, 98DS276

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WASTE PROFILE FORM

Section 2 - Characteristics

Ignitability (Check only one.) (°F)	(°C)	Corrosivity (Check only one.) (pH)	Reactivity (Check as many as apply.)	Boiling Point (Check only one.) (°F)	(°C)
☐ < 73	< 22.8	☐ ≤ 2.0	☐ RCRA Unstable	☐ ≤ 95	≤ 35
☐ 73 - 99	22.8 - 37.2	☐ 2.1 - 4.0	☐ Water Reactive	☒ > 95	> 35
☐ 100 - 139	37.8 - 59.4	☐ 4.1 - 6.0	☐ Cyanide Bearing (>250 ppm)		
☐ 140 - 200	60.0 - 99.3	☒ 6.1 - 9.0	☐ Sulfide Bearing (>500 ppm)		
☐ > 200	> 99.3	☐ 9.1 -12.4	☐ Pyrophoric		
☐ EPA Ignitable - Non-liquid		☐ ≥ 12.5	☐ Shock Sensitive		
☐ DOT Flammable Gas		☐ Liquid corrosive to steel	☐ Explosive - DOT Div. _____		
☐ DOT Oxidizer					
☒ Not ignitable		☐ Non-aqueous	☒ Non-reactive	☐ Not applicable	

Identify for all contaminants listed.	Characterization Method: AK	TCLP	Total	Concentration of Contaminants: None or Non-Detect	Present Below Regulatory Limit	Above Regulatory Limit (Concentration in ppm only): Minimum	Maximum
Toxicity Characteristic Metals							
Arsenic	☐	☒	☐	☒	☐ < 5.0 ppm	____ to	____ ppm
Barium	☐	☒	☐	☐	☒ < 100.0 ppm	____ to	____ ppm
Cadmium	☐	☒	☐	☒	☐ < 1.0 ppm	____ to	____ ppm
Chromium (Total)	☐	☒	☐	☒	☐ < 5.0 ppm	____ to	____ ppm
Lead	☐	☒	☐	☒	☐ < 5.0 ppm	____ to	____ ppm
Mercury	☐	☒	☐	☒	☐ < 0.2 ppm	____ to	____ ppm
Selenium	☐	☒	☐	☒	☐ < 1.0 ppm	____ to	____ ppm
Silver	☐	☒	☐	☒	☐ < 5.0 ppm	____ to	____ ppm
Toxicity Characteristic Organics							
Benzene	☐	☒	☐	☒	☐ < 0.5 ppm	____ to	____ ppm
Carbon tetrachloride	☐	☒	☐	☒	☐ < 0.5 ppm	____ to	____ ppm
Chlorodane	☐	☒	☐	☒	☐ < 0.03 ppm	____ to	____ ppm
Chlorobenzene	☐	☒	☐	☒	☐ < 100.0 ppm	____ to	____ ppm
Chloroform	☐	☒	☐	☒	☐ < 6.0 ppm	____ to	____ ppm
o - cresol	☐	☒	☐	☒	☐ < 200.0 ppm	____ to	____ ppm
m - cresol	☐	☒	☐	☒	☐ < 200.0 ppm	____ to	____ ppm
p - cresol	☐	☒	☐	☒	☐ < 200.0 ppm	____ to	____ ppm
Cresol - mixed	☐	☒	☐	☒	☐ < 200.0 ppm	____ to	____ ppm
2,4-D	☐	☒	☐	☒	☐ < 10.0 ppm	____ to	____ ppm
1,4-Dichlorobenzene	☐	☒	☐	☒	☐ < 7.5 ppm	____ to	____ ppm
1,2-Dichloroethane	☐	☒	☐	☒	☐ < 0.5 ppm	____ to	____ ppm
1,1-Dichloroethylene	☐	☒	☐	☒	☐ < 0.7 ppm	____ to	____ ppm
2,4-Dinitrotoluene	☐	☒	☐	☒	☐ < 0.13 ppm	____ to	____ ppm
Endrin	☐	☒	☐	☒	☐ < 0.02 ppm	____ to	____ ppm
Heptachlor (& its epoxide)	☐	☒	☐	☒	☐ < 0.008 ppm	____ to	____ ppm
Hexachlorobenzene	☐	☒	☐	☒	☐ < 0.13 ppm	____ to	____ ppm
Hexachlorobutadiene	☐	☒	☐	☒	☐ < 0.5 ppm	____ to	____ ppm
Hexachloroethane	☐	☒	☐	☒	☐ < 3.0 ppm	____ to	____ ppm
Lindane	☐	☒	☐	☒	☐ < 0.4 ppm	____ to	____ ppm
Methoxychlor	☐	☒	☐	☒	☐ < 10.0 ppm	____ to	____ ppm
Methyl ethyl ketone	☐	☒	☐	☐	☒ < 200.0 ppm	____ to	____ ppm
Nitrobenzene	☐	☒	☐	☒	☐ < 2.0 ppm	____ to	____ ppm
Pentachlorophenol	☐	☒	☐	☒	☐ < 100.0 ppm	____ to	____ ppm
Pyridine	☐	☒	☐	☒	☐ < 5.0 ppm	____ to	____ ppm
Tetrachloroethylene	☐	☒	☐	☒	☐ < 0.7 ppm	____ to	____ ppm
Toxaphene	☐	☒	☐	☒	☐ < 0.5 ppm	____ to	____ ppm
Trichloroethylene	☐	☒	☐	☒	☐ < 0.5 ppm	____ to	____ ppm
2,4,5-Trichlorophenol	☐	☒	☐	☒	☐ < 400.0 ppm	____ to	____ ppm
2,4,6-Trichlorophenol	☐	☒	☐	☒	☐ < 2.0 ppm	____ to	____ ppm
2,4,5- TP (Silvex)	☐	☒	☐	☒	☐ < 1.0 ppm	____ to	____ ppm
Vinyl chloride	☐	☒	☐	☒	☐ < 0.2 ppm	____ to	____ ppm

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WASTE PROFILE FORM

Section 3 - Addtional Constituents

Additional Constituents and Contaminates Please account for 100% of waste. Ranges should be given within guidelines of LIG 404-00-03 of individual constituents. List all other constituents (including inerts) not identified above and attach any applicable analysis. No chemical formulas allowed in this field. Continue in Section 3 Additional Inforamation as necessary. CAS Numbers are needed for all chemical constituents, for material without a CAS Number enter "No CAS Number". Contact Waste Services at 5-4000 for assistance.

CAS No.	Name of constituent	Minimum		Maximum	
	3+4 - methylphenol	0	to	8.9 ~~PPM~~ PPB	%
	Benzoic acid	0	to	320 ~~PPM~~ PPB	%
	water	95	to	100	%
			to		%
			to		%
			to		%
			to		%
			to		%
			to		%
			to		%
			to		%
			to		%
			to		%
	Total of max. ranges of this section.	100			in %
	Total of max. ranges from page 2.				in ppm

Additional Information (use additional sheet if necessary)

If additional information is available on the chemical, physical, or radiological character of the waste not covered on this form, provide it below.

WASTE GENERATOR CERTIFICATION: Based on my knowledge of the waste and/or chemical/physical analysis, I certify that the information on this form is correct. I understand that this information will be made available to regulatory agencies and that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Signature Robert Garcia | Date 7-13-98

WASTE MANAGEMENT COORDINATOR: I have reviewed this form and to the best of my knowledge, the information is complete and accurate.

Signature Albert Stadelmaier | Date 7-13-98

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WASTE PROFILE FORM

Attachment 1 - Wastewater Characteristics for SWSC (TA-46)

For help in completing this section of the form, call ESH-18 at 7-4882. Identify presence of any contaminants listed below. Use of Acceptable Knowledge in lieu of analytical data must be pre-approved by ESH-18.

Microtox Analysis # 80313 WAC NOTE: Microtox analysis must be performed. Contact JCI/ENV to schedule analysis.

Are there any detectable levels of gross Alpha, gross Beta, gross Gamma, and/or Tritium? ☒ No ☐ Yes

All methods of analysis must conform to those approved pursuant to 40 CFR 136 unless an alternative method has been approved by ESH-18.
All metal concentrations are for the dissolved fraction present in the sample unless otherwise indicated.

Flow Rate Parameters	☒ Flow Rate of 100 gallons/day or less			☐ Flow Rate greater than 100 gallons/day		
	None/ Non-Detect	Within Regulatory Limit	Above Limit	None/ Non-Detect	Within Regulatory Limit	Above Limit
pH		☒ 5 -11 SU	☐		☐ 5 - 11 SU	☐
Chemical Oxygen Demand (COD)		☒ ≤ 750 mg/l	☐		☐ ≤ 500 mg/l	☐
Microtox results: (a)		☒ < 55% screen	☐		☐ < 50% screen	☐
(b)		☐ > 20% EC50	☐		☐ > 25% EC50	☐
Temperature		☒ ≤ 180 °F	☐		☐ ≤ 140 °F	☐
Cyanide (Total)	☒	☐ < 5.0 mg/l	☐	☐	☐ < 1.0 mg/l	☐
Fluoride	☒	☐ < 200.0 mg/l	☐	☐	☐ < 50.0 mg/l	☐
Iron	☐	☒ < 100.0 mg/l	☐	☐	☐ < 35.0 mg/l	☐
Magnesium	☐	☒ < 100.0 mg/l	☐	☐	☐ < 50.0 mg/l	☐
Manganese	☐	☒ < 5.0 mg/l	☐	☐	☐ < 1.0 mg/l	☐
Metals (Total)	☐	☒ < 40.0 mg/l	☐	☐	☐ < 10.0 mg/l	☐
Nickel	☒	☐ < 50.0 mg/l	☐	☐	☐ ≤ 3.0 mg/l	☐
Nitrogen (Total)	☐	☒ ≤ 100.0 mg/l	☐	☐	☐ < 50.0 mg/l	☐
Oil and Grease	☒	☐ < 100.0 mg/l	☐	☐	☐ < 50.0 mg/l	☐
Phosphorus (Total)	☐	☒ < 100.0 mg/l	☐	☐	☐ < 50.0 mg/l	☐
Silver	☒	☐ < 5.0 mg/l	☐	☐	☐ < 0.5 mg/l	☐
Total Suspended Solids (TSS)	☐	☒ ≤ 400.0 mg/l	☐	☐	☐ ≤ 300.0 mg/l	☐
Zinc	☐	☒ < 25.0 mg/l	☐	☐	☐ < 5.0 mg/l	☐

Wastewater contaminants Identify for all constituents listed	None/Non-Detect	Present within Regulatory Limit	Above Limit
Dissolved Aluminum	☒	☐ < 5.0 mg/l	☐
Dissolved Arsenic	☒	☐ < 0.2 mg/l	☐
Dissolved Barium	☐	☒ < 100.0 mg/l	☐
Dissolved Beryllium	☒	☐ < 5.3 mg/l	☐
Dissolved Boron	☒	☐ < 5.0 mg/l	☐
Dissolved Cadmium	☒	☐ < 0.05 mg/l	☐
Chlorine (Total Residual)	☐	☒ < 3.0 mg/l	☐
Dissolved Chromium	☒	☐ < 1.0 mg/l	☐
Dissolved Cobalt	☒	☐ < 1.0 mg/l	☐
Dissolved Copper	☐	☒ < 0.5 mg/l	☐
Dissolved Lead	☒	☐ < 0.1 mg/l	☐
Total Mercury	☒	☐ < 0.01 mg/l	☐
Dissolved Molybdenum	☒	☐ < 75.0 mg/l	☐
Polychlorinated Biphenyls (PCB)	☒	None detected	☐
Dissolved Selenium	☒	☐ < 0.05 mg/l	☐
Dissolved Vanadium	☒	☐ < 0.1 mg/l	☐
Dissolved Zinc	☐	☒ < 25.0 mg/l	☐

Los Alamos
National Laboratory

WASTE PROFILE FORM

Attachment 2- Wastewater Characteristics for RLWTF (TA-50 & TA-21)

For help in completing this section of the form, call 7-4301.

Indicate if waste was: ☐ Accelerator produced ☐ Reactor produced ☐ Other (Describe in WPF Section 1 "Waste/Process Description")

Radionuclide Contaminants

Identify for the following:	Present At Or Below LOC (in Ci/l)	Range if Above LOC in Ci/l Min. / Max.	Identify for the following:	Present At Or Below LOC (in Ci/l)	Range if Above LOC in Ci/l Min. / Max.
As-74	☐ ≤ 4.0 E-8	_____ / _____	Rb-84	☐ ≤ 1.0 E-8	_____ / _____
Be-7	☐ ≤ 1.0 E-6	_____ / _____	Sc-46	☐ ≤ 2.0 E-8	_____ / _____
Ce-141	☐ ≤ 5.0 E-8	_____ / _____	Sc-48	☐ ≤ 2.0 E-8	_____ / _____
Cs-134	☐ ≤ 2.0 E-9	_____ / _____	Sc-75	☐ ≤ 2.0 E-8	_____ / _____
Cs-137	☐ ≤ 3.0 E-9	_____ / _____	Na-22	☐ ≤ 1.0 E-8	_____ / _____
Co-56	☐ ≤ 1.0 E-8	_____ / _____	Sr-85	☐ ≤ 7.0 E-8	_____ / _____
Co-57	☐ ≤ 1.0 E-7	_____ / _____	Sr-89	☐ ≤ 2.0 E-8	_____ / _____
Co-58	☐ ≤ 4.0 E-8	_____ / _____	Sr-90	☐ ≤ 1.0 E-9	_____ / _____
Co-60	☐ ≤ 5.0 E-9	_____ / _____	Sn-113	☐ ≤ 5.0 E-8	_____ / _____
Eu-152	☐ ≤ 2.0 E-8	_____ / _____	V-48	☐ ≤ 2.0 E-8	_____ / _____
H-3	☐ ≤ 2.0 E-8	_____ / _____	Y-88	☐ ≤ 3.0 E-8	_____ / _____
I-133	☐ ≤ 1.0 E-8	_____ / _____	Zn-65	☐ ≤ 9.0 E-9	_____ / _____
Mn-52	☐ ≤ 2.0 E-8	_____ / _____	Am-241	☐ ≤ 0.1 E-6	_____ / _____
Mn-54	☐ ≤ 5.0 E-8	_____ / _____	Pu-238	☐ ≤ 0.1 E-6	_____ / _____
Ra-226 + 228	☐ ≤ 3.0 E-11	_____ / _____	Pu-239	☐ ≤ 0.1 E-6	_____ / _____
Rb-83	☐ ≤ 2.0 E-8	_____ / _____	U-234	☐ ≤ 5.0 E-8	_____ / _____
Others:					
_____		_____ / _____	_____		_____ / _____
_____		_____ / _____	_____		_____ / _____
_____		_____ / _____	_____		_____ / _____

Other Contaminants

Metal contaminants	Present Below LOC (in ppm)	Range if above LOC (in ppm) Min. / Max.
Aluminum	☐ < 5.0	_____ to _____ ppm
Boron	☐ < 5.0	_____ to _____ ppm
Cobalt	☐ < 1.0	_____ to _____ ppm
Copper	☐ < 1.0	_____ to _____ ppm
Vanadium	☐ < 0.1	_____ to _____ ppm
Zinc	☐ < 95.4	_____ to _____ ppm

Additional Contaminants:	Min. / Max.
Chemical Oxygen Demand (COD)	_____ to _____ mg/l
Total Suspended Solids (TSS)	_____ to _____ mg/l
☐ Total Nitrogen or (only one	_____ to _____ mg/l
☐ Total Nitrates entry needed)	_____ to _____ mg/l

Radioactive Contaminant Totals:

Total Alpha: _____ Ci/l
Total Beta: _____ Ci/l
Total Gamma: _____ Ci/l

For TA-55 use only.

Wastewater will be discharged through one of the following:

☐ Acid Line ☐ Caustic Line ☐ Industrial waste line

☐ Yes ☐ No Scintillation Cocktail Brand Name _____ Volume _____ Unit _____

☐ Yes ☐ No Chemical treatment for Boilers / Water Chillers

☐ Yes ☐ No Industrial Cleaner Type _____ Volume _____ Unit _____

Average daily volume when discharge occurs: _____ ☐ Gallons/day ☐ Liters/day

Maximum daily volume when discharge occurs: _____ ☐ Gallons/day ☐ Liters/day

Estimated number of days per year discharge will occur: _____

Estimated total volume per year discharged to the Radioactive Liquid Waste Collection System at TA-50 / TA-21: _____ ☐ Gallons ☐ Liters

ASSAIGAI
ANALYTICAL
LABORATORIES, INC.
7300 Jefferson, N.E. • Albuquerque, New Mexico 87109 • (505) 345-8964 • FAX (505) 345-7259
3332 Wedgewood, E-5 • El Paso, Texas 79925 • (915) 593-6000 • FAX (915) 593-7820

LOS ALAMOS NATIONAL LABS
attn: DUSTIE STEPHENS
MAIL STOP K491/ESH-19
LOS ALAMOS, NM 87545

* explanation of codes	
B	analyte detected in Method Blank
E	result is estimated
H	analyzed out of hold time
N	tentatively identified compound
S	subcontracted
1-9	see footnote

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

Client: LOS ALAMOS NATIONAL LABS
Project: 9803111 8M70 XF70 30HE 0000 Z#111503

William P. Biava: President of Assaigai Analytical Laboratories, Inc.

Client Sample ID: *98DS270* Sample Matrix: *LIQUID* Sample Collected: *03/11/98 09:30:00*

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date
			SW846-8240 Volatiles							
9803111-01A	X98139	75-34-3	1,1 Dichloroethane	< 1.0	ug / L	1	1		XG.1998.227-7	03/16/98
	X98139	75-35-4	1,1 Dichloroethene	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	71-55-6	1,1,1 Trichloroethane	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	630-20-6	1,1,1,2 Tetrachloroethane	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	79-00-5	1,1,2 Trichloroethane	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	79-34-5	1,1,2,2 Tetrachloroethane	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	106-93-4	1,2 Dibromoethane (EDB)	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	95-50-1	1,2 Dichlorobenzene	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	107-06-2	1,2 Dichloroethane	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	78-87-5	1,2 Dichloropropane	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	96-18-4	1,2,3 Trichloropropane	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	541-73-1	1,3 Dichlorobenzene	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	764-41-0	1,4 Dichloro-2-butene	< 10	ug / L	1	10		XG.1998.227-7	
	X98139	106-46-7	1,4 Dichlorobenzene	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	78-93-3	2-Butanone (MEK)	5.6	ug / L	1	5		XG.1998.227-7	
	X98139	110-75-8	2-Chloroethylvinylether	< 5.0	ug / L	1	5		XG.1998.227-7	
	X98139	591-78-6	2-Hexanone (MBK)	< 5.0	ug / L	1	5		XG.1998.227-7	
	X98139	108-10-1	4-Methyl-2-pentanone (MIBK)	< 5.0	ug / L	1	5		XG.1998.227-7	
	X98139	67-64-1	Acetone	< 5.0	ug / L	1	5		XG.1998.227-7	
	X98139	107-02-8	Acrolein	< 20	ug / L	1	20		XG.1998.227-7	
	X98139	107-13-1	Acrylonitrile	< 20	ug / L	1	20		XG.1998.227-7	
	X98139	71-43-2	Benzene	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	75-27-4	Bromodichloromethane	< 1.0	ug / L	1	1		XG.1998.227-7	

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Certificate of Analysis

Client: **LOS ALAMOS NATIONAL LABS**

Project: **9803111 8M70 XF70 30HE 0000 Z#111503**

9803111-01A	X98139	75-25-2	Bromoform	< 1.0	ug / L	1	1		XG.1998.227-7	03/16/98
	X98139	74-83-9	Bromomethane	< 5.0	ug / L	1	5		XG.1998.227-7	
	X98139	75-15-0	Carbon disulfide	< 5.0	ug / L	1	5		XG.1998.227-7	
	X98139	56-23-5	Carbon tetrachloride	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	108-90-7	Chlorobenzene	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	124-48-1	Chlorodibromomethane	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	75-00-3	Chloroethane	< 5.0	ug / L	1	5		XG.1998.227-7	
	X98139	67-66-3	Chloroform	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	74-87-3	Chloromethane	< 5.0	ug / L	1	5		XG.1998.227-7	
	X98139	156-59-2	cis-1,2 dichloroethene	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	10061-01-5	cis-1,3 dichloropropene	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	74-95-3	Dibromomethane	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	97-63-2	Ethyl methacrylate	< 5.0	ug / L	1	5		XG.1998.227-7	
	X98139	100-41-4	Ethylbenzene	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139		Freon 113	< 5.0	ug / L	1	5		XG.1998.227-7	
	X98139	75-71-8	Freon 12	< 10	ug / L	1	10		XG.1998.227-7	
	X98139	74-88-4	Iodomethane	< 5.0	ug / L	1	5		XG.1998.227-7	
	X98139	1634-04-4	Methyl t-butyl ether (MTBE)	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	75-09-2	Methylene chloride	< 10	ug / L	1	10		XG.1998.227-7	
	X98139	95-47-6	o-Xylene	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139		p/m Xylenes	< 2.0	ug / L	1	2		XG.1998.227-7	
	X98139	100-42-5	Styrene	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	156-60-5	t-1,2 Dichloroethene	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	10061-02-6	t-1,3 Dichloropropene	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	127-18-4	Tetrachloroethene	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	108-88-3	Toluene	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	79-01-6	Trichloroethene	< 1.0	ug / L	1	1		XG.1998.227-7	
	X98139	75-69-4	Trichlorofluoromethane	< 5.0	ug / L	1	5		XG.1998.227-7	
	X98139	108-05-4	Vinyl acetate	< 5.0	ug / L	1	5		XG.1998.227-7	
	X98139	75-01-4	Vinyl chloride	< 5.0	ug / L	1	5		XG.1998.227-7	

Client Sample ID ***98DS271*** Sample Matrix ***LIQUID*** Sample Collected ***03/11/98 09:30:00***

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date
			SW846-8270 Semi-Volatiles							
9803111-02A	X98147	120-82-1	1,2,4-Trichlorobenzene	< 1.7	ug / L	2	1		XG.1998.299-7	04/01/98
	X98147	95-50-1	1,2-Dichlorobenzene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	541-73-1	1,3-Dichlorobenzene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	106-46-7	1,4-Dichlorobenzene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	90-12-0	1-Methylnaphthalene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	58-90-2	2,3,4,6-Tetrachlorophenol	< 8.6	ug / L	2	5		XG.1998.299-7	
	X98147	95-95-4	2,4,5-Trichlorophenol	< 8.6	ug / L	2	5		XG.1998.299-7	
	X98147	88-06-2	2,4,6-Trichlorophenol	< 8.6	ug / L	2	5		XG.1998.299-7	
	X98147	120-83-2	2,4-Dichlorophenol	< 8.6	ug / L	2	5		XG.1998.299-7	
	X98147	105-67-9	2,4-Dimethylphenol	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	51-28-5	2,4-Dinitrophenol	< 17	ug / L	2	10		XG.1998.299-7	

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9803111-02A	X98147	121-14-2	2,4-Dinitrotoluene	< 8.6	ug / L	2	5		XG.1998.299-7	04/01/98
	X98147	606-20-2	2,6-Dinitrotoluene	< 8.6	ug / L	2	5		XG.1998.299-7	
	X98147	91-58-7	2-Chloronaphthalene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	95-57-8	2-Chlorophenol	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	91-57-6	2-Methylnaphthalene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	95-48-7	2-Methylphenol	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	88-74-4	2-Nitroaniline	< 8.6	ug / L	2	5		XG.1998.299-7	
	X98147	88-75-5	2-Nitrophenol	< 8.6	ug / L	2	5		XG.1998.299-7	
	X98147		3+4 Methylphenol	8.9	ug / L	2	1		XG.1998.299-7	
	X98147	91-94-1	3,3'-Dichlorobenzidine	< 17	ug / L	2	10		XG.1998.299-7	
	X98147	99-09-2	3-Nitroaniline	< 8.6	ug / L	2	5		XG.1998.299-7	
	X98147	534-52-1	4,6-Dinitro-2-methylphenol	< 17	ug / L	2	10		XG.1998.299-7	
	X98147	101-55-3	4-Bromophenyl-phenylether	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	59-50-7	4-Chloro-3-methylphenol	< 8.6	ug / L	2	5		XG.1998.299-7	
	X98147	106-47-8	4-Chloroaniline	< 8.6	ug / L	2	5		XG.1998.299-7	
	X98147	7005-72-3	4-Chlorophenyl-phenylether	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	100-01-6	4-Nitroaniline	< 8.6	ug / L	2	5		XG.1998.299-7	
	X98147	100-02-7	4-Nitrophenol	< 17	ug / L	2	10		XG.1998.299-7	
	X98147	83-32-9	Acenaphthene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	208-96-8	Acenaphthylene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	62-53-3	Aniline	< 17	ug / L	2	10		XG.1998.299-7	
	X98147	120-12-7	Anthracene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147		Azobenzene&1,2-Diphenylhydrazine	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	92-87-5	Benzidine	< 43	ug / L	2	25		XG.1998.299-7	
	X98147	56-55-3	Benzo (a) anthracene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	50-32-8	Benzo(a)pyrene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147		Benzo(b & k)fluoranthene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	191-24-2	Benzo(g,h,i)perylene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	64-85-0	Benzoic acid	320	ug / L	3	25		XG.1998.299-15	04/02/98
	X98147	100-51-6	Benzyl alcohol	< 8.6	ug / L	2	5		XG.1998.299-7	04/01/98
	X98147	111-44-4	bis (2-Chloroethyl) ether	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	111-91-1	bis(2-Chloroethoxy)methane	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	108-60-1	bis(2-Chloroisopropyl)ether	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	117-81-7	bis(2-Ethylhexyl)phthalate	< 8.6	ug / L	2	5		XG.1998.299-7	
	X98147	85-68-7	Butylbenzylphthalate	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	218-01-9	Chrysene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	84-74-2	di-n-Butylphthalate	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	117-84-0	di-n-Octylpthalate	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	53-70-3	Dibenz(a,h)anthracene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	132-64-9	Dibenzofuran	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	84-66-2	Diethylphthalate	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	131-11-3	Dimethylphthalate	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	206-44-0	Fluoranthene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	86737	Fluorene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	118-74-1	Hexachlorobenzene	< 17	ug / L	2	10		XG.1998.299-7	
	X98147	87-68-3	Hexachlorobutadiene	< 17	ug / L	2	10		XG.1998.299-7	
	X98147	77-47-4	Hexachlorocyclopentadiene	< 17	ug / L	2	10		XG.1998.299-7	
	X98147	67-72-1	Hexachloroethane	< 8.6	ug / L	2	5		XG.1998.299-7	
	X98147	193-39-5	Indeno(1,2,3-cd)pyrene	< 1.7	ug / L	2	1		XG.1998.299-7	

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9803111-02A	X98147	78-59-1	Isophorone	< 1.7	ug / L	2	1		XG.1998.299-7	04/01/98
	X98147	621-64-7	n-Nitroso-di-n-propylamine	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	62-75-9	n-Nitroso-dimethyl-amine	< 17	ug / L	2	10		XG.1998.299-7	
	X98147	86-30-6	n-Nitrosodiphenylamine	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	91-20-3	Naphthalene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	98-95-3	Nitrobenzene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	87-86-5	Pentachlorophenol	< 17	ug / L	2	10		XG.1998.299-7	
	X98147	85-01-8	Phenanthrene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	108-95-2	Phenol	< 17	ug / L	2	10		XG.1998.299-7	
	X98147	129-00-0	Pyrene	< 1.7	ug / L	2	1		XG.1998.299-7	
	X98147	110-86-1	Pyridine	< 17	ug / L	2	10		XG.1998.299-7	

Client Sample ID **98DS272** Sample Matrix **LIQUID** Sample Collected **03/11/98 09:30:00**

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date
			SW846-6010 ICP							
9803111-03A	M98228	7440-38-2	Arsenic	< 0.06	mg / L	1	0.06		MW.1998.396-70	03/29/98
	M98228	7440-39-3	Barium	0.02	mg / L	1	0.01		MW.1998.396-70	
	M98228	7440-43-9	Cadmium	< 0.008	mg / L	1	0.008		MW.1998.396-70	
	M98228	7440-47-3	Chromium	< 0.04	mg / L	1	0.04		MW.1998.396-70	
	M98228	7439-92-1	Lead	< 0.06	mg / L	1	0.06		MW.1998.396-70	
	M98228	7782-49-2	Selenium	< 0.05	mg / L	1	0.05		MW.1998.396-70	
	M98228	7440-22-4	Silver	< 0.02	mg / L	1	0.02		MW.1998.396-70	
			SW846-7470 / EPA-245.1							
9[illegible]111-03A	M98221	7439-97-6	Mercury	< 0.0002	mg / L	1	0.0002		MW.1998.367-13	03/26/98

Client Sample ID **98DS273** Sample Matrix **LIQUID** Sample Collected **03/11/98 09:30:00**

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date
			EPA-410.1							
9803111-04A	COD98006		Chemical Oxygen Demand	76.5	mg / L	1	1		MT.1998.636-6	03/18/98

Client Sample ID **98DS274** Sample Matrix **LIQUID** Sample Collected **03/11/98 09:30:00**

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date
			EPA-300.0 anions							
[illegible]3111-05A	W9895		Nitrate, as N	< 0.2	mg / L	1	0.2		MW.1998.395-32	03/25/98
			SM-4500-N & NH3B,C							
[illegible]3111-05A	W9891		Kjeldahl Nitrogen, Total	59.6	mg / L	25	0.2		MW.1998.341-15	03/20/98

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

Client: **LOS ALAMOS NATIONAL LABS**

Project: **9803111** **8M70 XF70 30HE 0000 Z#111503**

SM-4500-NH3B,C

9[illegible]3111-05A	W9892	7664-41-7	Ammonia, as N	49.8	mg / L	25	0.2		MW.1998.342-9	03/20/98

Client Sample ID ***98DS275*** Sample Matrix ***LIQUID*** Sample Collected ***03/11/98 09:30:00***

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date
			EPA-150.1							
9803111-06A	WPH98027		pH	8.1	units	1	0.1		MT.1998.610-4	03/12/98
			EPA-160.2							
9803111-06A	TSS98015		Total Suspended Solids	26.0	mg / L	1	4		MT.1998.628-16	03/13/98
			EPA-300.0 anions							
9[illegible]3111-06A	W98105		Chloride	48.5	mg / L	5	0.5		MW.1998.399-23	03/31/98
	W9895		Fluoride	< 0.5	mg / L	1	0.5		MW.1998.395-34	03/25/98

**** Sample specific analytical Detection Limit is determined by multiplying the sample Dilution Factor by the listed method Detection Limit. ****

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: **LOS ALAMOS NATIONAL LABS**

Project: **9803111** **8M70 XF70 30HE 0000 Z#111503**

* explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

QC Type **LCS: Lab Control Spike** QC Matrix **WATER**

QC Group	Run ID		Result	Units	*	Run Group - #	Run Date
		EPA-160.2					
TSS98015	TSS98015(2)	Total Suspended Solids	59	% Recovery		MT.1998.628 - 2	03/13/98
		EPA-300.0 anions					
W98105	W98105-002	Chloride	98	% Recovery		MW.1998.399 - 4	03/30/98
W9895	W9895-002	Fluoride	99	% Recovery		MW.1998.395 - 4	03/24/98
	W9895-002	Nitrate, as N	97	% Recovery		MW.1998.395 - 4	
		EPA-410.1					
COD98006	COD98006(1)	Chemical Oxygen Demand	103	% Recovery		MT.1998.636 - 1	03/18/98
	COD98006(13)	Chemical Oxygen Demand	92	% Recovery		MT.1998.636 - 13	
		SM-4500-N & NH3B,C					
W9891	W9891-004	Kjeldahl Nitrogen, Total	104	(%) Recov		MW.1998.341 - 5	03/20/98
		SM-4500-NH3B,C					
W9892	W9892-004	Ammonia, as N	92	(%) Recov		MW.1998.342 - 5	03/20/98
		SW846-6010 ICP					
M98228	M98228-002	Arsenic	102	(%) Recov		MW.1998.396 - 62	03/29/98
	M98228-002	Barium	96	(%) Recov		MW.1998.396 - 62	
	M98228-002	Cadmium	103	(%) Recov		MW.1998.396 - 62	
	M98228-002	Chromium	100	(%) Recov		MW.1998.396 - 62	
	M98228-002	Lead	100	(%) Recov		MW.1998.396 - 62	
	M98228-002	Selenium	105	(%) Recov		MW.1998.396 - 62	
	M98228-002	Silver	100	(%) Recov		MW.1998.396 - 62	
		SW846-7470 / EPA-245.1					
M98221	M98221-002	Mercury	100	(%) Recov		MW.1998.367 - 9	03/26/98
		SW846-8240 Volatiles					
X98139	X98139-001	1,1 Dichloroethene	101	% Recovery		XG.1998.227 - 1	03/16/98
	X98139-001	Benzene	99	% Recovery		XG.1998.227 - 1	
	X98139-001	Chlorobenzene	97	% Recovery		XG.1998.227 - 1	
	X98139-001	Toluene	98	% Recovery		XG.1998.227 - 1	
	X98139-001	Trichloroethene	98	% Recovery		XG.1998.227 - 1	
		SW846-8270 Semi-Volatiles					
X98147	X98147-002	1,2,4-Trichlorobenzene	75	% Recovery		XG.1998.299 - 1	04/01/98
	X98147-002	1,4-Dichlorobenzene	70	% Recovery		XG.1998.299 - 1	
	X98147-002	2,4-Dinitrotoluene	92	% Recovery		XG.1998.299 - 1	
	X98147-002	2-Chlorophenol	79	% Recovery		XG.1998.299 - 1	
	X98147-002	4-Chloro-3-methylphenol	81	% Recovery		XG.1998.299 - 1	
	X98147-002	4-Nitrophenol	38	% Recovery		XG.1998.299 - 1	
	X98147-002	Acenaphthene	82	% Recovery		XG.1998.299 - 1	
	X98147-002	n-Nitroso-di-n-propylamine	82	% Recovery		XG.1998.299 - 1	
	X98147-002	Pentachlorophenol	92	% Recovery		XG.1998.299 - 1	
	X98147-002	Phenol	36	% Recovery		XG.1998.299 - 1	

Quality Control Summary

Client: **LOS ALAMOS NATIONAL LABS**

Project: **9803111 8M70 XF70 30HE 0000 Z#111503**

* explanation of codes	
D	*Not applicable due to sample dilution*
L	*Not applicable due to MDL proximity*

X98147	X98147-002	Pyrene	90	% Recovery		XG.1998.299 - 1	04/01/98

QC Type **LCSD: Lab Control Spike Duplicate Accuracy** QC Matrix **WATER**

QC Group	Run ID		Result	Units	*	Run Group - #	Run Date
		EPA-160.2					
TSS98015	TSS98015(3)	Total Suspended Solids	75	% Recovery		MT.1998.628 - 3	03/13/98
		EPA-300.0 anions					
W98105	W98105-003	Chloride	98	% Recovery		MW.1998.399 - 5	03/30/98
W9895	W9895-003	Fluoride	98	% Recovery		MW.1998.395 - 5	03/24/98
	W9895-003	Nitrate, as N	99	% Recovery		MW.1998.395 - 5	
		EPA-410.1					
COD98006	COD98006(2)	Chemical Oxygen Demand	103	% Recovery		MT.1998.636 - 2	03/18/98
	COD98006(14)	Chemical Oxygen Demand	92	% Recovery		MT.1998.636 - 14	
		SM-4500-N & NH3B,C					
W9891	W9891-005	Kjeldahl Nitrogen, Total	101	(%) Recov		MW.1998.341 - 6	03/20/98
		SM-4500-NH3B,C					
W9892	W9892-005	Ammonia, as N	91	(%) Recov		MW.1998.342 - 6	03/20/9
		SW846-6010 ICP					
M98228	M98228-003	Arsenic	103	(%) Recov		MW.1998.396 - 63	03/29/9
	M98228-003	Barium	96	(%) Recov		MW.1998.396 - 63	
	M98228-003	Cadmium	103	(%) Recov		MW.1998.396 - 63	
	M98228-003	Chromium	100	(%) Recov		MW.1998.396 - 63	
	M98228-003	Lead	100	(%) Recov		MW.1998.396 - 63	
	M98228-003	Selenium	106	(%) Recov		MW.1998.396 - 63	
	M98228-003	Silver	100	(%) Recov		MW.1998.396 - 63	
		SW846-7470 / EPA-245.1					
M98221	M98221-003	Mercury	97	(%) Recov		MW.1998.367 - 10	03/26/98
		SW846-8240 Volatiles					
X98139	X98139-002	1,1 Dichloroethene	104	% Recovery		XG.1998.227 - 2	03/16/98
	X98139-002	Benzene	100	% Recovery		XG.1998.227 - 2	
	X98139-002	Chlorobenzene	97	% Recovery		XG.1998.227 - 2	
	X98139-002	Toluene	98	% Recovery		XG.1998.227 - 2	
	X98139-002	Trichloroethene	100	% Recovery		XG.1998.227 - 2	
		SW846-8270 Semi-Volatiles					
X98147	X98147-003	1,2,4-Trichlorobenzene	79	% Recovery		XG.1998.299 - 2	04/01/98
	X98147-003	1,4-Dichlorobenzene	74	% Recovery		XG.1998.299 - 2	
	X98147-003	2,4-Dinitrotoluene	96	% Recovery		XG.1998.299 - 2	
	X98147-003	2-Chlorophenol	82	% Recovery		XG.1998.299 - 2	
	X98147-003	4-Chloro-3-methylphenol	84	% Recovery		XG.1998.299 - 2	
	X98147-003	4-Nitrophenol	39	% Recovery		XG.1998.299 - 2	
	X98147-003	Acenaphthene	86	% Recovery		XG.1998.299 - 2	
	X98147-003	n-Nitroso-di-n-propylamine	86	% Recovery		XG.1998.299 - 2	
	X98147-003	Pentachlorophenol	94	% Recovery		XG.1998.299 - 2	

Client: **LOS ALAMOS NATIONAL LABS**

Project: **9803111 8M70 XF70 30HE 0000 Z#111503**

* explanation of codes	
D	*Not applicable due to sample dilution*
L	*Not applicable due to MDL proximity*

X98147	X98147-003	Phenol	38	% Recovery		XG.1998.299 - 2	04/01/98
	X98147-003	Pyrene	95	% Recovery		XG.1998.299 - 2	

QC Type **LCSD: Lab Control Spike Duplicate Precision** QC Matrix **WATER**

QC Group	Run ID		Result	Units	*	Run Group - #	Run Date
		EPA-160.2					
TSS98015	TSS98015(3)	Total Suspended Solids	12	PFA		MT.1998.628 - 3	03/13/98
		EPA-300.0 anions					
W98105	W98105-003	Chloride	< 1	RPD		MW.1998.399 - 5	03/30/98
W9895	W9895-003	Fluoride	< 1	RPD		MW.1998.395 - 5	03/24/98
	W9895-003	Nitrate, as N	2	RPD		MW.1998.395 - 5	
		EPA-410.1					
COD98006	COD98006(2)	Chemical Oxygen Demand	< 1	RPD		MT.1998.636 - 2	03/18/98
	COD98006(14)	Chemical Oxygen Demand	< 1	RPD		MT.1998.636 - 14	
		SM-4500-N & NH3B,C					
W9891	W9891-005	Kjeldahl Nitrogen, Total	3	(%) RPD		MW.1998.341 - 6	03/20/98
		SM-4500-NH3B,C					
W9892	W9892-005	Ammonia, as N	1	(%) RPD		MW.1998.342 - 6	03/20/98
		SW846-6010 ICP					
M98228	M98228-003	Arsenic	< 1	(%) RPD		MW.1998.396 - 63	03/29/98
	M98228-003	Barium	< 1	(%) RPD		MW.1998.396 - 63	
	M98228-003	Cadmium	< 1	(%) RPD		MW.1998.396 - 63	
	M98228-003	Chromium	< 1	(%) RPD		MW.1998.396 - 63	
	M98228-003	Lead	< 1	(%) RPD		MW.1998.396 - 63	
	M98228-003	Selenium	< 1	(%) RPD		MW.1998.396 - 63	
	M98228-003	Silver	< 1	(%) RPD		MW.1998.396 - 63	
		SW846-7470 / EPA-245.1					
M98221	M98221-003	Mercury	3	(%) RPD		MW.1998.367 - 10	03/26/98
		SW846-8240 Volatiles					
X98139	X98139-002	1,1 Dichloroethene	3	RPD		XG.1998.227 - 2	03/16/98
	X98139-002	Benzene	2	RPD		XG.1998.227 - 2	
	X98139-002	Chlorobenzene	< 1	RPD		XG.1998.227 - 2	
	X98139-002	Toluene	< 1	RPD		XG.1998.227 - 2	
	X98139-002	Trichloroethene	1	RPD		XG.1998.227 - 2	
		SW846-8270 Semi-Volatiles					
X98147	X98147-003	1,2,4-Trichlorobenzene	6	RPD		XG.1998.299 - 2	04/01/98
	X98147-003	1,4-Dichlorobenzene	5	RPD		XG.1998.299 - 2	
	X98147-003	2,4-Dinitrotoluene	4	RPD		XG.1998.299 - 2	
	X98147-003	2-Chlorophenol	4	RPD		XG.1998.299 - 2	
	X98147-003	4-Chloro-3-methylphenol	4	RPD		XG.1998.299 - 2	
	X98147-003	4-Nitrophenol	4	RPD		XG.1998.299 - 2	
	X98147-003	Acenaphthene	5	RPD		XG.1998.299 - 2	
	X98147-003	n-Nitroso-di-n-propylamine	4	RPD		XG.1998.299 - 2	

Client: **LOS ALAMOS NATIONAL LABS**

Project: **9803111 8M70 XF70 30HE 0000 Z#111503**

* explanation of codes	
D	*Not applicable due to sample dilution*
L	*Not applicable due to MDL proximity*

X98147	X98147-003	Pentachlorophenol	2	RPD		XG.1998.299 - 2	04/01/98
	X98147-003	Phenol	5	RPD		XG.1998.299 - 2	
	X98147-003	Pyrene	5	RPD		XG.1998.299 - 2	

QC Type: MB: Method Blank — QC Matrix: WATER

QC Group	Run ID		Result	Units	*	Run Group - #	Run Date
		EPA-160.2					
TSS98015	TSS98015(1)	Total Suspended Solids	< 4.0	mg / L		MT.1998.628 - 1	03/13/98
		EPA-300.0 anions					
W98105	W98105-001	Chloride	< 0.5	mg / L		MW.1998.399 - 3	03/30/98
W9895	W9895-001	Fluoride	< 0.5	mg / L		MW.1998.395 - 3	03/24/98
	W9895-001	Nitrate, as N	< 0.2	mg / L		MW.1998.395 - 3	
		SM-4500-N & NH3B,C					
W9891	W9891-001	Kjeldahl Nitrogen, Total	< 0.2	mg / L		MW.1998.341 - 2	03/20/98
		SM-4500-NH3B,C					
W9892	W9892-001	Ammonia, as N	< 0.2	mg / L		MW.1998.342 - 2	03/20/98
		SW846-6010 ICP					
M98228	M98228-001	Arsenic	< 0.06	mg / L		MW.1998.396 - 61	03/29/98
	M98228-001	Barium	< 0.01	mg / L		MW.1998.396 - 61	
	M98228-001	Cadmium	< 0.008	mg / L		MW.1998.396 - 61	
	M98228-001	Chromium	< 0.04	mg / L		MW.1998.396 - 61	
	M98228-001	Lead	< 0.06	mg / L		MW.1998.396 - 61	
	M98228-001	Selenium	< 0.05	mg / L		MW.1998.396 - 61	
	M98228-001	Silver	< 0.02	mg / L		MW.1998.396 - 61	
		SW846-7470 / EPA-245.1					
M98221	M98221-001	Mercury	< 0.0002	mg / L		MW.1998.367 - 8	03/26/98
		SW846-8240 Volatiles					
X98139	X98139-003	1,1 Dichloroethane	< 1.0	ug / L		XG.1998.227 - 3	03/16/98
	X98139-003	1,1 Dichloroethene	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	1,1,1 Trichloroethane	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	1,1,1,2 Tetrachloroethane	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	1,1,2 Trichloroethane	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	1,1,2,2 Tetrachloroethane	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	1,2 Dibromoethane (EDB)	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	1,2 Dichlorobenzene	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	1,2 Dichloroethane	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	1,2 Dichloropropane	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	1,2,3 Trichloropropane	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	1,3 Dichlorobenzene	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	1,4 Dichloro-2-butene	< 10	ug / L		XG.1998.227 - 3	
	X98139-003	1,4 Dichlorobenzene	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	2-Butanone (MEK)	< 5.0	ug / L		XG.1998.227 - 3	
	X98139-003	2-Chloroethylvinylether	< 5.0	ug / L		XG.1998.227 - 3	
	X98139-003	2-Hexanone (MBK)	< 5.0	ug / L		XG.1998.227 - 3	

Quality Control Summary

Client: **LOS ALAMOS NATIONAL LABS**

Project: **9803111 8M70 XF70 30HE 0000 Z#111503**

* explanation of codes	
D	*Not applicable due to sample dilution*
L	*Not applicable due to MDL proximity*

X98139	X98139-003	4-Methyl-2-pentanone (MIBK)	< 5.0	ug / L		XG.1998.227 - 3	03/16/98
	X98139-003	Acetone	< 5.0	ug / L		XG.1998.227 - 3	
	X98139-003	Acrolein	< 20	ug / L		XG.1998.227 - 3	
	X98139-003	Acrylonitrile	< 20	ug / L		XG.1998.227 - 3	
	X98139-003	Benzene	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	Bromodichloromethane	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	Bromoform	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	Bromomethane	< 5.0	ug / L		XG.1998.227 - 3	
	X98139-003	Carbon disulfide	< 5.0	ug / L		XG.1998.227 - 3	
	X98139-003	Carbon tetrachloride	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	Chlorobenzene	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	Chlorodibromomethane	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	Chloroethane	< 5.0	ug / L		XG.1998.227 - 3	
	X98139-003	Chloroform	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	Chloromethane	< 5.0	ug / L		XG.1998.227 - 3	
	X98139-003	cis-1,2 dichloroethene	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	cis-1,3 dichloropropene	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	Dibromomethane	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	Ethyl methacrylate	< 5.0	ug / L		XG.1998.227 - 3	
	X98139-003	Ethylbenzene	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	Freon 113	< 5.0	ug / L		XG.1998.227 - 3	
	X98139-003	Freon 12	< 10	ug / L		XG.1998.227 - 3	
	X98139-003	Iodomethane	< 5.0	ug / L		XG.1998.227 - 3	
	X98139-003	Methyl t-butyl ether (MTBE)	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	Methylene chloride	< 10	ug / L		XG.1998.227 - 3	
	X98139-003	o-Xylene	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	p/m Xylenes	< 2.0	ug / L		XG.1998.227 - 3	
	X98139-003	Styrene	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	t-1,2 Dichloroethene	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	t-1,3 Dichloropropene	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	Tetrachloroethene	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	Toluene	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	Trichloroethene	< 1.0	ug / L		XG.1998.227 - 3	
	X98139-003	Trichlorofluoromethane	< 5.0	ug / L		XG.1998.227 - 3	
	X98139-003	Vinyl acetate	< 5.0	ug / L		XG.1998.227 - 3	
	X98139-003	Vinyl chloride	< 5.0	ug / L		XG.1998.227 - 3	

SW846-8270 Semi-Volatiles

X98147	X98147-001	1,2,4-Trichlorobenzene	< 1.5	ug / L		XG.1998.299 - 3	04/01/98
	X98147-001	1,2-Dichlorobenzene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	1,3-Dichlorobenzene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	1,4-Dichlorobenzene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	1-Methylnaphthalene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	2,3,4,6-Tetrachlorophenol	< 7.7	ug / L		XG.1998.299 - 3	
	X98147-001	2,4,5-Trichlorophenol	< 7.7	ug / L		XG.1998.299 - 3	
	X98147-001	2,4,6-Trichlorophenol	< 7.7	ug / L		XG.1998.299 - 3	
	X98147-001	2,4-Dichlorophenol	< 7.7	ug / L		XG.1998.299 - 3	
	X98147-001	2,4-Dimethylphenol	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	2,4-Dinitrophenol	< 15	ug / L		XG.1998.299 - 3	
	X98147-001	2,4-Dinitrotoluene	< 7.7	ug / L		XG.1998.299 - 3	
	X98147-001	2,6-Dinitrotoluene	< 7.7	ug / L		XG.1998.299 - 3	

Quality Control Summary

Client: **LOS ALAMOS NATIONAL LABS**

Project: **9803111 8M70 XF70 30HE 0000 Z#111503**

* explanation of codes	
D	*Not applicable due to sample dilution*
L	*Not applicable due to MDL proximity*

X98147	X98147-001	2-Chloronaphthalene	< 1.5	ug / L		XG.1998.299 - 3	04/01/98
	X98147-001	2-Chlorophenol	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	2-Methylnaphthalene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	2-Methylphenol	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	2-Nitroaniline	< 7.7	ug / L		XG.1998.299 - 3	
	X98147-001	2-Nitrophenol	< 7.7	ug / L		XG.1998.299 - 3	
	X98147-001	3+4 Methylphenol	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	3,3'-Dichlorobenzidine	< 15	ug / L		XG.1998.299 - 3	
	X98147-001	3-Nitroaniline	< 7.7	ug / L		XG.1998.299 - 3	
	X98147-001	4,6-Dinitro-2-methylphenol	< 15	ug / L		XG.1998.299 - 3	
	X98147-001	4-Bromophenyl-phenylether	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	4-Chloro-3-methylphenol	< 7.7	ug / L		XG.1998.299 - 3	
	X98147-001	4-Chloroaniline	< 7.7	ug / L		XG.1998.299 - 3	
	X98147-001	4-Chlorophenyl-phenylether	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	4-Nitroaniline	< 7.7	ug / L		XG.1998.299 - 3	
	X98147-001	4-Nitrophenol	< 15	ug / L		XG.1998.299 - 3	
	X98147-001	Acenaphthene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Acenaphthylene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Aniline	< 15	ug / L		XG.1998.299 - 3	
	X98147-001	Anthracene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Azobenzene&1,2-Diphenylhydrazine	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Benzidine	< 38	ug / L		XG.1998.299 - 3	
	X98147-001	Benzo (a) anthracene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Benzo(a)pyrene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Benzo(b & k)fluoranthene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Benzo(g,h,i)perylene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Benzoic acid	< 38	ug / L		XG.1998.299 - 3	
	X98147-001	Benzyl alcohol	< 7.7	ug / L		XG.1998.299 - 3	
	X98147-001	bis (2-Chloroethyl) ether	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	bis(2-Chloroethoxy)methane	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	bis(2-Chloroisopropyl)ether	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	bis(2-Ethylhexyl)phthalate	< 7.7	ug / L		XG.1998.299 - 3	
	X98147-001	Butylbenzylphthalate	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Chrysene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	di-n-Butylphthalate	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	di-n-Octylpthalate	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Dibenz(a,h)anthracene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Dibenzofuran	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Diethylphthalate	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Dimethylphthalate	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Fluoranthene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Fluorene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Hexachlorobenzene	< 15	ug / L		XG.1998.299 - 3	
	X98147-001	Hexachlorobutadiene	< 15	ug / L		XG.1998.299 - 3	
	X98147-001	Hexachlorocyclopentadiene	< 15	ug / L		XG.1998.299 - 3	
	X98147-001	Hexachloroethane	< 7.7	ug / L		XG.1998.299 - 3	
	X98147-001	Indeno(1,2,3-cd)pyrene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Isophorone	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	n-Nitroso-di-n-propylamine	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	n-Nitroso-dimethyl-amine	< 15	ug / L		XG.1998.299 - 3	
	X98147-001	n-Nitrosodiphenylamine	< 1.5	ug / L		XG.1998.299 - 3	

Quality Control Summary

Client: **LOS ALAMOS NATIONAL LABS**

Project: **9803111** **8M70 XF70 30HE 0000 Z#111503**

* explanation of codes	
D	*Not applicable due to sample dilution*
L	*Not applicable due to MDL proximity*

X98147	X98147-001	Naphthalene	< 1.5	ug / L		XG.1998.299 - 3	04/01/98
	X98147-001	Nitrobenzene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Pentachlorophenol	< 15	ug / L		XG.1998.299 - 3	
	X98147-001	Phenanthrene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Phenol	< 15	ug / L		XG.1998.299 - 3	
	X98147-001	Pyrene	< 1.5	ug / L		XG.1998.299 - 3	
	X98147-001	Pyridine	< 15	ug / L		XG.1998.299 - 3	

MD: Matrix Duplicate

QC Matrix **WATER**

C Group	Run ID		Result	Units	*	Run Group - #	Run Date
		EPA-150.1					
W/PH98027	WPH98027(2)	pH	0.01	DIFF		MT.1998.610 - 2	03/12/98
		EPA-160.2					
TSS98015	TSS98015(22)	Total Suspended Solids	2	PFA		MT.1998.628 - 22	03/13/98

MS: Matrix Spike

QC Type

QC Matrix **WATER**

QC Group	Run ID		Result	Units	*	Run Group - #	Run Date
		EPA-300.0 anions					
W98105	W98105-014	Chloride	97	% Recovery		MW.1998.399 - 18	03/31/98
W9895	W9895-005	Fluoride	102	% Recovery		MW.1998.395 - 7	03/24/98
	W9895-005	Nitrate, as N	95	% Recovery		MW.1998.395 - 7	
		EPA-410.1					
COD98006	COD98006(4)	Chemical Oxygen Demand	101	% Recovery		MT.1998.636 - 4	03/18/98
		SM-4500-N & NH3B,C					
W9891	W9891-009	Kjeldahl Nitrogen, Total	107	(%) Recov		MW.1998.341 - 10	03/20/98
		SM-4500-NH3B,C					
W9892	W9892-012	Ammonia, as N	91	(%) Recov		MW.1998.342 - 14	03/20/98
		SW846-6010 ICP					
M98228	M98228-005	Arsenic	108	(%) Recov		MW.1998.396 - 65	03/29/98
	M98228-005	Barium	100	(%) Recov		MW.1998.396 - 65	
	M98228-005	Cadmium	107	(%) Recov		MW.1998.396 - 65	
	M98228-005	Chromium	103	(%) Recov		MW.1998.396 - 65	
	M98228-005	Lead	104	(%) Recov		MW.1998.396 - 65	
	M98228-005	Selenium	111	(%) Recov		MW.1998.396 - 65	
	M98228-005	Silver	100	(%) Recov		MW.1998.396 - 65	
		SW846-7470 / EPA-245.1					
M98221	M98221-010	Mercury	84	(%) Recov		MW.1998.367 - 17	03/26/98
		SW846-8240 Volatiles					
X98139	X98139-005	1,1 Dichloroethene	102	% Recovery		XG.1998.227 - 5	03/16/98

* explanation of codes	
D	*Not applicable due to sample dilution*
L	*Not applicable due to MDL proximity*

X98139	X98139-005	Benzene	98	% Recovery		XG.1998.227 - 5	03/16/98
	X98139-005	Chlorobenzene	97	% Recovery		XG.1998.227 - 5	
	X98139-005	Toluene	95	% Recovery		XG.1998.227 - 5	
	X98139-005	Trichloroethene	98	% Recovery		XG.1998.227 - 5	
		SW846-8270 Semi-Volatiles					
X98147	X98147-010	1,2,4-Trichlorobenzene	87	% Recovery		XG.1998.299 - 10	04/01/98
	X98147-010	1,4-Dichlorobenzene	83	% Recovery		XG.1998.299 - 10	
	X98147-010	2,4-Dinitrotoluene	100	% Recovery		XG.1998.299 - 10	
	X98147-010	2-Chlorophenol	84	% Recovery		XG.1998.299 - 10	
	X98147-010	4-Chloro-3-methylphenol	88	% Recovery		XG.1998.299 - 10	
	X98147-010	4-Nitrophenol	42	% Recovery		XG.1998.299 - 10	
	X98147-010	Acenaphthene	91	% Recovery		XG.1998.299 - 10	
	X98147-010	n-Nitroso-di-n-propylamine	88	% Recovery		XG.1998.299 - 10	
	X98147-010	Pentachlorophenol	101	% Recovery		XG.1998.299 - 10	
	X98147-010	Phenol	41	% Recovery		XG.1998.299 - 10	
	X98147-010	Pyrene	99	% Recovery		XG.1998.299 - 10	

MSD: Matrix Spike Duplicate Accuracy

QC Matrix **WATER**

C Group	Run ID		Result	Units	*	Run Group - #	Run Date
		EPA-300.0 anions					
W98105	W98105-015	Chloride	96	% Recovery		MW.1998.399 - 19	03/31/98
W9895	W9895-006	Fluoride	99	% Recovery		MW.1998.395 - 8	03/24/98
	W9895-006	Nitrate, as N	95	% Recovery		MW.1998.395 - 8	
		EPA-410.1					
OD98006	COD98006(5)	Chemical Oxygen Demand	104	% Recovery		MT.1998.636 - 5	03/18/98
		SM-4500-N & NH3B,C					
W9891	W9891-010	Kjeldahl Nitrogen, Total	106	(%) Recov		MW.1998.341 - 11	03/20/98
		SM-4500-NH3B,C					
W9892	W9892-013	Ammonia, as N	95	(%) Recov		MW.1998.342 - 15	03/20/98
		SW846-6010 ICP					
M98228	M98228-006	Arsenic	108	(%) Recov		MW.1998.396 - 66	03/29/98
	M98228-006	Barium	100	(%) Recov		MW.1998.396 - 66	
	M98228-006	Cadmium	105	(%) Recov		MW.1998.396 - 66	
	M98228-006	Chromium	102	(%) Recov		MW.1998.396 - 66	
	M98228-006	Lead	104	(%) Recov		MW.1998.396 - 66	
	M98228-006	Selenium	108	(%) Recov		MW.1998.396 - 66	
	M98228-006	Silver	100	(%) Recov		MW.1998.396 - 66	
		SW846-7470 / EPA-245.1					
M98221	M98221-011	Mercury	18	(%) Recov		MW.1998.367 - 20	03/26/98
		SW846-8240 Volatiles					
X98139	X98139-006	1,1 Dichloroethene	104	% Recovery		XG.1998.227 - 6	03/16/98
	X98139-006	Benzene	97	% Recovery		XG.1998.227 - 6	
	X98139-006	Chlorobenzene	96	% Recovery		XG.1998.227 - 6	

* explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

X98139	X98139-006	Toluene	93	% Recovery		XG.1998.227 - 6	03/16/98
	X98139-006	Trichloroethene	98	% Recovery		XG.1998.227 - 6	

QC Type **MSD: Matrix Spike Duplicate Precision** QC Matrix **WATER**

QC Group	Run ID		Result	Units	*	Run Group - #	Run Date
		EPA-300.0 anions					
W98105	W98105-015	Chloride	1	RPD		MW.1998.399 - 19	03/31/98
W9895	W9895-006	Fluoride	4	RPD		MW.1998.395 - 8	03/24/98
	W9895-006	Nitrate, as N	< 1	RPD		MW.1998.395 - 8	
		EPA-410.1					
COD98006	COD98006(5)	Chemical Oxygen Demand	2	RPD		MT.1998.636 - 5	03/18/98
		SM-4500-N & NH3B,C					
W9891	W9891-010	Kjeldahl Nitrogen, Total	1	(%) RPD		MW.1998.341 - 11	03/20/98
		SM-4500-NH3B,C					
W9892	W9892-013	Ammonia, as N	4	(%) RPD		MW.1998.342 - 15	03/20/98
		SW846-6010 ICP					
M98228	M98228-006	Arsenic	< 1	(%) RPD		MW.1998.396 - 66	03/29/98
	M98228-006	Barium	< 1	(%) RPD		MW.1998.396 - 66	
	M98228-006	Cadmium	1	(%) RPD		MW.1998.396 - 66	
	M98228-006	Chromium	< 1	(%) RPD		MW.1998.396 - 66	
	M98228-006	Lead	< 1	(%) RPD		MW.1998.396 - 66	
	M98228-006	Selenium	3	(%) RPD		MW.1998.396 - 66	
	M98228-006	Silver	< 1	(%) RPD		MW.1998.396 - 66	
		SW846-7470 / EPA-245.1					
M98221	M98221-011	Mercury	129	(%) RPD		MW.1998.367 - 20	03/26/98
		SW846-8240 Volatiles					
X98139	X98139-006	1,1 Dichloroethene	2	RPD		XG.1998.227 - 6	03/16/98
	X98139-006	Benzene	< 1	RPD		XG.1998.227 - 6	
	X98139-006	Chlorobenzene	< 1	RPD		XG.1998.227 - 6	
	X98139-006	Toluene	2	RPD		XG.1998.227 - 6	
	X98139-006	Trichloroethene	< 1	RPD		XG.1998.227 - 6	

Assaigai Analytical Laboratories, Inc.

Surrogate Summary: Fraction

Client: **LOS ALAMOS NATIONAL LABS**

Project: **9803111** **8M70 XF70 30HE 0000 Z#111503**

* explanation of codes	
D	*Not applicable due to sample dilution*

Client Sample ID **98DS270** Sample Matrix **LIQUID**

Fraction	QC Group	Run ID	Surrogate	% Recovery	*	Run Group - #	Run Date
			SW846-8240 Volatiles				
9803111-01A	X98139	X98139-007	1,2 Dichloroethane-D4	102		XG.1998.227 - 7	03/16/98
		X98139-007	Bromofluorobenzene	91		XG.1998.227 - 7	
		X98139-007	Toluene-D8	100		XG.1998.227 - 7	

Client Sample ID **98DS271** Sample Matrix **LIQUID**

Fraction	QC Group	Run ID	Surrogate	% Recovery	*	Run Group - #	Run Date
			SW846-8270 Semi-Volatiles				
9803111-02A	X98147	X98147-007	2,4,6-Tribromophenol	105		XG.1998.299 - 7	04/01/98
		X98147-007	2,4,6-Tribromophenol	94		XG.1998.299 - 15	04/02/98
		X98147-007	2-Fluorobiphenyl	92		XG.1998.299 - 7	04/01/98
		X98147-007	2-Fluorobiphenyl	85		XG.1998.299 - 15	04/02/98
		X98147-007	2-Fluorophenol	58		XG.1998.299 - 7	04/01/98
		X98147-007	2-Fluorophenol	54		XG.1998.299 - 15	04/02/98
		X98147-007	Nitrobenzene-D5	93		XG.1998.299 - 7	04/01/98
		X98147-007	Nitrobenzene-D5	86		XG.1998.299 - 15	04/02/98
		X98147-007	Phenol-D6	43		XG.1998.299 - 7	04/01/98
		X98147-007	Phenol-D6	40		XG.1998.299 - 15	04/02/98
		X98147-007	Terphenyl-D14	87		XG.1998.299 - 7	04/01/98
		X98147-007	Terphenyl-D14	78		XG.1998.299 - 15	04/02/98

Assaigai Analytical Laboratories, Inc.

Surrogate Summary: QC

Client: **LOS ALAMOS NATIONAL LABS**

Project: **9803111** **8M70 XF70 30HE 0000 Z#111503**

* explanation of codes	
D	*Not applicable due to sample dilution*

LCS: Lab Control Spike

QC Matrix **WATER**

QC Group	Run ID	Surrogate	% Recovery	*	Run Group - #	Run Date
		SW846-8240 Volatiles				
X98139	X98139-001	1,2 Dichloroethane-D4	101		XG.1998.227 - 1	03/16/98
	X98139-001	Bromofluorobenzene	93		XG.1998.227 - 1	
	X98139-001	Toluene-D8	99		XG.1998.227 - 1	
		SW846-8270 Semi-Volatiles				
X98147	X98147-002	2,4,6-Tribromophenol	96		XG.1998.299 - 1	04/01/98
	X98147-002	2-Fluorobiphenyl	87		XG.1998.299 - 1	
	X98147-002	2-Fluorophenol	55		XG.1998.299 - 1	
	X98147-002	Nitrobenzene-D5	90		XG.1998.299 - 1	
	X98147-002	Phenol-D6	38		XG.1998.299 - 1	
	X98147-002	Terphenyl-D14	87		XG.1998.299 - 1	

LCSD: Lab Control Spike Duplicate Precision

QC Type

QC Matrix **WATER**

QC Group	Run ID	Surrogate	% Recovery	*	Run Group - #	Run Date
		SW846-8240 Volatiles				
X98139	X98139-002	1,2 Dichloroethane-D4	100		XG.1998.227 - 2	03/16/98
	X98139-002	Bromofluorobenzene	91		XG.1998.227 - 2	
	X98139-002	Toluene-D8	99		XG.1998.227 - 2	
		SW846-8270 Semi-Volatiles				
X98147	X98147-003	2,4,6-Tribromophenol	98		XG.1998.299 - 2	04/01/98
	X98147-003	2-Fluorobiphenyl	90		XG.1998.299 - 2	
	X98147-003	2-Fluorophenol	56		XG.1998.299 - 2	
	X98147-003	Nitrobenzene-D5	94		XG.1998.299 - 2	
	X98147-003	Phenol-D6	40		XG.1998.299 - 2	
	X98147-003	Terphenyl-D14	90		XG.1998.299 - 2	

MB: Method Blank

QC Matrix **WATER**

QC Group	Run ID	Surrogate	% Recovery	*	Run Group - #	Run Date
		SW846-8240 Volatiles				
X98139	X98139-003	1,2 Dichloroethane-D4	101		XG.1998.227 - 3	03/16/98
	X98139-003	Bromofluorobenzene	89		XG.1998.227 - 3	
	X98139-003	Toluene-D8	100		XG.1998.227 - 3	
		SW846-8270 Semi-Volatiles				
X98147	X98147-001	2,4,6-Tribromophenol	102		XG.1998.299 - 3	04/01/98
	X98147-001	2-Fluorobiphenyl	93		XG.1998.299 - 3	

Surrogate Summary: QC

Client: **LOS ALAMOS NATIONAL LABS**

Project: **9803111** **8M70 XF70 30HE 0000 Z#111503**

* explanation of codes	
D	*Not applicable due to sample dilution*

X98147	X98147-001	2-Fluorophenol	59		XG.1998.299 - 3	04/01/98
	X98147-001	Nitrobenzene-D5	98		XG.1998.299 - 3	
	X98147-001	Phenol-D6	42		XG.1998.299 - 3	
	X98147-001	Terphenyl-D14	91		XG.1998.299 - 3	

QC Type: MS: Matrix Spike — QC Matrix: WATER

QC Group	Run ID	Surrogate	% Recovery	*	Run Group - #	Run Date
		SW846-8240 Volatiles				
98139	X98139-005	1,2 Dichloroethane-D4	99		XG.1998.227 - 5	03/16/98
	X98139-005	Bromofluorobenzene	94		XG.1998.227 - 5	
	X98139-005	Toluene-D8	99		XG.1998.227 - 5	
		SW846-8270 Semi-Volatiles				
98147	X98147-010	2,4,6-Tribromophenol	113		XG.1998.299 - 10	04/01/98
	X98147-010	2-Fluorobiphenyl	104		XG.1998.299 - 10	
	X98147-010	2-Fluorophenol	64		XG.1998.299 - 10	
	X98147-010	Nitrobenzene-D5	110		XG.1998.299 - 10	
	X98147-010	Phenol-D6	47		XG.1998.299 - 10	
	X98147-010	Terphenyl-D14	103		XG.1998.299 - 10	

QC: MSD: Matrix Spike Duplicate Precision — QC Matrix: WATER

QC Group	Run ID	Surrogate	% Recovery	*	Run Group - #	Run Date
		SW846-8240 Volatiles				
X98139	X98139-006	1,2 Dichloroethane-D4	100		XG.1998.227 - 6	03/16/98
	X98139-006	Bromofluorobenzene	93		XG.1998.227 - 6	
	X98139-006	Toluene-D8	99		XG.1998.227 - 6	

JENV Environmental Laboratory
667-0105

Route To: Dusty Stephens

Mail Stop: K498

SWSC WAC REPORT FORM

SAMPLE INFORMATION

MICROTOX ANALYSIS #	COLLECTION DATE TIME ANALYST	LOCATION TA-BLD-RM	DESCRIPTION/COMMENTS	FLOW (GAL/DAY) ≤100	> 100
SC313WAC(5-6)	3/11/98 — DS	TA-11	98DS262		
SC313WAC (7-8)	— — DS	—(K-43)	98DS269		
SC313WAC (9-12)	— — DS	— (16-385)	98DS276		
SC313WAC (13-14)	— — DS	— (16-175)	~~98283~~ 98DS283		

ANALYTICAL RESULTS

MICROTOX ANALYSIS #	pH (SU)	COD (mg/L)	MTX[1] SCREEN (%)	MTX[2] EC50 (%)	TSS (mg/L)	COMMENTS
SC313WAC (5-6)	7.9	239	36%		34.4	TDS= 370 (98DS262)
SC313WAC (7-8)	6.9	>1500	94%		4278	TDS= 550 (98DS269) - Fails SWSC WAC toxicity and COD limits
SC313WAC (9-10)	8.2	63	31%		35.0	TDS= 136 (98DS276)
SC313WAC (13-14)	7.5	42	35%		14.0	TDS= 76 (98DS283)
SC313WAC (11-12)	7.4(adj)	—	34%		—	(98DS283 - pH adjusted to 7.4)
SC313WC2 (1-2)	—	—	6.4%			(98DS269 - tested supernatant after centrifuging) Fails SWSC WAC Toxicity

[1] The Microtox Screen test is the preliminary toxicity test. Samples with a Screen result of less than 55% (for ≤100 gal/day) or less than 50% (for >100 gal/day) are not toxic and the EC_{50} test is not required.
[2] The Microtox EC_{50} test is the confirming toxicity test. The toxicity of samples with a Screen result of greater than 50% is confirmed by the EC_{50} test. A sample with an EC_{50} less than 20% (for ≤100 gal/day) or less than 25% (for >100 gal/day) exceeds the SWSC WAC toxicity limit.

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LA-UR-99-4010
August 1999

Closure Plan for the TA-16-387 Flash Pad

Environmental Restoration Project
A Department of Energy Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY
Los Alamos, NM 87545

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1.0 INTRODUCTION

1.1 Purpose and Scope

This closure plan describes the activities necessary to close the TA-16-387 flash pad, hereinafter referred to as the flash pad, an interim status Resource Conservation and Recovery Act (RCRA) hazardous waste treatment unit located at the Los Alamos National Laboratory (LANL or the Laboratory). Submission of this closure plan serves as notification to the New Mexico Environment Department (NMED) of LANL's intent to close the flash pad.

The activities described in this closure plan are intended to meet the closure requirements of the *New Mexico Administrative Code*, Title 20, Chapter 4, Part 1 (20NMAC4.1), Subpart VI, (40 CFR, Part 265, Subparts G and P), revised January 1, 1997 [1-1-97]. The procedures described and the information provided herein supplement the general closure procedures described in Section 9.0, "Closure Plan," of the *RCRA Part B Permit Application for Technical Area 16, Building 88, Container Storage Area; Flash Pad 387, Open Burn Unit; Burn Pads 388 and 399; Open Burn Units; Burn Tray 394, Open Burn Unit; Pressure Vessels 401 and 406, Open Burn Units* (LANL 1995b, 63560), hereinafter referred to as the *TA-16 Part B Permit Application*. Closure of this unit will minimize the need for further maintenance, preclude the release of hazardous waste or constituents to environmental media, and protect human health and the environment.

1.2 Unit Description

The flash pad is an open burn structure located at Technical Area 16 (TA-16), within an area referred to as the Burning Ground. Figure 1.0-1 shows the location of TA-16 at LANL; Figure 1.0-2 shows the location of the Burning Ground at TA-16. The pad is a concrete structure consisting of a base pad (30 ft by 30 ft) and shield reflector walls around the western, northern, and eastern sides. The structure is situated within a 100-ft-by-100-ft area enclosed by a cyclone fence (8 ft high). Attachment A contains a recent photograph of the flash pad.

The flash pad is included in the *Los Alamos National Laboratory General Part A Permit Application* (LANL 1998, 63498) and has operated pursuant to 20 NMAC 4.1, Subpart VI. The flash pad was used to treat high explosive (HE) waste and is currently used to treat potentially HE-contaminated waste. Treatment of HE-contaminated wastes involves burning combustible wastes and "flashing" noncombustible wastes to remove the hazardous characteristic of reactivity and to ensure that there are no remaining safety hazards associated with the waste prior to disposal. Additional information regarding operation of the flash pad, including operations and waste management practices, can be found in the *TA-16 Part B Permit Application* (LANL 1995b, 63560). The flash pad is also identified as Potential Release Site (PRS) 16-010(b) and is listed on Table A of the Hazardous and Solid Waste Amendments (HSWA) Module of LANL's Hazardous Waste Facility Permit.

There are additional sites undergoing closure or remediation within the immediate vicinity of the flash pad. These sites are: Material Disposal Area P (MDA P), which is also identified as PRS 16-018, and PRSs 16-016(c), 16-010(a), and 16-006(e), which are collectively known as consolidated PRS 16-016(c)-99. MDA P (PRS 16-018) and PRSs 16-016(c), 16-010(a), and 16-006(e) are also listed on Table A of the HSWA Module of LANL's Hazardous Waste Facility Permit.

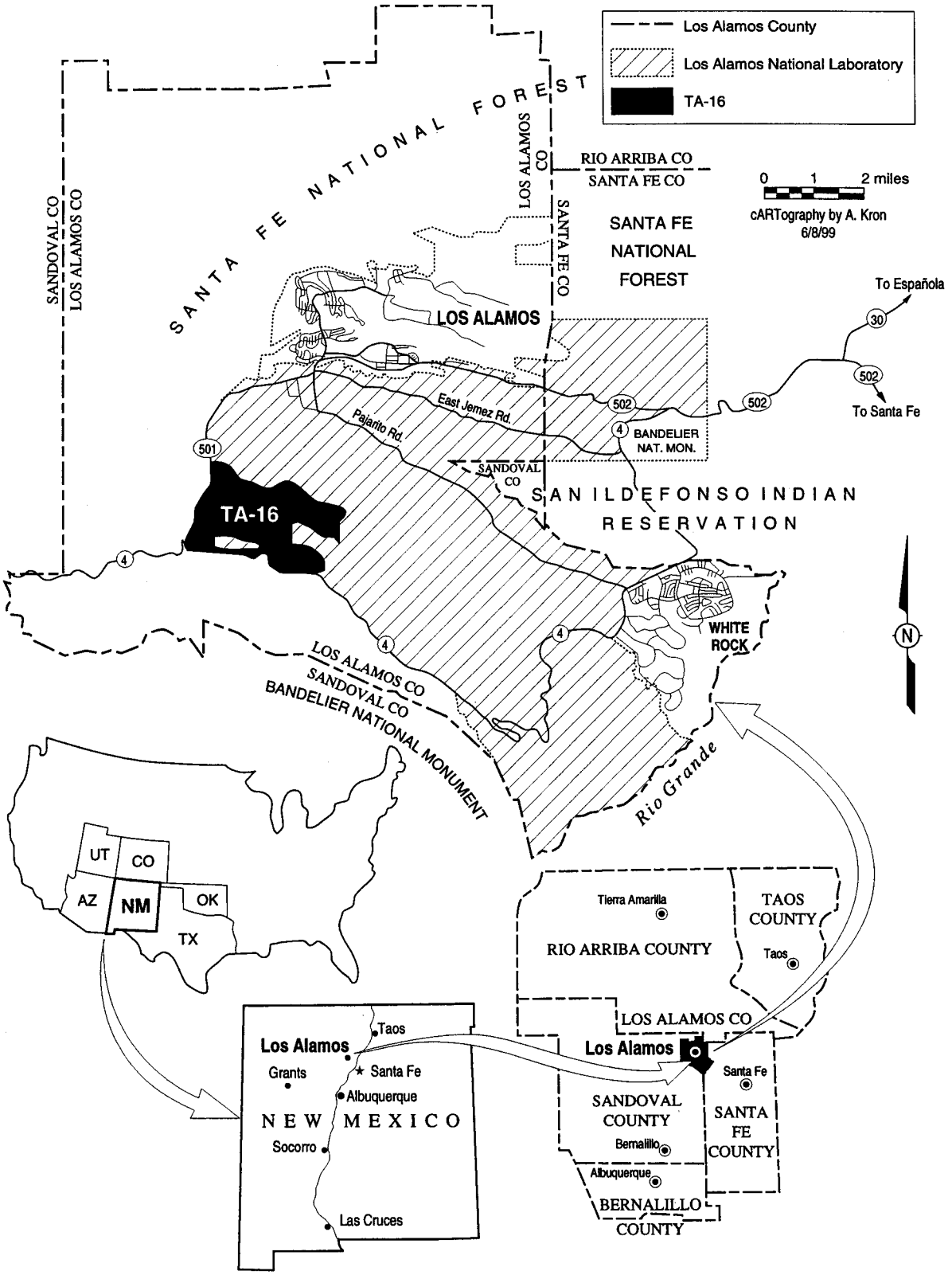


Figure 1.0-1. Location of TA-16 within Los Alamos National Laboratory, Los Alamos County, NM.

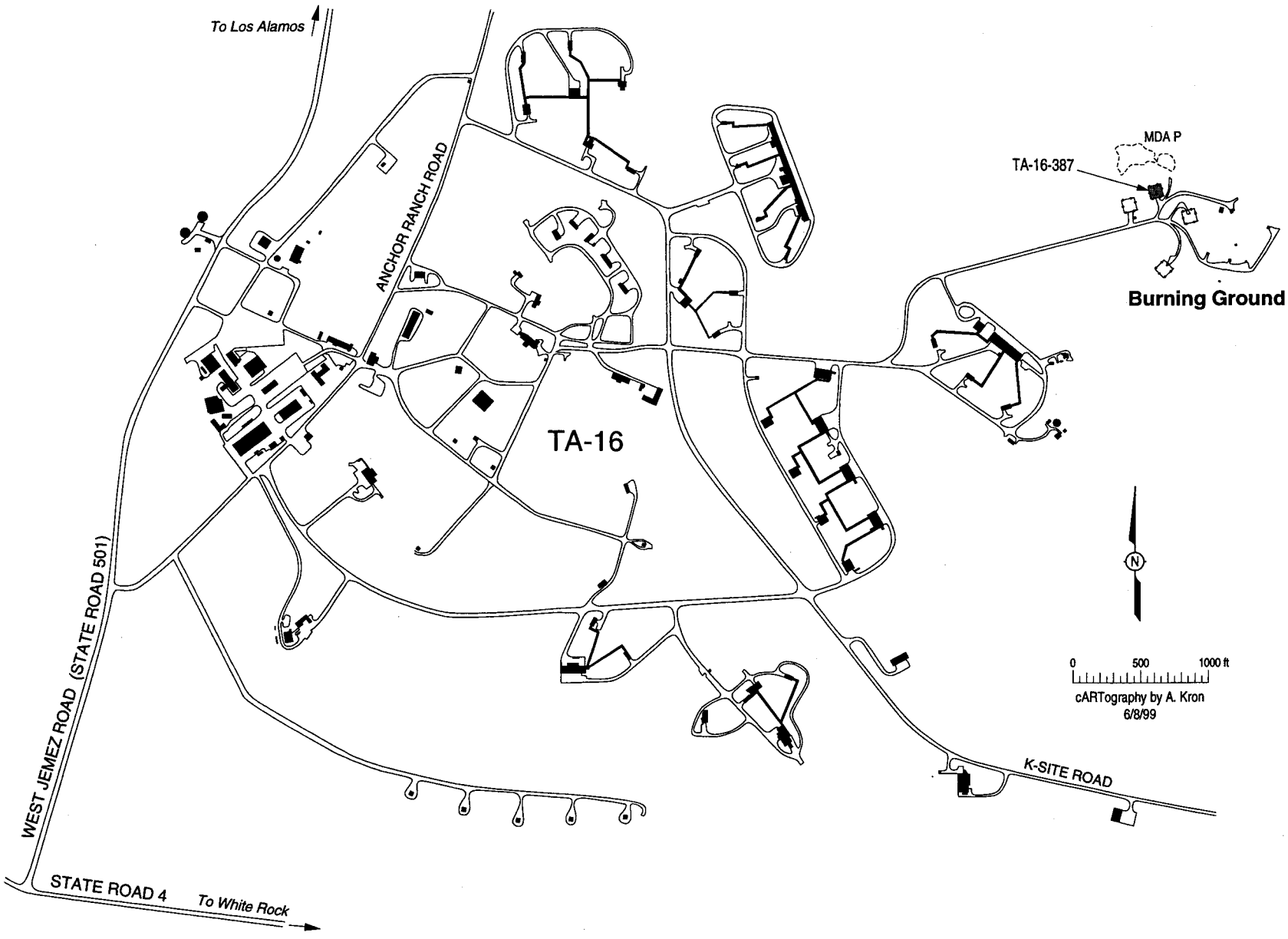


Figure 1.0-2. Site map of TA-16 showing the location of Burning Ground.

Figure 1.0-3 shows the location of the flash pad with respect to MDA P and PRSs 16-016(c), 16-010(a), and 16-006(e). MDA P is an interim status hazardous waste disposal unit currently undergoing closure; the closure plan for MDA P (LANL 1995, 58713.1), approved by NMED on February 20, 1997, provides details regarding site history, disposal activities, waste types, and all activities and information required for closure. Consolidated PRS 16-016(c)-99 is a corrective action unit proposed for voluntary corrective action (VCA). Information regarding this site and proposed cleanup activities are outlined in the VCA Plan for PRS 16-016(c)-99, which is included as Attachment 3 of the sampling and analysis plan for MDA P (LANL 1999, 63546).

1.3 Rationale for Closure and Remediation Activities

Based on discussions with the New Mexico Environment Department Hazardous and Radioactive Materials Bureau (NMED-HRMB), the LANL Environmental Restoration (ER) Project will employ a combined approach that will address closure activities at the flash pad and MDA P concurrently with remediation activities at consolidated PRS 16-016(c)-99. This decision was based on the following considerations:

- Results from sampling events conducted during RCRA facility investigations, baseline studies to support the TA-16 Part Be Permit Application, and ongoing closure operations at MDA P indicate that similar contaminants are present at each of the individual sites as well as within the area encompassing all of these sites (see Attachment 1 of the sampling and analysis plan for MDA P);
- The desire to utilize mobilized equipment and structures associated with ongoing closure operations at MDA P; and
- The appropriateness of conducting exposure assessments for human health and ecological effects (following removal activities) for the area encompassing all of the sites.

The closure activities for the flash pad will be coordinated with, and reflect, those for MDA P currently being implemented. The MDA P closure activities are presented in detail in the approved closure plan for MDA P (LANL 1995, 58713.1).

The MDA P closure approach has two phases. Phase I is ongoing and involves excavation to remove waste and waste residues. Phase II involves confirmation sampling and analysis to verify that the closure performance standards have been met. The sampling and analysis plan for MDA P (LANL 1999, 63546) details the sampling and analysis activities proposed to determine whether 1) any residual contamination associated with MDA P, the flash pad, and consolidated PRS 16-016(c)-99, remains in the environment following removal activities, and 2) whether any such residual contamination poses an unacceptable risk to human health and the environment. Phase I and Phase II activities specific to the flash pad are presented in Section 2.0 of this report, and general closure information is provided in Section 3.0 of this report.

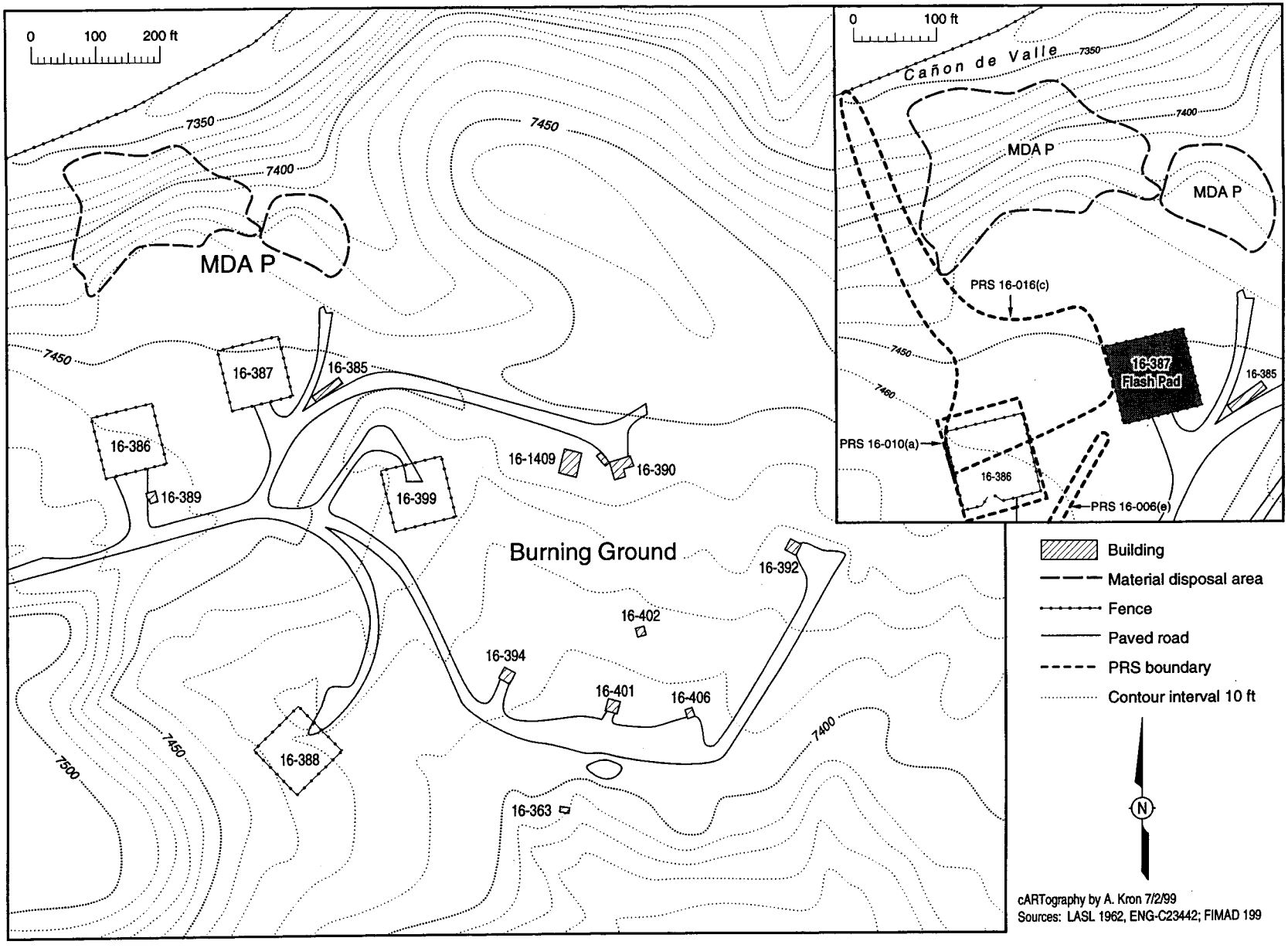


Figure 1.0-3. **Map of the Burning Ground with inset showing the location of the TA-16-387 Flash Pad with respect to MDA-P and PRSs 16-016(c), 16-010(a) and 16-006(a).**

2.0 CLOSURE OF THE TA-16-387 FLASH PAD [20NMAC4.1, Subpart 4.1, §265.112(b)]

2.1 Description of Waste and Estimate of Maximum Inventory of Hazardous Waste

At LANL, HE wastes and HE-contaminated wastes are generated primarily from research and development (R&D) and decontamination and decommissioning (D&D) activities. These waste streams include homogeneous and heterogeneous wastes and are described in detail in the "Waste Analysis Plan for Thermal Treatment by Open Burning at Technical Area 16", Section 3b.0, of the *TA-16 Part B Permit Application* (LANL 1995b, 63560). The waste streams treated at the flash pad include the following:

- solid and scrap HE,
- HE-contaminated D&D soil and/or debris,
- HE-contaminated equipment, and
- HE-contaminated waste rags, wipes, and other combustibles.

The *TA-16 Part B Permit Application* (LANL 1995, 63560) also references 40,000 pounds (lb) as the estimated maximum weight of equipment and structures that may be flashed at one time. According to facility records, the maximum weight of equipment and structures treated at one time was 38,000 lb. Notably, most burns were considerably less. The total annual quantities of waste treated at the flash pad in 1997 and 1998 were 63,000 lb and 31,000 lb, respectively.

2.2 Closure Procedures

2.2.1 Phase I Activities

Phase I activities involve removal of the flash pad and underlying material as well as waste management activities to ensure proper handling, characterization and disposal. Phase I activities will utilize the equipment and structures already onsite as part of MDA P closure operations. Decontamination of equipment and structures will occur as part of closure activities for MDA P. Onsite equipment includes excavation and transportation equipment, pressure washing equipment, tanks to store collected storm water and decontaminated water), and sampling equipment. Existing structures that will be utilized include the decontamination pad, debris staging and segregation areas, and the soil staging area. The storm water control trenches will continue to divert storm water around the area of closure operations. However, an additional run-on control trench (or other appropriate best management practice [BMP] to control storm water) may be required upgradient (south) of the flash pad to divert and/or manage run-on during closure activities. A map showing the closure project area is included as Attachment B. The following Phase I activities are specific to the flash pad.

(a) Removal, Decontamination, and Disposal of the Flash Pad

Prior to demolition, the flash pad will be field-screened using a Ludlum 139 (or equivalent) to detect alpha radiation and an ESP-1 (or equivalent) to detect beta/gamma radiation. The results of this radiological field-screening will be used for two purposes: 1) to initially determine whether the flash pad (or portions of the flash pad) is radiologically contaminated and requires segregation during demolition activities, and 2) to determine whether any potential radiological health and safety concerns exist at the site. After all

potential safety concerns have been addressed, the flash pad will be demolished into manageable pieces of concrete debris and, if necessary, segregated into two waste streams based on the radiological field-screening results (i.e., nonradiologically-contaminated debris and radiologically-contaminated debris). Nonradiologially-contamnated debris will then be transported to the decontamination pad where it will be pressure washed for decontamination purposes. After decontamination, the concrete debris will screened using HE test kits to confirm the absence of HE. Radiological release surveys will then be conducted on the debris to determine appropriate disposition (recycling or disposal at an appropriate RCRA Subtitle D landfill facility). Concrete debris considered radiologically contaminated based on the radiological field-screening results will be disposed at TA-54 (once all waste acceptance criteria requirements for low-level waste are addressed).

Decontamination water generated from pressure washing concrete debris will be sampled for waste characterization purposes to determine disposition. One composite sample per container will be collected in accordance with ER-SOP-6.15, Rev. 0, "Coliwasa Sampler for Liquids and Slurries" and submitted for fixed laboratory analyses of the following:

- target analyte list (TAL) metals using Environmental Protection Agency (EPA) Solid Waste (SW)-846 Methods 6010 and 7470,
- volatile organic compounds (VOCs) using EPA SW-846 Method 8260,
- semivolatile organic compounds (SVOCs) using EPA SW-846 Method 8270,
- HE using EPA SW-846 Method 8330, and
- isotopic uranium using alpha spectroscopy.

Depending on analytical results and subsequent characterization, decontamination water may be re-applied at the site as dust suppression measures, transported to the TA-16 high explosives wastewater treatment facility (HEWTF), or transported to the TA-50 waste water treatment facility (WWTF). Additional analysis for pH, chemical oxygen demand (COD), total suspended solids (TSS) will be required to address waste acceptance criteria requirements at the TA-16 HEWTF or the TA-50 WWTF.

(b) Removal and Disposal of Underlying Material

Prior to excavating material underlying the (removed) flash pad, a radiological field survey of the newly exposed area will be conducted using a Ludlum 139 (or equivalent) to detect alpha radiation and an ESP-1 (or equivalent) to detect beta/gamma radiation. The results of this radiological field-screening will be used for two purposes: 1) to initially determine whether the material underlying the (removed) flash pad is radiologically contaminated, and 2) to determine whether any potential radiological health and safety concerns exist at the site. Subsequent to the radiological survey, five grab surface samples will be collected in accordance with ER-SOP-6.09, Rev.0, "Spade and Scoop Method for Collection of Soil Samples" or ER-SOP-6.10, Rev. 0, "Hand auger and Thin-Wall Tube Sampler," (as appropriate). Samples will be field-screened for the presence of radioactive contamination and field-analyzed for HE and metals. A Ludlum 139 and an ESP-1 (or equivalents) will be used to detect alpha radiation and beta/gamma radiation, respectively. Samples will be field-analyzed for HE using EPA SW-846 Methods 8515 (nitroaromatics) and 8510 (nitroamines) and for metals using X-ray Fluorescence (XRF). Field-screening and field analytical results will be used to determine the types and levels of expected contaminants

present in the material prior to excavation. After reviewing the field screening and analytical results, the material underlying the (removed) flash pad will be excavated. During excavation, field-screening and field analytical activities will continue on excavated material to assist with possible segregation of waste streams. Excavated material will be transported to the soil staging area and staged in (maximum) 100 cubic yard (cy) lots. Each waste stream (if segregation was necessary and/or possible) will then be sampled for waste characterization purposes to determine final disposition. One composite sample per lot will be collected in accordance with ER-SOP-6.09, "Spade and Scoop Method for Collection of Soil Samples." Samples will be submitted for fixed laboratory analysis of VOCs, SVOCs, HE, and isotopic uranium using the analytical methods described above for decontamination water. Additionally, in order to meet waste acceptance criteria requirements of potential treatment, storage, and disposal (TSD) facilities, samples will also be submitted for fixed laboratory analyses of the following:

- Toxicity Characteristic Leaching Procedure (TCLP) metals using EPA SW-846 Method1311,
- Reactive cyanide using EPA SW-846 Method 9010A,
- Reactive sulfide using EPA SW-846 Method 9030A,
- Gamma-emitting isotopes using gamma spectroscopy,
- Organo-chlorine pesticides and polychlorinated biphenlys (PCBs) using EPA SW-846 Method 8080A,
- Chlorinated herbicides using EPA SW-846 Method 8150A,
- Dioxins using EPA SW-846 Method 8280, and
- pH using EPA SW-846 Method 9045.

Depending on analytical results and subsequent characterization, generated waste may include mixed waste, low-level waste, hazardous waste, and/or solid waste. Mixed waste will be: 1) disposed at an audited and approved treatment, storage and disposal (TSD) for mixed waste, or 2) treated at an audited and approved TSD to remove the hazardous component and disposed at an audited and approved low-level waste facility. Low-level waste will be disposed at TA-54, hazardous waste will be stored or disposed at an audited and approved TSD facility for hazardous waste, and solid waste will be disposed at an audited and approved RCRA Subtitle D landfill facility.

Field-screening and field analytical results will be used to determine whether excavation activities should continue vertically and/or laterally at the flash pad area. Samples will be collected intermittently during removal activities from the excavated area; when and where samples are collected will be determined based on visual evidence and best professional judgment. Samples will be field-screened for the presence of radioactive contamination and field-analyzed for HE and metals, as described in Section 2.1.1(b). Field analytical results will be compared to the Region VI preliminary remediation goals (PRGs) presented and discussed in "Data Quality Objectives," Section 3.1 of the sampling and analysis plan for MDA P (LANL 1999, XXXX). The primary PRGs are: 530 mg/kg for 2,4,6-Trinitrotoluene (2,4,6-TNT), 270 mg/kg for Hexahydro-1,3,5—trinitro-1,3,5-triazine (RDX), 2,000 mg/kg for barium, and 2,000 mg/kg for lead. Excavation activities will continue until field-analytical results from intermittent sampling are below the applicable PRGs.

2.2.2 Phase II Activities

Phase II activities involve confirmation sampling, analysis, and assessment to verify that closure performance standards have been achieved. The performance standards for MDA P are also the proposed closure performance standards for the flash pad. The closure performance standards described in the approved closure plan for MDA P (LANL 1995, 58713.1) allow for using risk assessment as a tool to determine if residual levels of environmental contamination are acceptable. Additionally, risk-based decisions are also compatible with current corrective action guidance governing those PRSs on the HSWA Module of LANL's Hazardous Waste Facility Permit, which includes PRSs 16-018 (MDA P) and 16-010(b) (flash pad), and PRSs 16-016(c), 16-010(a), and 16-006(e).

The sampling and analysis plan for MDA P details the activities needed to determine if any residual contamination associated with MDA P and closure operations areas, the flash pad, or consolidated PRS 16-016(c)-99 remains in the environment. It also outlines the assessment activities to evaluate whether residual contamination poses potentially unacceptable human health or ecological risks.

The sampling and analysis plan for MDA P describes the rationale and technical approach for collecting, analyzing, and evaluating the residual contaminant concentrations following removal activities, per the requirements of 20NMAC4.1 §265.112(b)(4). Sampling activities and assessment activities are summarized below:

(a) Confirmation Sampling Activities

The confirmatory sampling activities specific to the flash pad are described within Section 2.2.3 of the sampling and analysis plan for MDA P (LANL 1999, 63546). These activities include the collection of samples from 12 locations at the center of grid cells which are formed by the extension of the 10-m by 10-m sampling grid for MDA P (see Figure 2.1 of the sampling and analysis plan). One grab sample (soil) will be collected at a depth of 0 to 12 in. at each location. One auger sample (tuff) will be collected at a depth of 24 to 36 in. at three of the 12 locations. All samples will be submitted for analysis of HE and inorganic chemicals; three of the 0- to 12-in. samples and two of the 24- to 36-in. samples will also be submitted for analysis of SVOCs. Isotopic uranium Procedures and methods for sample collection, analysis, and documentation are described throughout Sections 3.2 and 3.3 of the sampling and analysis plan for MDA P (LANL 1999, 63546).

(b) Assessment Approach

The data assessment will be applied to the dataset resulting from confirmation sampling from MDA P, the flash pad, and PRS 16-016(c)-99. Sample locations are shown on Figure 2.1 of the sampling and analysis plan for MDA P. The assessment approach includes:

- comparing contaminant concentration data to background values (BVs),
- determining if nature and extent of contamination have been established,
- calculating spatially averaged contaminant concentrations,
- comparing spatially averaged contaminant concentrations to EPA Region VI preliminary remediation goals (PRGs), which are based on human health effects and industrial land use scenarios,

- comparing spatially averaged contaminant concentrations to appropriate ecological screening levels (currently under development), and
- conducting risk assessments to evaluate human health and/or ecological risk, if necessary.

The results of the assessment will confirm that either the closure performance standards have been met or additional removal activities are required. Additional removal of soil/tuff will require additional confirmation sampling, with subsequent assessment activities. Once nature and extent of residual contamination is satisfactorily determined and shown to pose no unacceptable human health or ecological risks, these conditions will be documented in the final closure report (see Section 3.8).

2.2.3 Schedule

Closure activities will begin according to the requirements of 20 NMAC 4.1, Subpart VI, §265.112(d)(2) [1-1-97]. The estimated schedule for completing closure activities at the flash pad is presented in Attachment C and reflects coordination with Phase I and Phase II activities for MDA P closure activities.

3.0 GENERAL CLOSURE INFORMATION [20NMAC4.1, SUBPART VI, SUBPART G]

This section is prepared in accordance with the requirements of 20NMAC4.1, Subpart VI, §265 (40 CFR, Part 265, Subparts G and P, as applicable). Until closure is complete and has been certified in accordance with 20NMAC4.1, Subpart VI, §265.115 [1-1-97], a copy of the approved closure plan and any approved revisions will be on file at LANL's Hazardous and Solid Waste Group (ESH-19) and at the U.S. Department of Energy (DOE) Los Alamos Area Office (LAAO).

3.1 Closure Performance Standard [20NMAC4.1, SUBPART VI, §265.111]

The flash pad will be closed to meet the following standards:

- to minimize the need for further maintenance;
- to control, minimize, or eliminate, to the extent necessary to protect human health and the environment, the post-closure escape of hazardous waste, hazardous constituents, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or atmosphere; and
- to comply with 20NMAC4.1, Subpart VI, §265.381 [1-1-97], for thermal treatment units during the closure of the flash pad.

These standards will be met by following the closure activities (outlined in Section 2.0) of removing the concrete flash pad structure and potentially contaminated underlying material. Decontamination of the debris associated with the concrete pad will be conducted prior to disposal. Confirmation sampling will be performed to ensure that the closure performance standards have been achieved. All equipment and structures associated with closure operations will be decontaminated, reclaimed, recycled, or disposed of as part of MDA P closure activities. Closure will be considered complete when the closure performance standards have been met, closure certification has been submitted to the Secretary of the NMED, (see Section 3.6) and NMED has approved the closure.

3.2 Partial and Final Closure [20NMAC4.1, Subpart VI, §265.112(d)]

This closure plan has been written for implementation of the partial closure (referred to as *closure* within this plan) at the flash pad rather than the closure of the entire LANL facility. Closure will consist of closing the flash pad at the Burning Ground while leaving other RCRA-regulated waste-management units at the TA-16 Burning Ground and at LANL in service. Final closure will occur when LANL's remaining RCRA-regulated waste management units are closed.

3.3 Closure Schedule [20NMAC4.1, Subpart VI, §265.113]

Once approval is received from the NMED and waste removal activities for MDA P have been completed, closure activities will begin at the flash pad, in accordance with the closure plan. All hazardous wastes will be removed from the unit within 90 days of closure plan approval and closure activities and reporting requirements will then be completed within 180 days of closure plan approval, as required by 20NMAC4.1, Subpart VI, §265.113(a) and (b) [1-1-97]. Closure will be conducted in accordance with the schedule presented in Attachment C and reflects coordination with Phase I and Phase II MDA P closure activities. In the event that closure is prevented from proceeding according to schedule, LANL will notify the Secretary of the NMED in accordance with extension request requirements in 20 NMAC 4.1, Subpart VI, §265.113(b) [1-1-97]. In addition, the demonstrations in 20 NMAC 4.1, Subpart VI, §265.113(a)(1) and (b)(1) [1-1-97] will be made in accordance with 20 NMAC 4.1, Subpart VI, §265.113(c) [1-1-97].

3.4 Amendment of the Closure Plan [20NMAC4.1, Subpart VI, §265.112(c)]

In accordance with 20NMAC4.1, Subpart VI, §265.112(c) [1-1-97], LANL will submit a written request to NMED to authorize a change in the approved closure plan whenever

- there are changes in operating plans or facility design that affect the closure plan,
- there is a change in the expected year of closure, or
- unexpected events occur during closure that require modification of the approved closure plan.

LANL will submit the written request, along with a copy of the amended closure plan, to the Secretary of the NMED for approval. Submittal of the request will occur at least 60 days prior to the proposed change in unit design or operation, and no later than 60 days after an occurrence of an unexpected event that affects the closure plan. If the unexpected event occurs during the closure, the request will be submitted within 30 days of the occurrence. If the Secretary of the NMED requests a modification of the closure plan, a plan modification (in accordance with the request) will be submitted within 60 days of notification or within 30 days of the notification if a change in facility condition occurs during the closure process.

3.5 Closure Cost Estimate, Financial Assurance, and Liability Requirements [20NMAC4.1, Subpart VI, §265.140(c)]

In accordance with 20NMAC4.1, Subpart VI, 265.140(c), LANL, as a federal facility, is exempt from the requirements of 20NMAC4.1, Subpart VI, §265.140(c), Subpart H [1-1-97], to provide a cost estimate, financial assurance mechanisms, and liability insurance for closure actions.

3.6 Closure Certification [20NMAC4.1, Subpart VI, §265.115]

Within 60 days after completion of closure activities for the flash pad, LANL will submit to the Secretary of the NMED (via certified mail) a certification that the unit has been closed in accordance with the specifications of the approved closure plan. The certification will be attested to by a registered professional engineer and will be signed by the appropriate DOE and LANL officials, in accordance with 20NMAC4.1, Subpart VI, §265.115 [1-1-97]. Documentation that supports the independent registered engineer's certification will be furnished to the Secretary of the NMED along with the original certification. DOE/LAAO and ESH-19 will maintain copies of the certification and supporting documentation.

3.7 Security

Because of the ongoing nature of waste management operations at TA-16, the site will remain under the care of DOE or another authorized federal agency. Consequently, fences and site security will be maintained for as long as necessary to prohibit public access and to meet DOE requirements for protection of the public.

3.8 Closure Report

According to the 1995 update to the LANL Site Development Plan (LANL 1995, 57224.1) future land use at TA-16 is designated as HE research and development and HE testing. Upon completion of closure activities for the flash pad, a closure report will be prepared and submitted to the Secretary of the NMED. The report will document the closure and contain, for example, the following:

- The certification described in Section 3.6,
- Any variance from the approved closure activities and the reason for the variance,
- A summary of all sampling and analytical results, showing
    - sample identification,
    - sample location,
    - datum reported,
    - detection limit for each datum,
    - a measure of analytical precision (e.g., uncertainty, range, variance),
    - identification of analytical procedure, and
    - identification of analytical laboratory
- A quality assurance (QA)/quality control(QC) statement on analytical data validation and decontamination verification
- An assessment of the data following the approach outlined in Section 2.2.2 and detailed in the sampling and analysis plan for MDA P (LANL 1999, 63546); conclusions will be based on the combined assessment of the overall area.

- The storage or disposal location of the regulated hazardous/mixed waste that resulted from closure activities
- A certification of accuracy of the report

3.9 Survey Plat and Post-Closure Requirements [20NMAC4.1, Subpart VI, §265.116, §§265.117 through 265.120]

As part of closure activities at the flash pad, LANL intends to remove and dispose of the TA-16-387 concrete structure and any residual hazardous waste and waste residues. Additionally, LANL intends to decontaminate all structures and equipment used during closure activities; any contaminated structures and/or equipment remaining after decontamination will be disposed of properly. Therefore, the requirements for a survey plat, post-closure certification, and post-closure notices are not applicable for the closure of the flash pad. However, if established cleanup levels cannot be achieved, LANL will amend this closure plan to address appropriate closure procedures or post-closure care requirements pursuant to 20NMAC4.1, Subpart VI, §§265.117 through 265.120 [1-1-97].

4.0 REFERENCES

LANL, February 1995. "TA-16 Closure Plan for MDA P," Los Alamos National Laboratory, Los Alamos National Laboratory, Los Alamos, NM. (LANL 1995a, 58713.1)

LANL, May 1995. *RCRA Part B Permit Application for Technical Area 16, Building 88, Container Storage Area; Flash Pad 387, Open Burn Unit; Burn Pads 388 and 399; Open Burn Units; Burn Tray 394, Open Burn Unit; Pressure Vessels 401 and 406, Open Burn Units*, Revision 2.0, Los Alamos National Laboratory Hazardous and Solid Waste Group (ESH-19), Los Alamos, NM. (LANL 1995b, 63560)

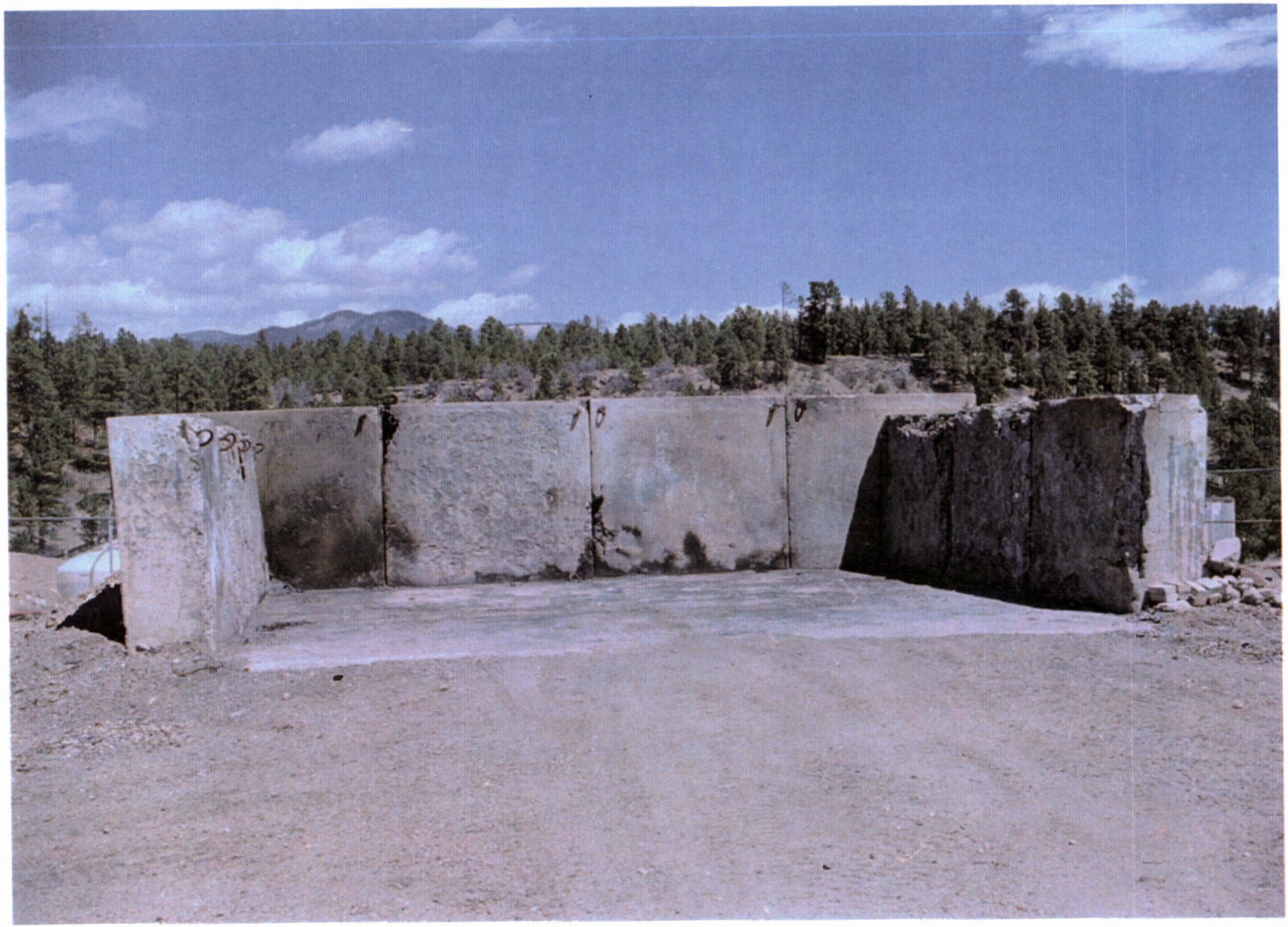
LANL, 1995. "Site Development Plan, Annual Update 1995," Los Alamos National Laboratory Publication LALP-95-113, Los Alamos, New Mexico (LANL 1995, 5224.1)

LANL, April 1998. *Los Alamos National Laboratory General Part A Permit Application*, Revision 0.0, Los Alamos National Laboratory Hazardous and Solid Waste Group (ESH-19), Los Alamos, NM. (LANL 1998, 63498)

LANL, 1999. "Sampling and Analysis Plan for Material Disposal Area (MDA) P," Los Alamos National Laboratory, Los Alamos, NM. (LANL 1999, 63546)

Attachment A

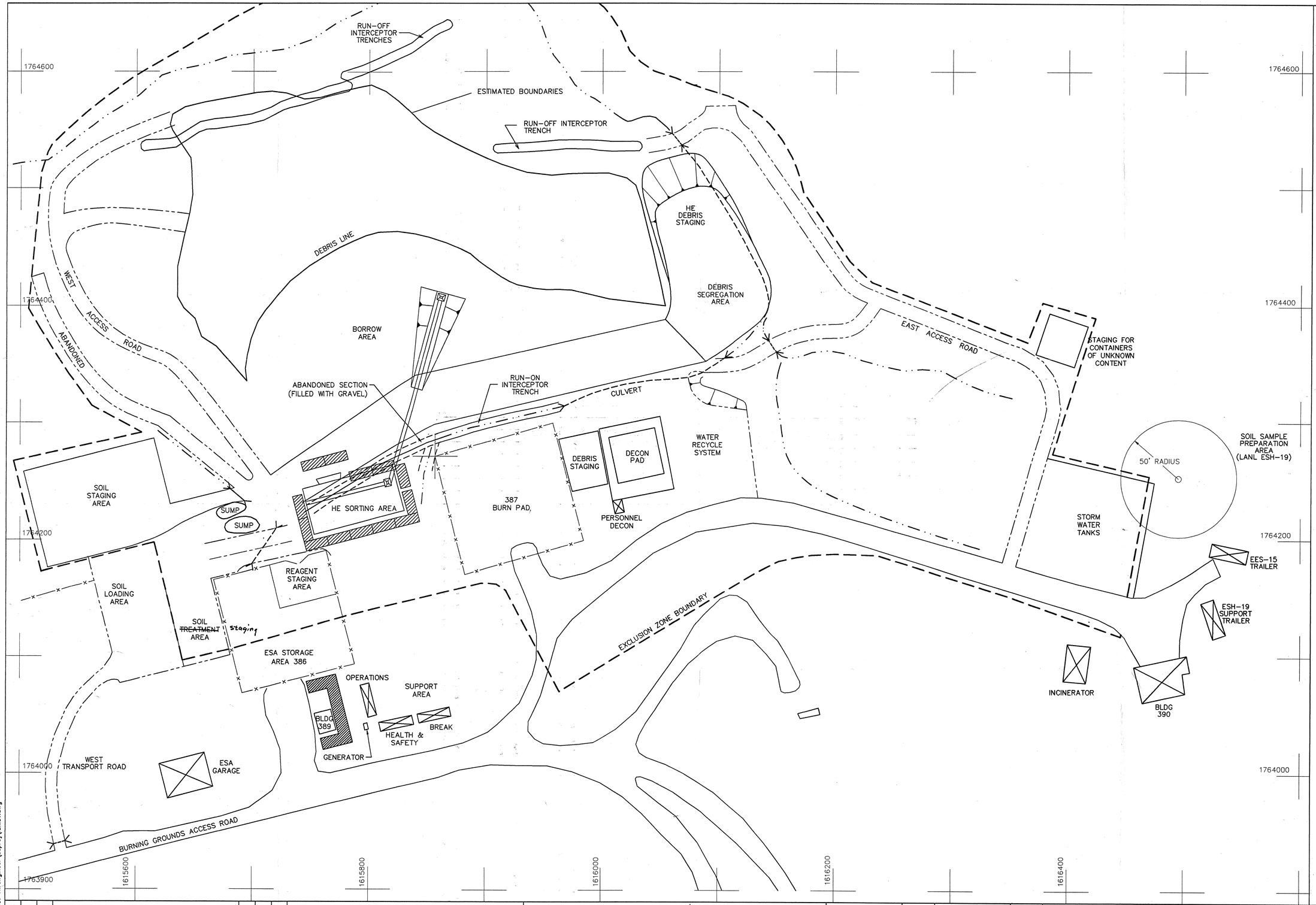
Photograph of TA-16-387



TA-16-387 Flash Pad

Attachment B

Map Showing Project Area



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NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION

EARTH & ENVIRONMENTAL SCIENCES DIVISION
LOS ALAMOS NATIONAL LABORATORY
LOS ALAMOS NEW MEXICO

WESTON MANAGERS DESIGNERS/CONSULTANTS
ALBUQUERQUE NEW MEXICO

CHECKED	DATE	CLIENT APPROVALS	DATE
DES. ENG.			
PROJ. ENG.			
PROJ. MGR.			
APPROVED			
APPROVED			

SITE LAYOUT – AS-BUILT
CLEAN CLOSURE MDA-P

DRAWN	DATE	DWG. NO.	REV. NO.
EJS	10/17/98	1	0
SCALE 1" = 40'	CONTRACT NO. 2982U0017-8M	SHT. 1 OF 3	

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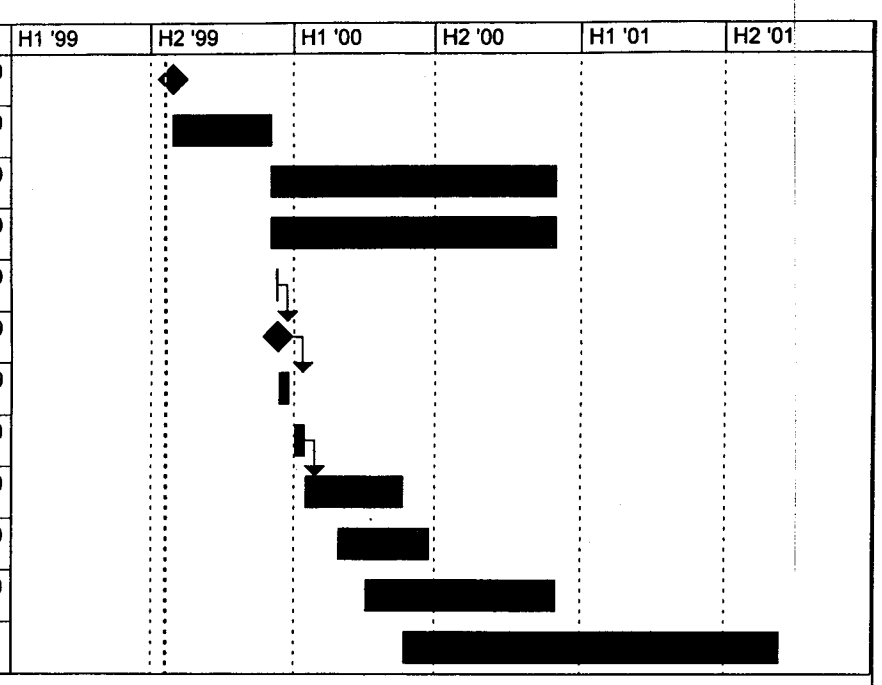
PLT. SC. 1:40

Attachment C

Estimated Schedule for Closure Activities at TA-16-387

ID		Task Name	Duration	Start	Finish
1		Submit Closure Plan	0 days	Fri 7/30/99	Fri 7/30/99
2		Closure Plan Approved	90 days	Fri 7/30/99	Thu 12/2/99
3		Permit Modifications	260 days	Fri 12/3/99	Thu 11/30/00
4		Procure Equipment & Subcontractors	260 days	Fri 12/3/99	Thu 11/30/00
5		Readiness Review	1 day	Fri 12/10/99	Fri 12/10/99
6		Begin Operations	0 days	Fri 12/10/99	Fri 12/10/99
7		Preliminary Construction	10 days	Mon 12/13/99	Fri 12/24/99
8		Excavate, Decontaminate & Sample	10 days	Mon 1/3/00	Fri 1/14/00
9		Waste Treatment/Disposal (as needed)	90 days	Mon 1/17/00	Fri 5/19/00
10		Phase 2 Sampling	85 days	Mon 2/28/00	Fri 6/23/00
11		Final Closure Report	174 days	Mon 4/3/00	Thu 11/30/00
12		Reseed/Replant Vegetation	340 days	Mon 5/22/00	Fri 9/7/01



ESTIMATED PROJECT SCHEDULE

Task		Rolled Up Task		External Tasks	
Progress		Rolled Up Milestone	◇	Project Summary	
Milestone	◆	Rolled Up Progress			
Summary		Split			