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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

Environmental
Restoration
Project

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EXECUTIVE SUMMARY

This Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) report discusses Phase I investigations, results, and recommendations for 12 potential release sites (PRSs) within Technical Area 16 (TA-16), which is located in the southwestern quadrant of Los Alamos National Laboratory (LANL). This site has been used from 1944 to the present. Past and present activities at this site have centered around the development, processing, fabrication, and testing of explosive components used in the United States' nuclear weapons program.

Of the 12 PRSs, 5 are outfalls from sumps or other drainage systems. Three PRSs are components of septic systems. The remaining PRSs include high explosives (HE) magazines and an HE burn pad.

Phase I sampling at this site was conducted primarily in 1995. Surface and/or subsurface samples were collected at each PRS. All samples were soil and/or tuff samples; no water sampling was conducted. Samples were analyzed for a combination of HE, metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total uranium, and other radionuclides. Appendix B lists the details of the data analysis, including any problems that arose during analysis. Many of the metals analyses were qualified, therefore requiring manual examination, due to poor duplicate recovery during analysis. In general, this problem did not affect the decisions made at these sites. Some data missed holding times by a few days and are qualified as estimated values; however, very few data were rejected for serious problems. Data that were rejected were not used. The overall data quality is assessed to be good.

The primary objective of Phase I investigation at these sites was to determine, using biased sampling, if a release had occurred within a PRS. At many PRSs, Phase I data also was designed to support a preliminary risk assessment and to bound the extent of contamination. Analytical results would determine if a release had caused contamination at levels above screening action levels (SALs) and/or background upper tolerance limits (UTLs). Phase I investigation results would then lead to further decisions and actions, such as a Phase II investigation to obtain more data, accelerated cleanup leading to the final remedy for the site, or a recommendation for no further action (NFA) as a final remedy for the site. If contamination did occur, another Phase I investigation objective was to identify chemicals of potential concern (COPCs).

The decisions made for each PRS are summarized below and shown in Table ES-1. This table also identifies the section of this report in which each PRS is discussed in detail. All decisions assume a continued industrial scenario for this area.

- PRSs 11-012(a,b) are two former HE magazines located near TA-16-370, a metal forming building. No contamination was present at levels above SALs. These sites are recommended for human-health NFA.
- PRSs 13-003(a), is a septic system located near TA-16-340, an HE processing building. The PRS could not be positively located during sampling and is believed to have been removed. Further sampling in the area is not possible. The site is recommended for human-health NFA.
- PRS 16-006(c) is a septic system associated with TA-16-370. It is recommended for human-health NFA because all constituents present above SALs were bounded during the Phase I investigation and contaminants were not present at levels that represent a significant risk to humans under an industrial scenario.
- PRS 16-006(d) is a septic system associated with TA-16-380, an HE inspection building. It is recommended for human-health NFA because no constituents were present at levels above SALs.
- PRS 16-010(a) is an HE burn pad located at the TA-16 Burning Ground. This PRS partially overlaps PRS 16-016(c). Barium is present at levels above SALs. The locations containing barium contamination will be considered in PRS 16-016(c), a former barium nitrate pile and potential source of barium contamination, which will be recommended for cleanup in a separate report. PRS 16-010(a) is recommended for human-health NFA because no other constituents are present at levels above SALs.
- PRS 16-021(a) is the outfall from floor drains in TA-16-450, a non-HE processing building. This PRS is recommended for human-health NFA because no constituents were present at levels above SALs. Arsenic, which was present at levels greater than UTLs, is only slightly above the UTL value.
- PRS 16-026(c) is the outfall from two sumps associated with TA-16-305, an HE storage building. It is recommended for human-health NFA. Polynuclear aromatic hydrocarbons (PAHs) were the only constituents found at levels greater than SALs. PAHs above SALs at this site are due to runoff from asphalt pavement.

- PRS 16-026(d) is the outfall from two sumps associated with TA-16-303, an HE storage building. It is recommended for human-health NFA. PAHs were the only constituents found at levels greater than SALs. PAHs above SALs at this site are due to runoff from asphalt pavement.
- PR 16-026(v) is the outfall from TA-16-460, an analytical chemistry laboratory. It is recommended for human-health NFA because all constituents present above SALs were not present at levels that represent a significant risk to human health under an industrial scenario. PAHs above SALs at this site are due to runoff from asphalt paving.
- PRS 16-028(a) is the south drainage from the TA-16 Burning Ground. HEs were present above SALs in one sample, but the extent of contamination was bounded during the Phase I investigation. This PRS is recommended for human-health NFA because the constituents at this site do not pose a significant risk to human health.
- PRS-16-030(g) is the outfall from a sump associated with TA-16-380, an HE powder inspection building. PAHs and lead were present above SALs. PAHs above SALs at this site are due to runoff from asphalt pavement. The lead level did not pose a risk to human health under an industrial scenario. Therefore, this PRS is recommended for human-health NFA.

TABLE ES-1

SUMMARY OF PRSs

PRS	HSWA	NFA CRITERIA	RATIONALE	SECTION
11-012(a)	No	5	Constituents below SALs.	5.1
11-012(b)	No	5	Constituents below SALs.	5.1
13-003(a)	Yes	1	PRS not located by sampling.	5.2
16-006(c)	Yes	5	No significant risk to human health.	5.3
16-006(d)	Yes	5	Constituents below SALs.	5.4
16-010(a)	Yes	5	Contaminants transferred to PRS 16-016(c). All other constituents are below SALs.	5.5
16-021(a)	Yes	5	Constituents below SALs.	5.6
16-026(c)	Yes	5	No significant risk to human health.	5.7
16-026(d)	Yes	5	No significant risk to human health.	5.8
16-026(v)	Yes	5	No significant risk to human health.	5.9
16-028(a)	Yes	5	No significant risk to human health.	5.10
16-030(g)	No	5	No significant risk to human health.	5.11

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1.0 INTRODUCTION

1.1 General Site History

Technical area 16 (TA-16) and associated TAs (11, 13, 24, 25, 28, 29, 37) are located in the southwestern corner of the Laboratory (Fig. 1.1-1 and Fig. 1.1-2). TA-16 contains 2 410 acres or 3.8 square miles. The land is a portion of that which was acquired by the Department of Army for the Manhattan Project in 1943. It was used prehistorically by the ancestral Indians of the Pajarito Plateau, and prior to World War II, for farming and a sawmill operation. TA-16 is bordered by Bandelier National Monument along New Mexico (NM) State Highway 4 to the south and the Santa Fe National Forest along NM State Highway 501 to the west (Fig. 1.1-3). To the north and east, it is bordered by TAs 8, 9, 14, 15, and 49. TA-16 is fenced and posted along NM State Highway 4. Water Canyon, a 200-ft-deep ravine with steep walls, separates State Highway 4 from active sites at TA-16. Cañon de Valle forms the northern border of TA-16. Security fences surround the HE production facilities.

TA-16 was established to develop explosive formulations, to cast and machine explosive charges, and to assemble and test explosive components for the US nuclear weapons program. Almost all of the work was conducted in support of the development, testing, and production of explosive charges for the implosion method. Present-day use of this site is essentially unchanged, although facilities have been upgraded and expanded as explosive and manufacturing technologies have advanced.

Many of the PRSs included in this report are outfalls from HE sumps. Sumps separate insoluble pieces of HE from the liquid they are suspended in by taking advantage of the difference in density between HE and water. HE floats to the surface where it is removed and disposed of; the water beneath the HE flows from the outfall, carrying potential contamination from dissolved HE into the drainage. Further discussion of HE sumps can be found in Subsection 5.2.1 of the Operable Unit (OU) 1082 work plan (LANL 1993, 1094). Other outfalls included in this report, such as septic systems, have potential contaminants based on the specific activities conducted in their associated buildings. Contamination in a septic system could be due to a range of activities within a building or within the area surrounding a building. Other PRSs in this report were firing sites and incineration sites. Contaminants at these sites include metals as well as HE and burn products from the combustion of HE.

A comprehensive table of the potential contaminants that were expected at this site prior to beginning fieldwork is contained in Chapter 4 of the second addendum to the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) Work Plan for OU 1082

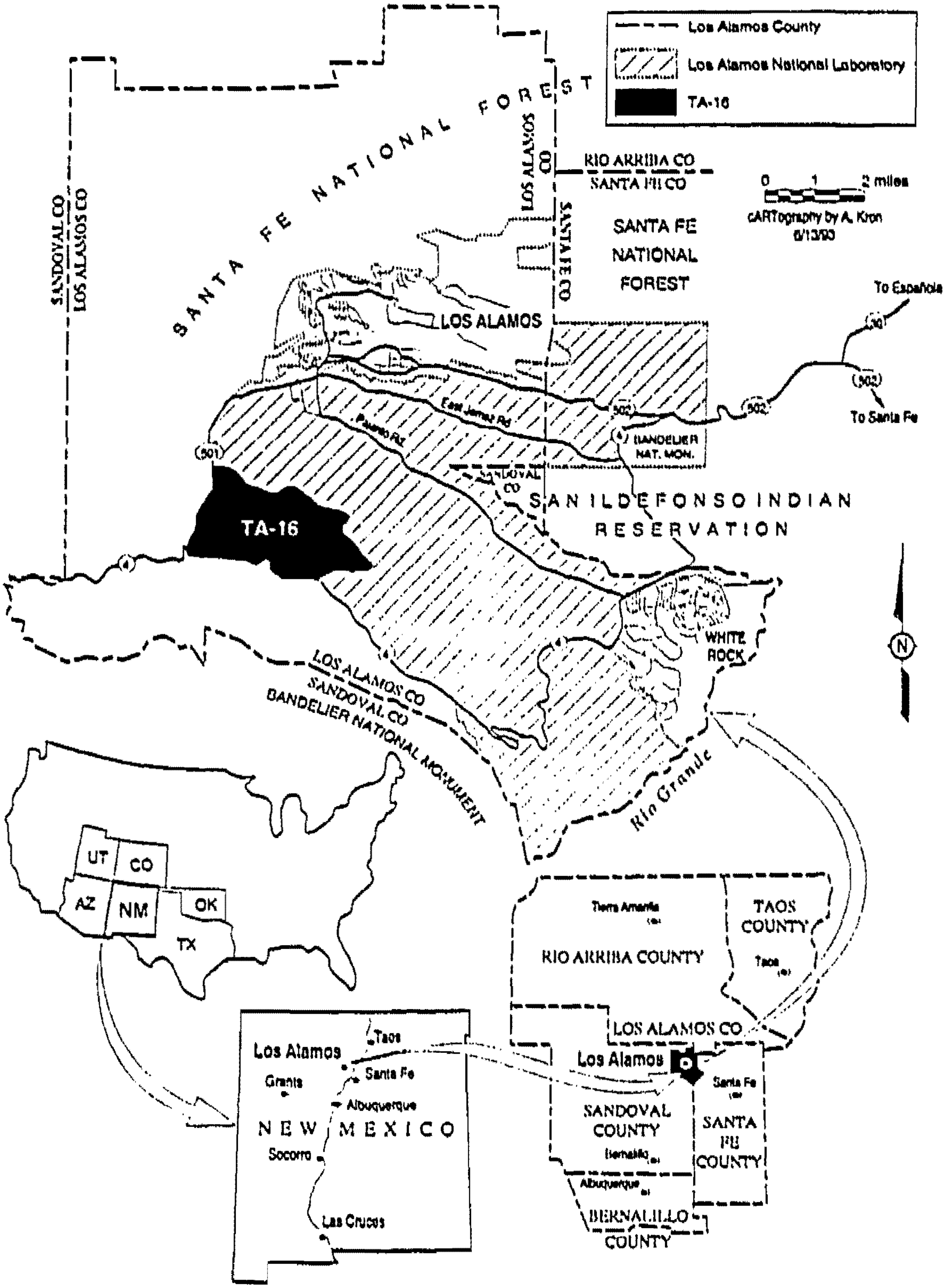


Fig. 1.1-1. Location of TA-16 within Los Alamos National Laboratory, Los Alamos County, New Mexico.

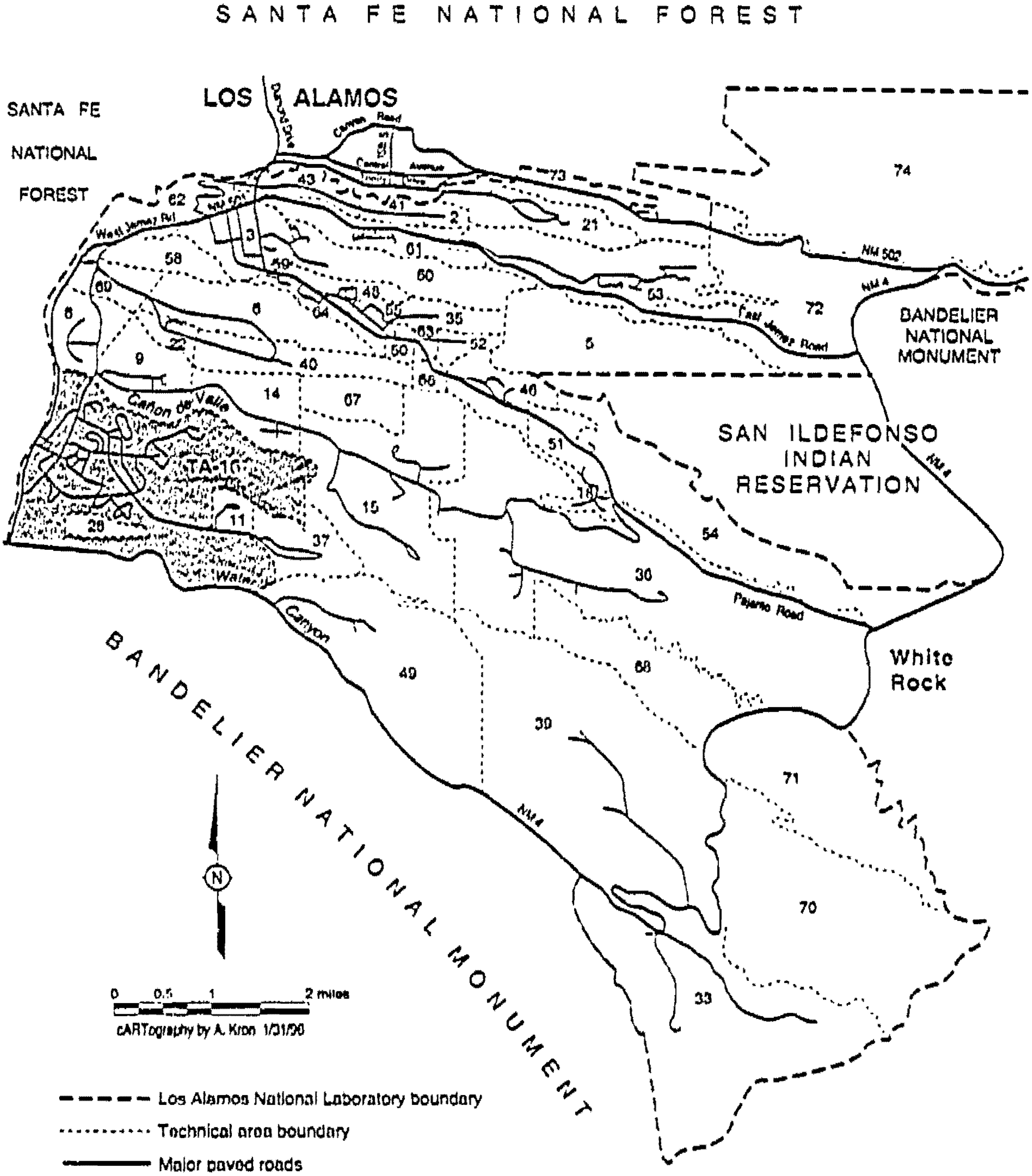


Fig. 1.1-2. Location of TA-16 with respect to Laboratory TAs and surrounding land holdings.

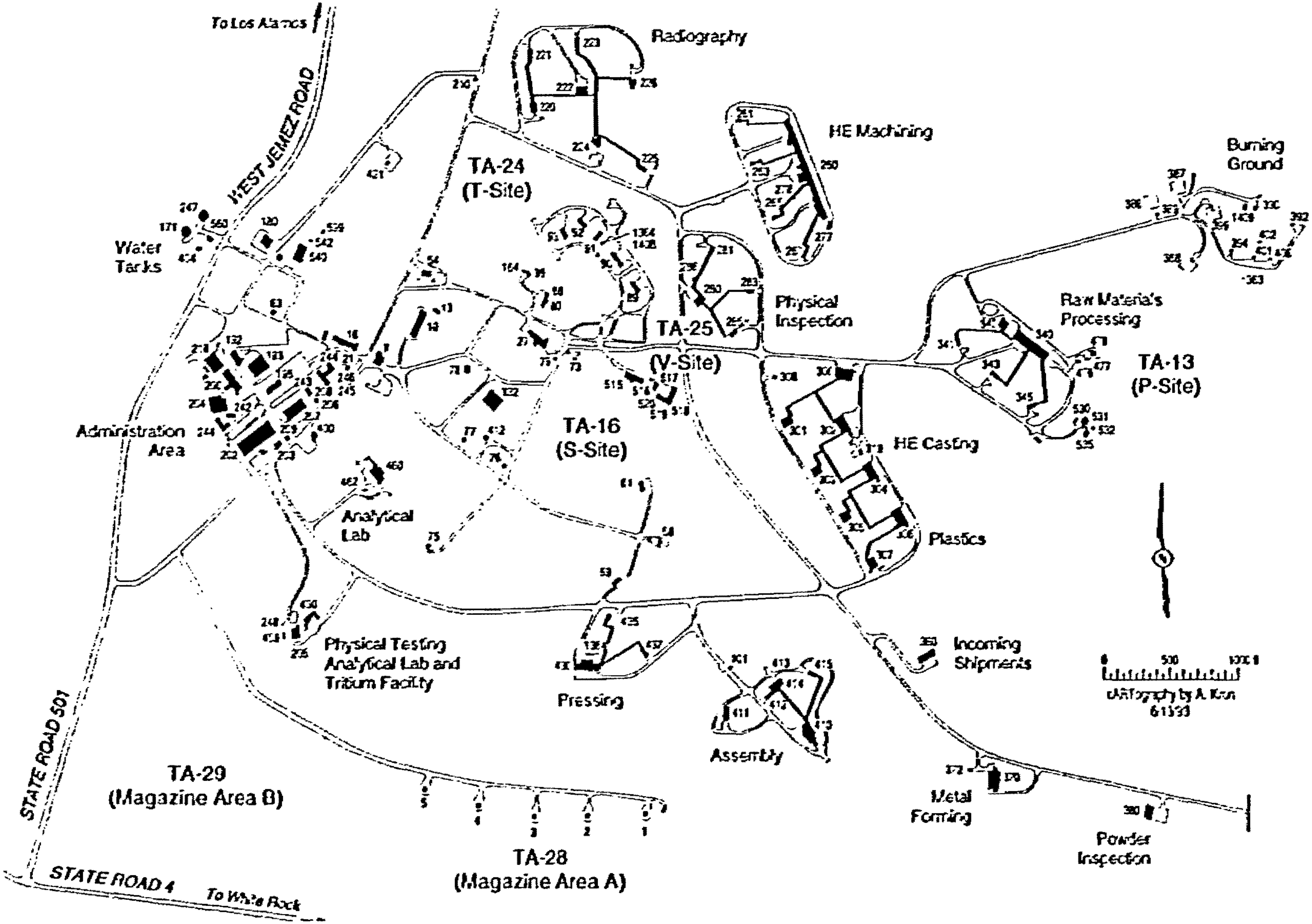


Fig. 1.1-3. Location map of TA-16 (S-Site) and TA-28 (Magazine Area A).

(LANL 1995, 1342). This table includes a wide range of HE used at LANL over the years, as well as standard industrial solvents, metals, and a few radionuclides.

1.2 RFI Overview

The sampling plans for the PRSs discussed in this document are contained in the RFI Work Plan for OU 1082 (LANL 1993, 1094). This work plan was submitted to Environmental Protection Agency (EPA) Region 6 in July 1993. A notice of deficiency (NOD) was received in July 1994. LANL's response was submitted to the Los Alamos Area Office of the Department of Energy (DOE) in August 1994. EPA's approval of the work plan, with modifications, was received during December 1994 (Taylor 1995, 1357).

The technical approach of this plan included phased sampling to locate the sources of contamination associated with LANL activities. Contaminants detected during Phase I reconnaissance sampling may be subject to subsequent sampling to ensure that contamination is investigated in compliance with the Hazardous & Solid Waste Amendments (HSWA) Module VIII of the LANL RCRA Facility Permit (EPA 1990, 0306).

The conceptual model for this site is referenced in Subsection 4.3 of the RFI Work Plan for OU 1082 (LANL 1993, 1094). The primary exposure routes for continued industrial operations include ingestion, inhalation, dermal contact, and external radiation. HE detonation is also a concern under an industrial scenario.

1.3 Field Activities

The fieldwork for the PRSs in this report began in April 1995 and ended in October 1995. Additional samples at PRS 16-006(d) during 1996 and at PRS 16-028(a) during 1997. All fieldwork was conducted by ICF Kaiser Engineers. All applicable LANL Environmental Restoration (ER) SOPs (LANL 0875) were followed, unless otherwise noted in Chapter 5 of this document.

Laboratory analysis samples were screened for radioactivity, HE, and the presence of organic vapors. Radioactive screening was conducted with a 2x2 NaI2 detector. Screening for organic vapors was conducted with a photoionization detector (PID) with an 11.7 eV lamp. HE screening was conducted using a spot test kit. The spot test has a nominal detection limit of 100 ppm, above which the test results are considered positive and below which the test results are considered negative. The test changes color to indicate the presence of HE above or below that limit (see Appendix C).

Sampling at these PRSs involved surface and subsurface sampling. A few PRSs required only surface sampling because of the nature of the presumed contamination. Surface samples were collected with a spade and a scoop. Because many of the PRSs in this RFI report are outfalls, they have very similar sampling plans. Two boreholes were drilled near the outfall for surface and subsurface sampling. Surface samples were collected further down the drainage. Where possible, subsurface samples were collected with a hand auger. Generally, the hand auger was used to collect samples down to the soil-tuff interface. Deeper borehole samples were collected with a split spoon using a drill rig. Borehole depths reached 9 ft below the soil surface.

The purpose of field screening was to bias samples to locations with the highest contamination and to aid in bounding the extent of contamination. Screening was also needed to ensure compliance with shipping requirements for explosive materials. HE spot test results were frequently relied upon for biasing laboratory sampling locations.

All sampling data were loaded into a field 4-D database that was later uploaded to the Facility for Information Management, Analysis, and Display (FIMAD).

Land surveys were conducted between January and March 1995 and finished in June 1996. All surface samples were taken to an approximate depth of 6 in. within a diameter of 6 to 8 in. VOC samples were taken from a depth of greater than 6 in.

Field quality assessment (QA) samples, in the form of collocated and performance evaluation (PE) samples, were collected as specified and defined in the site-specific quality assurance/quality control (QA/QC) plan for the fiscal year (FY) 95 TA-16 field campaign (ICF Kaiser 1995, 15-16-628). Collocated surface samples, designated as field duplicates in the RFI work plan, were established less than 1 ft north of their respective RFI-mandated sample locations. Split subsurface samples were collected from 1- to 2-ft intervals of core.

The PE samples were collected for these reasons:

- to check for contamination that may have been introduced from ambient conditions or improper handling procedures,
- to evaluate matrix effects on analytical laboratory recovery of inorganics and radioactive constituents, and
- to evaluate the overall process of sample handling and analysis.

2.0 ENVIRONMENTAL SETTING

The environmental setting of the Laboratory is described in Subsection 2.4 of the Installation Work Plan (IWP) for Environmental Restoration (LANL 1995, 1164). A discussion of the environmental setting, including climate, geology, hydrology, and a conceptual hydrogeologic model for the area and surroundings, is presented in Chapter 3 of the RFI work plan for OU 1082 (LANL 1993, 1094). A summary of that and new data collected since 1993 is presented in the following sections.

2.1 Climate

Los Alamos County has a semiarid, temperate, mountain climate. Summers are generally sunny with moderate, warm days and cool nights. High altitude, light winds, clear skies, and dry atmosphere allow mean summer temperatures to range from 60°F to 68°F at TA-16. Winter mean temperatures typically range from 30°F to 37°F. The average annual rainfall in the area of TA-16 is estimated to range from 18 to 20 in. (Bowen 1990, 0333). Of this total, approximately 40% occurs as brief, intense thunderstorms during July and August.

2.2 Geology

2.2.1 Geologic Setting

A detailed discussion of the geology of the entire Los Alamos area can be found in Subsection 2.5.1 of the IWP (LANL 1995, 1164). The geology of TA-16 is described in Subsection 3.4 of the RFI work plan (LANL 1993, 1094). However, significant additional information about the geology of TA-16 has become available during the last 3 years. These new data are described below.

The operations area at TA-16 is bounded on the south by Water Canyon and on the north by Cañon de Valle. Cañon de Valle is a tributary of Water Canyon; they join at the east end of TA-16. Water Canyon drains into the Rio Grande approximately 7 miles east of the easternmost boundary of TA-16.

Operational areas at TA-16 are located on the mesa tops, which are composed of Unit 4 (Qbt4) of the Tshirege Member of the Bandelier Tuff. Unit 3 (Qbt3) of the Tshirege Member of the Bandelier Tuff crops out on the mesa tops at the east end of TA-16 and in the bottoms and walls of Cañon de Valle and Water Canyon. Correlation of recent mapping at Material Disposal Area P (MDA-P) with the recently released bedrock geologic map of Rogers (Rogers 1995, 1353) suggests that mesa top portions of TA-16 are underlain by approximately 80-110 ft of Unit 4 of the Tshirege Member of the Bandelier Tuff.

At MDA-P, Qbt4 is a lithologically complex unit consisting of the following material in ascending order: (1) a poorly indurated, white to light gray, nonwelded ignimbrite; (2) an indurated, light tan, nonwelded, cliff-forming tuff overlain by a broad bench; (3) a varicolored, nonwelded, cliff-forming tuff with devitrified base and a 10-ft-thick glassy upper part; (4) a crystal-rich surge bed up to 1 ft thick; and (5) a hard, densely welded tuff that forms the caprock for the mesa (Broxton et al. 1996, 1305). The latter subunit correlates with Unit Qbtf and the first 3 units correlate with Unit Qbte of Rogers (Rogers 1995, 1353). The crystal-rich surge bed was mapped by Rogers as the boundary between her Units Qbte and Qbtf. This high-permeability sandy parting may represent a possible perched zone - provided it also overlies a low-permeability zone. Examination of this contact in the walls of Cañon de Valle suggests that the surge bed is discontinuous. The Rogers subunit Qbte contains a unit characterized by horizontal fractures that also may represent a possible perched-flow pathway.

The Qbt3 in Cañon de Valle that is adjacent to MDA-P consists of two hard, pinkish-brown, partially to moderately welded, cliff-forming ignimbrites that are separated by a soft, pinkish-orange, nonwelded, slope-forming tuff. The uppermost subunit within Unit 3 contains significant horizontal fractures.

Detailed information about the mineralogy, modes, whole-rock chemistry, and outcrop characteristics of Unit 3 and Unit 4 at TA-16 are provided in Broxton et al. (Broxton et al. 1996, 15-16-1305).

A large, near-vertical fault, the Frijoles segment of the Pajarito fault zone, has been mapped to the west of OU 1082. This fault is the largest segment of the Pajarito fault system in the Los Alamos area, with down-to-the-east displacement ranging up to 400 ft during the last 1.1 million years. Fault zones may provide pathways for water flow.

2.2.2 Soils

A detailed discussion of soils in the Los Alamos area can be found in Subsection 2.5.1.3 of the IWP (LANL 1995, 1164). Soil at TA-16 is described in Subsection 3.4.3.2 of the RFI work plan (LANL 1993, 1094).

A recent study of background soils on the north and south slopes of Cañon de Valle near the TA-16 burning ground suggests that (1) soil horizons ranged from 40 to 237 cm in depth; (2) soils are poorly developed and consist of A-R, A-Bw-R, or A-Bw-C soil profiles; and (3) soils are classified as Lithic Ustorthents, Typic Haplumbrept, Cumulic Haplumbrept, Typic Ustochrept, and Udic Paleoustalf (McDonald et al. 1996, 1354).

2.3 Hydrology

The hydrology of the Pajarito Plateau is summarized in Subsection 2.5.2 of the IWP (LANL 1995, 1164). Site-specific conditions are summarized below.

The shallowest depth to groundwater at TA-16 is unknown. Shallow perched aquifers at TA-16 are likely to be quite heterogeneous. Several moderate-depth (up to 200 ft) boreholes drilled at the TA-16 burning ground near MDA-P did not encounter a saturated zone. The depth to the regional aquifer at TA-16 is estimated to be greater than 1 000 ft.

Four deep groundwater wells to the regional aquifer are scheduled in and around TA-16 as part of sitewide hydrogeologic studies scheduled for FY98 to FY05. These four wells will be drilled in the following locations: (1) in Cañon de Valle near MDA-P, (2) at the confluence of Cañon de Valle and Water Canyon, (3) at NM State Highway 501 and Cañon de Valle, and (4) at NM State Highway 501 and Water Canyon.

2.3.1 Surface Water

Surface water issues at TA-16 are described in Subsection 3.5.1 of the RFI work plan (LANL 1993, 1094). Additional information about surface water that was collected since 1993, is summarized below. Figure 2.3.1-1 shows the locations of surface water reaches, possible wetlands, springs and seeps, and other features relevant to surface water investigations at TA-16.

Perennial and intermittent surface water exists at many locations at TA-16, due to both natural and anthropogenic sources. Cañon de Valle contains what appears to be a perennial reach: the surface water between the TA-16-260 outfall and a location beyond MDA-P has flowed continuously since initial investigations in 1992. Several small saturated areas are present in small tributary drainages to Cañon de Valle and Water Canyon. Many of these zones are due to the discharge of process waters from TA-16 operations. Process water discharges at most of the TA-16 NPDES outfalls, including that at TA-16-260 outfall, were shut off during 1996 and 1997.

Surface water in many of these locations has been analyzed as part of Framework Studies surface water characterization activities, sampling was performed by New Mexico Environment Department (NMED) Agreement in Principle (AIP) personnel as part of their surveillance activities, and as part of non-RFI hydrogeologic sampling at TA-16. These data are provided in Appendix C of the RFI report for PRSs 16-003(k) and 16-021(c), which was submitted in September 1996 (Environmental Restoration Project, 1996, 1419). Information on constituents above background in surface waters is summarized below.

Certain surface waters in Cañon de Valle are contaminated with several constituents at levels above drinking water standards and above background levels. Barium in Cañon de Valle ranges from 2 to 3 ppm, which is above the New Mexico drinking water maximum concentration level (MCL) of 1 ppm. The high explosive RDX is also consistently found at levels above 100 ppb, which is greater than the New Mexico drinking water MCL for that constituent. Several other constituents in Cañon de Valle are at levels above regional spring background, including HMX, chlorine, sodium, and manganese.

Other surface waters at TA-16 that have anomalously high levels of constituents include the pond behind the 90s-Line, which contains barium at levels above the MCL, and a surface water zone at K-Site, which contains barium and boron above background levels.

2.3.2 Groundwater

Groundwater issues at TA-16 are described in Subsection 3.5.2 of the RFI Work Plan (LANL 1993, 1094). Additional information about groundwater that was collected or reinterpreted since 1993, is summarized below.

Borehole SHB-3 (near the tritium facility on Fig. 1.1-3)(Fig. 2.3.1-1), which was drilled in November 1991, encountered perched groundwater that was hypothesized to have been derived from a depth of 750-350 ft. (Gardner et al. 1993, 0848). This water may represent a perched zone or it could represent the regional aquifer. Water samples were taken from SHB-3 during the summer of 1993. These data show sporadically elevated values of lead, phosphate, rubidium, and ammonium relative to background spring data (Blake et al. 1995, 1355). Static water depth in SHB-3 was roughly 664 ft during 1992 (Environmental Protection Group 1994, 1179).

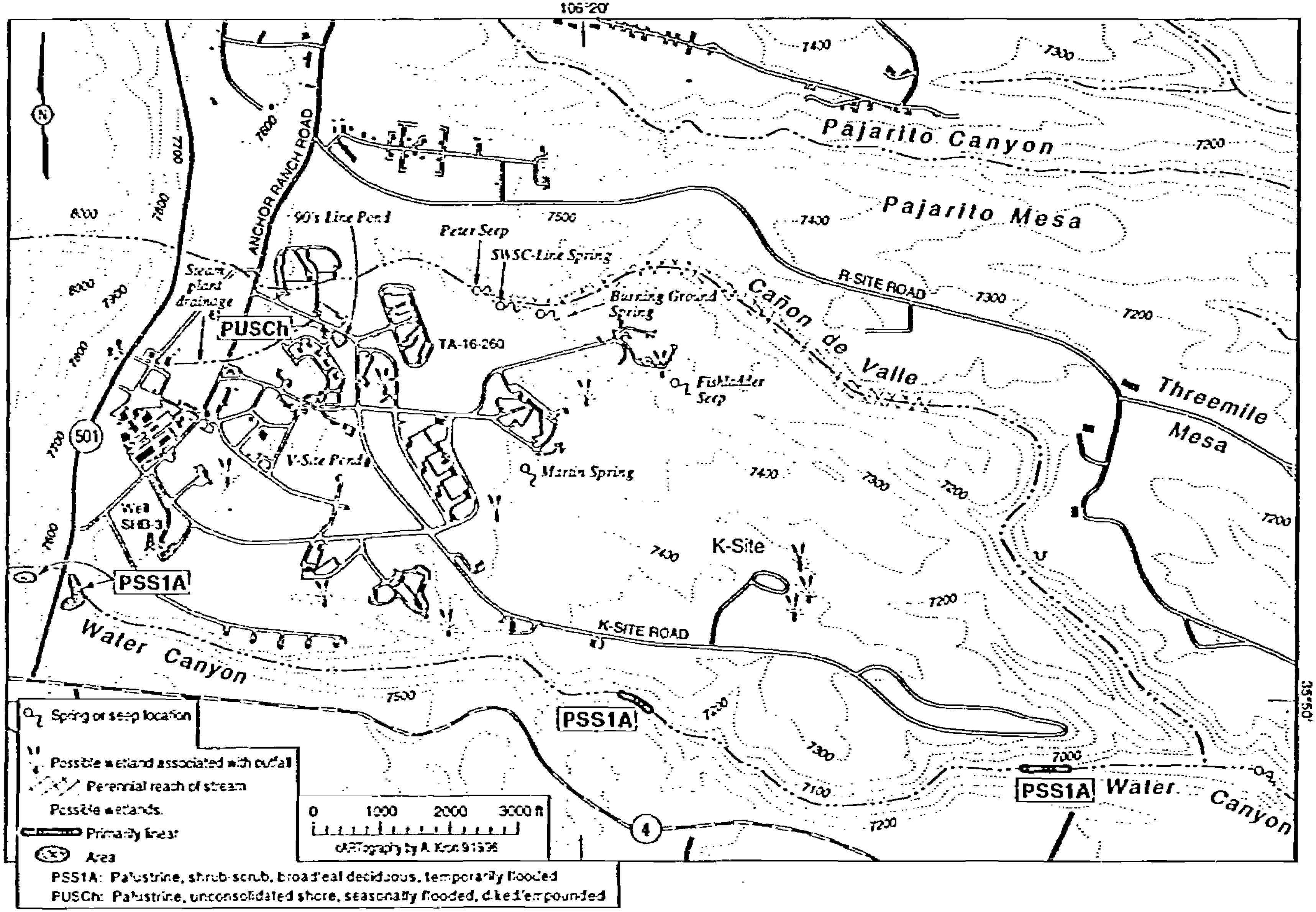


Fig. 2.3.1-1. Topography, springs, seeps, National Wetlands Inventory, and LANL-defined wetlands associated with National Pollution Discharge Elimination System (NPDES) HE outfalls (active and inactive) at TA-16.

Several springs and seeps have been identified at TA-16 during the past four years. SWSC Line and the Burning Ground spring discharge from within the uppermost, platy, subunit of Tshirege Unit 3. Martin spring apparently discharges from the lower portion of Tshirege Unit 4 (Figure 2.3.1-1). All the springs and seeps are contaminated with constituents (e.g., barium, boron, HE, solvents) at levels above background. All these springs are also contaminated at levels above drinking water criteria for RDX. Martin spring appears to be the most highly contaminated. The presence of these springs suggests the existence of one or more perched zones at a shallow level beneath TA-16.

2.4 Biological Surveys

Biological surveys were performed at TA-16 prior to sampling.

Appendix B to the RFI work plan for OU 1082 (LANL 1993, 1094) and Raymer (1996, 15-16-621) describe the results of field surveys for threatened, endangered, and sensitive species. Ten plant and animal species of concern were identified in those surveys: Jemez Mountain salamander, northern goshawk, peregrine falcon, Mexican spotted owl, broad billed hummingbird, pine marten, meadow jumping mouse, spotted bat, checker lily, and wood lily. Appropriate notifications and mitigation measures for each species were also identified in Appendix B to the RFI work plan. One of these species is known to reside in Cañon de Valle (Dunham 1996, 15-16-622; Raymer 1996, 15-16-621)

2.5 Cultural Survey

The methods and techniques used for this survey conform to those specified in the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (National Park Service 1983, 0632). A cultural resource survey was also conducted in the area of the PRSs in this RFI report, as required by the National Historic Preservation Act (amended), in 1992.

Appendix A to the RFI work plan (LANL 1993, 1094) identifies 33 cultural sites that are eligible for inclusion on the National Register of Historic Places under Criterion D within OU 1082. However, that Appendix also notes that the attributes that make those sites eligible for inclusion on the National Register will not be affected by ER project sampling activities.

3.0 APPROACH TO DATA ASSESSMENT AND ANALYSES

The approach to data assessment used by the ER Project is described in the "Technical Approach to Data Assessment for ER Project Site Characterization Decisions" (Knudson et al. 1996, 1299). The approach includes

- sampling and analysis design,
- field investigation and collection of field and QA samples,
- chemical and radiological analyses of samples and reporting of analytical data,
- routine verification and validation of analytical data,
- organization of field and analytical data into PRS-specific data packages,
- exploratory data analysis,
- focused validation when necessary to further assess questionable data,
- comparison of validated analytical results with LANL background data,
- comparison of validated analytical results with SALs,
- assessment of human health risk, and
- formulation of decisions.

The following subsections provide overviews of the methods used to complete these steps for the PRSs discussed in this RFI report.

3.1 Sample Analyses

Samples were collected in accordance with the sampling design specified in the RFI Work Plan for OU 1082 (LANL 1993, 1094). During the sampling activities, field data were collected for each sample. This data includes unique sample identification number, location number, time and date of collection, soil type, sampling anomalies, etc. Field screening analyses were completed using volatile organic methods (photoionization detector[PID]), metals methods (X-ray fluorescence [XRF] and laser induced breakdown spectrometry [LIBS]), the HE spot test for explosives, and gamma radioactivity detection (sodium iodide detector). All samples requiring chemical and radiochemical analyses and chain-of-custody documentation were submitted to the sample management office (SMO) for analyses.

3.1.1 Analytical Methods

The field screening methods are described in Appendix C.

All laboratory samples were analyzed by contract analytical laboratories using methods specified in ER SMO analytical subcontracts (LANL 1995, 1278). The allowed methods are current EPA SW-846 and Contract Laboratory Program (CLP) methods or equivalent.

All solid samples for inorganic and organic analyses were digested using EPA's 3050 digestion procedure (EPA 1992, 1207). The subcontracts specify LANL-approved methods for radiochemical analyses according to the technologies identified in the subcontract (e.g., americium-241 by alpha spectroscopy, tritium by liquid scintillation, or multiple isotopes by gamma spectroscopy). Samples for uranium analysis were prepared by a total digestion procedure comparable to LANL method ER320, "Uranium in Environmental Matrices—KPA" (Gautier 1417), and analyzed by ICPMS.

Analytical method selection is described in Appendix IV of the ER Project Quality Assurance Project Plan Requirements for Sampling and Analysis (QAPP) (LANL 1996, 1292). For each analyte, quantitation or detection limits are specified as contract-required estimated quantitation limits (EQLs) for organic chemicals and radionuclides and estimated detection limits (EDLs) for inorganic chemicals. These limits are included in Appendix III of the ER Project QAPP, along with the target analytes for each analytical suite, and their appropriateness for the investigations described in this report is discussed in Chapter 4.

The following analytical suites were used for the sample analyses in this RFI report: inorganic chemicals, total uranium, radionuclides, VOCs, SVOCs, HE, as well as an expanded HE suite. A list of the target analytes for which analyses were performed for the purpose of this report can be found in Appendix A. Because TA-16 has been used for decades for the study of experimental HE, an expanded HE analysis was conducted at some PRSs to indicate whether a broader range of less common HE might be contaminants at TA-16.

3.1.2 Data Validation

Data verification and baseline validation procedures are used to determine whether analytical data packages had been generated according to specifications and contain the information necessary to determine data sufficiency for decision-making. Data verification includes ascertaining that data packages are complete, including results for all requested analyses and all supporting information such as chromatograms.

For analytical data used for decisions discussed in this RFI report, baseline data validation was performed under the auspices of the SMO as described in the ER Project Quality Assurance Project Plan Requirements for Sampling and Analysis (QAPP) (LANL 1996, 1292). The product of this process is a validation report, including data qualifiers that designate potential deficiencies for affected results. Each data qualifier is accompanied by a reason code that provides information about how the deficiency might impact data use. Data qualifiers assigned by baseline validation, together with their reason codes, are also recorded in FIMAD. The validation report is used in the decision-making process, and it may also be used to direct a focused validation for evaluating the usability of the data of interest.

Data may be qualified for a variety of reasons during the baseline validation process, each of which may or may not limit the use of data for a specific purpose. It is important to recognize that qualified data (i.e., a result together with its assigned data qualifiers) generally have great utility. The baseline validation procedure is designed to provide information about the reason the qualifier has been applied and what its potential impact is on the affected data. The object is not to reject data but rather to ensure that its merit is understood and that the data are used appropriately. The use of qualified data in this report is consistent with EPA guidance (EPA 1992, 1166) and is further discussed in Section 4.0.

Data qualifiers used in the LANL ER Project baseline validation process are defined in Table 3.1.2-1.

TABLE 3.1.2-1

DEFINITION OF DATA QUALIFIERS ASSIGNED DURING BASELINE VALIDATION

U	Analyte was not detected above the reported EQL.
J	Analyte was positively identified, but the result is estimated to be more uncertain than would normally be expected for that analysis.
UJ	Analyte was not detected; the associated value is an estimate of the detection limit or quantitation limit.
J+	Analyte was positively identified, result is likely biased high.
J-	Analyte was positively identified, result is likely biased low.
P	Professional judgment should be applied, depending on proposed use of the data.
PM	Professional judgment should be applied prior to using the data. Manual review of the raw data is recommended.
R	Sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Any results qualified as "R" should be further evaluated for relevance for data use. Thus "R" implies "PM".
RPM	Sample results should not be used without further review of the raw data.
A	Missing required QC data, or QC results not available to the baseline validator.

Focused validation was performed on several data packages as a follow up to the baseline validation. The purpose of a focused validation is to determine the adequacy of reported results for their intended use when

- the data have been qualified as deficient or as requiring professional judgment during the verification/baseline validation process, or
- the data quality assessment process requires additional information about the variability or uncertainty of the reported data or data quality prior to making a data use decision.

Results of the data quality assessment process, including a review of baseline and focused validation results, are presented in Chapter 4 of this RFI report. Qualifiers assigned by baseline and focused validation are shown in the analytical results tables included in Chapter 5 of this RFI report. Summaries of data quality evaluations and focused validation of analytical data relevant to this RFI report are given in Appendix B.

3.2 Process for Identification of COPCs

3.2.1 Inorganic Chemicals

Detected inorganic chemicals are compared with natural background distributions to determine if they should be retained as COPCs or eliminated from further consideration. Background comparison geochemistry issues, field identification of soil horizons, and statistical tests for background comparisons are discussed by Ryti et al. (1996, 1298). The inorganic background data used in this RFI report are from that document. The most recent screening values for use in the "hot measurement comparison" (Ryti et al, 1996, 1298) were used. The UTLs are updated as more background information becomes available; the current values are available in FIMAD. The "all horizons" background soil screening values were used for soil samples because the soil master horizon could not be identified in the disturbed material sampled for the investigations described herein.

In this report, comparisons between site data and background data are performed by comparing each observed concentration datum with a chemical-specific background screening value that is either an upper tolerance limit (UTL) or the maximum reported concentration in the background data sets. The maximum reported concentration is used only for chemicals that are reported as undetected in most background samples (including mercury, antimony, cadmium, and selenium). The derivation of these background screening levels is discussed by

Rytl et al. (1996, 1298). Inorganic chemicals below these background screening levels are not reported in the Chapter 5 data tables. In the case of analytes that were never detected in background samples (such as silver), all detected results are considered to be above background and are reported in Chapter 5.

The "all horizons" background soil screening values were used for soil samples. The underlying tuff unit for the sampled locations at TA-16 is Bandelier Tuff Unit 4, also known as Qbt4. The Qbt4 soil screening values were used for tuff samples. This Qbt4 UTL was calculated with significantly fewer samples and has not been calculated for the complete metals suite. Those samples collected at the soil/tuff interface were typically compared to tuff UTLs because generally those UTLs are more conservative.

3.2.2 Radionuclides

Comparing reported radiochemical results with minimum detectable activities and background data is necessary to determine the presence of radionuclides and to distinguish concentrations of radionuclides associated with Laboratory operations from those attributable to global fallout or to naturally occurring radionuclides and those used as indicators of the quality of the radiological measurement process. Determination of detection status by comparison with minimum detectable activities and other criteria is discussed in Section 4.2.

Detected radionuclides are retained as COPCs or eliminated from further consideration based on a comparison with natural or anthropogenic background distributions. Methods for those comparisons together with radionuclide background data are provided in (Environmental Restoration Decision Support Council and Earth Science Council 1997, 1414) and reviewed in Chapter 4. Sources of background data cited in that document include Longmire et al. (1995, 1266) and Fresquez et al. (1996, 1360).

In this report, comparisons between site data and background data are performed by comparing each observed concentration datum with a radionuclide-specific background screening value calculated as an upper tolerance limit (UTL) for the background data. Radionuclides detected below these background screening levels are not reported in the Chapter 5 data tables. In the case of radionuclides for which there are no applicable background data and no other guidance (as defined in Section 4.2), all detected results are considered to be above background and are reported in Chapter 5.

3.2.3 Organic Chemicals

Background data are not available for organic chemicals. Organic chemicals positively identified in one or more samples have been carried forward to the screening assessment process for the PRSs in this RFI report. Chemicals not detected in any sample have been removed from further consideration.

Based on previous investigations conducted by the ER Project, polycyclic aromatic hydrocarbons (PAHs) have been detected at multiple PRSs across the Laboratory and its surrounding area. In most cases, the presence of PAHs is not related to historical PRS operations, but rather is attributable to non-PRS activities such as run-off from asphalt roads, parking lots, or roofs; combustion of fossil fuels; or forest fires (ATSDR 1995, 55663; Bradley et al. 1994, 1144; Edwards 1983, 55636). Potential site contaminants were evaluated prior to conducting risk-based screening assessment (Section 3.2.4), and the identification of potential contaminants took into consideration the frequency, magnitude and location at which these chemicals were detected and the presence of obvious, non-PRS-related sources. Only those chemicals believed or suspected to be attributable to a PRS-associated release are carried forward in the screening assessment.

3.2.4 Risk-Based Screening Assessment

Inorganic chemicals and radionuclides that exceed background and organic chemicals positively identified in one or more samples and believed or suspected to be attributable to a PRS-associated release require further evaluation if they also exceed SALs. SALs for nonradioactive chemicals are based on EPA Region 9 preliminary remediation goals (PRGs) for residential soil, and are applied to soil and shallow tuff samples in this report. The decision to identify a chemical as a COPC when a SAL is not available is made on a case-by-case basis, taking into account the availability of process knowledge and toxicological information.

If more than one COPC is present at the site, the potential for additive effects of chemicals present below SALs must be considered. In this report, the method for performing an MCE summarized in the policy document Risk-Based Corrective Action Process (Dorries 1996, 1297) is followed. Those comparisons are the last quantitative steps in the screening assessment process for human health concerns. If COPCs remain after this step, then further evaluation is required. If no COPCs remain after this step and the data set is sufficient to support the decision, an NFA recommendation may be proposed based on human health concerns.

If COPCs remain after the screening assessment, several options exist for the PRS. A further site-specific evaluation may lead to eliminating a COPC without going into a formal risk assessment. The site may be proposed for further sampling to more completely characterize the site or for remediation if it is cost effective to proceed without a risk assessment. A risk assessment may be conducted to determine if the remaining COPCs present an unacceptable human health risk. For the sites considered in this report for which COPCs have been identified, the first of those options has been selected.

3.3 Human Health Assessment

3.3.1 Risk Due to Background

Background risks can result from inorganics that are naturally occurring at a site. Calculation of background risks using the same methodology as site risk estimates provides a frame of reference for risk levels calculated at a site. This information provides a basis for determining risk-based remediation goals, which in some circumstances may be set at target risks comparable to background rather than default values (i.e., cancer risk of 1E-6 or hazard index of 1). Background risks can also affect decisions at sites that have constituents for which there is a threshold of toxicity. For some inorganics, background intakes may be near a toxicity threshold such that incremental intakes associated with contamination may be unacceptable.

Background risks calculated here use the same exposure assumptions by which SALs are calculated. SALs are based on health-protective assumptions for a residential scenario (EPA 1995, 1307). For soil exposure, the pathways include incidental soil ingestion, inhalation of resuspended dust, and dermal contact with soil. Because background soil data represent geographically diverse locations, background risks are estimated for both a median concentration and the UTL from the entire background data set to present the range of potential risk associated with different soil constituent concentrations found in and around Los Alamos. The background risks based on the SAL residential exposure model are provided in Table 3.4.1-1.

Risks due to background concentrations are presented for both noncarcinogenic and carcinogenic outcomes. The potential for adverse noncarcinogenic health effects is estimated by a hazard quotient. Intakes leading to a hazard quotient less than 1 are not associated with adverse health effects. None of the median background concentrations result in hazard quotients greater than 1. The hazard quotient of the UTL concentration for manganese exceeds 1 (1.9). However, given the unlikely occurrence of this concentration, the conservative assumptions in the exposure assessment, the margin of safety in the reference dose, and the

TABLE 3.4.1-1

RISK DUE TO BACKGROUND CONCENTRATIONS OF SOIL INORGANICS ASSUMING A RESIDENTIAL SCENARIO[a]

SOIL INORGANIC	SOIL CONCENTRATION (mg/kg)		HAZARD QUOTIENT		LIFETIME CANCER RISK	
	Median	UTL	Median	UTL	Median	UTL
Aluminum	10 000	38 700	0.13	0.5	nc[b]	nc
Antimony	0.6	1.0	0.019	0.032	nc	nc
Arsenic	4.0	7.82	0.18	0.36	1.2E-5	2.4E-5
Barium	130	315	0.025	0.059	nc	nc
Beryllium	0.895	1.95	0.0027	0.0059	6.4E-6	1.4E-5
Cadmium[c]	0.20	2.7	0.0053	0.071	1.4E-10	1.9E-9
Chromium[d]	7.2	16.1	0.00009	0.0002	nc	nc
Cobalt	6.0	19.2	0.0013	0.0042	nc	nc
Copper	5.75	30.7	0.0021	0.011	nc	nc
Lead	12	23.3	0.03	0.058	nc	nc
Manganese	320	714	0.84	1.9	nc	nc
Mercury	0.05	0.1	0.0022	0.0043	nc	nc
Nickel	7.0	15.2	0.0047	0.01	nc	nc
Selenium	0.3	1.7	0.00078	0.0045	nc	nc
Thallium	0.2	1.0	0.033	0.16	nc	nc
Uranium	0.9	1.87	0.0039	0.0081	nc	nc
Vanadium	21	41.9	0.039	0.078	nc	nc
Zinc	30.7	50.8	0.0013	0.0022	nc	nc

[a] Risk estimates are based on reference doses, slope factors, and EPA Region 9 default exposure assumptions effective in April 1996.

[b] nc = noncarcinogen

[c] Cancer risks for cadmium are based solely on inhalation of resuspended dust.

[d] Naturally occurring chromium is assumed to exist in a trivalent state.

exceedance of less than a factor of two, this intake estimate is not expected to be associated with adverse health effects.

Four of the background inorganics provided in Table 3.4.1-1 are also carcinogens. According to the default exposure assumptions used for SALs, the lifetime cancer risks due to background residential soil exposure are estimated at 1 to 2 in 100 000 for arsenic and beryllium.

These background risk estimates provide a frame of reference for a risk-based screening assessment and site decisions. If a site-specific risk assessment is necessary to further evaluate risks, background risks can also be calculated using the site/scenario-specific assumptions to assist in the remedial action decisions for the site.

3.3.2 Risk Assessment

No quantitative site-specific human health risk assessments were performed for these PRSs. In several cases, site data were compared to industrial preliminary remediation goals in qualitative risk assessments.

3.4 Ecological Assessment

In cooperation with the New Mexico Environment Department (NMED) and EPA Region 6, the Laboratory ER Project is developing an approach for ecological risk assessment. Further discussion of ecological risk assessment methodology will be deferred until the ecological exposure unit methodology being developed has been approved. When completed, the ecological risk assessment will be provided as an attachment.

4.0 RESULTS OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

This section reviews the impact on data usability of laboratory quality control (QC) results summarized in Appendix B of this report, as well as results from field QA samples and the overall performance of the HE field screening methods.

A total of 90 laboratory samples are associated with the twelve PRSs included in this report. With the exception of one follow-up sample for PRS 16-006(c) collected in 1996 and 4 samples for PRS 16-028(a) collected in 1997, all were collected in the 1995 field season and analyzed by a single contract laboratory. The 90 samples discussed in this report were batched together with 121 other samples collected by Field Unit 3 during the same time periods, so some of the laboratory QC results (in particular, matrix spikes and duplicate analyses) may have been obtained from samples that are not discussed in this report. Such results are considered relevant for the analyses of samples in the same analytical batches, and are included in the reviews of this Chapter and Appendix B.

Twelve field duplicate pairs of samples and two PE samples were collected during the 1995 field season and submitted with the other samples discussed in this report. Field duplicates of surface samples were collocated with the original samples (type CO in Table 4.0-1), while field duplicates of subsurface samples were splits collected after the sample material was homogenized in a aluminum bowl (SP). Two rinsate samples (type EB) were collected at the end of the season. While not all of the samples listed in Table 4.0-1 are associated with the PRSs discussed in this report, all were collected by the same field teams in the same field season. Thus the results may be used to assess problems, if any, associated with the collection, handling and shipping of the samples considered in this report.

LANL quality control (QC) requirements for all routine sample analyses performed by external subcontractor laboratories are given in the Environmental Restoration Project analytical services statement of work (SOW) (LANL 1995, 1278). For routine organic and inorganic

TABLE 4.0-1

1995 FIELD QA SAMPLES AT TA-16

SAMPLE	TYPE[b]	LOCATION	PRS	RELATED SAMPLE
0316-95-0259	CO	16-1587	16-003(a)	0316-95-0256
0316-95-0504	SP	16-2166	16-026(j2)	0316-95-0502
0316-95-2000	PE	NA[a]	NA	NA
0316-95-2001	PE	NA	NA	NA
0316-95-2010	SP	16-1526	16-021(a)	0316-95-0210
0316-95-2011	CO	16-1456	16-026(b)	0316-95-0118
0316-95-2012	CO	16-1382	16-021(c)	0316-95-0030
0316-95-2013	CO	16-1383	16-021(c)	0316-95-0031
0316-95-2014	SP	16-1453	16-026(b)	0316-95-0111
0316-95-2015	SP	16-1379	16-021(c)	0316-95-0044
0316-95-2016	SP	16-1582	16-020	0316-95-0483
0316-95-2017	CO	16-2167	16-010(a)	0316-95-0392
0316-95-2018	SP	16-1290	16-010(k)	0316-95-0378
0316-95-2019	SP	16-1230	16-010(m)	0316-95-0380
0316-95-2020	EB	NA	NA	split spoon samples
0316-95-2021	EB	NA	NA	hand auger samples

[a] NA = Not Applicable
[b] See text

analyses, the LANL requirements are based either on requirements contained in the EPA Contract Laboratory Program (CLP) SOW or guidance provided in the EPA SW-846 procedures. LANL requirements for the routine radiochemical analyses have been adapted from the EPA requirements for organic and inorganic analyses. Batch-specific QC samples, such as blank, matrix spike, and duplicate samples, must be analyzed at a frequency of one QC sample for each instrumental method, each sample matrix, and/or each analytical batch, whichever is more frequent. The inorganic and radiochemical methods also require the analysis of a laboratory control sample with each analytical batch. Known amounts of surrogates are added to most organic analyses, and their recovery during analysis provides a sample-specific QC measure. The LANL requirements for the frequency of non-batch specific QC procedures and samples, such as initial calibration and continuing calibration verification, adhere to EPA requirements for each specific organic and inorganic instrumental technique.

In addition to reporting results for QC samples and other QC procedures, analytical laboratories routinely supply qualifier codes with their results indicating which results may be affected by problems indicated by out-of-control QC results. These laboratory qualifiers, included in FIMAD, are to be distinguished from data qualifiers added by baseline or focused validation, which are discussed below. Batch-specific QC indicators (e.g., results for duplicate, blank, spike and laboratory control samples), surrogate and tracer recoveries, and laboratory qualifiers are also available in FIMAD. Non batch-specific QC indicators are not provided electronically in LANL's current electronic deliverable but are discussed below.

All of the data discussed in this report have also undergone baseline validation by data validators, who have access to all of the QA/QC indicators reported by the analytical laboratories including non batch-specific indicators such as initial and continuing calibration results. Where these indicators suggest that a result is of less than expected accuracy or precision, this is communicated to the data user both in hard copy validation reports and also by the assignment of data qualifiers which are recorded in FIMAD. Table 3.1.2-1 provides definitions of the data qualifiers used. As discussed in Section 3.1.2, the purpose of data qualification is not to reject data but rather to ensure that its merit is understood and that the data are used appropriately.

"U", meaning that the analyte was analyzed for but not detected, is the most common laboratory qualifier. For the sake of efficiency, baseline validators do not copy a laboratory "U" qualifier into the data qualifier field in FIMAD. If they agree with the laboratory "U", they leave the data qualifier field blank. Therefore, where the data qualifier field is empty and the laboratory qualifier is "U", the result is accepted as a non-detect.

After "U", the most commonly occurring laboratory and data qualifier is "J", indicating that the result is "estimated" (see Table 3.1.2-1). While there are other reasons why a result may be "J" qualified, by far the most common one is that the result lies between the instrument detection limit (IDL) and the estimated quantitation limit (EQL). Below the EQL, quantitation is less precise than above the EQL. Thus the "J" qualifier most often indicates that a chemical has been detected, but at levels so low that it cannot be well quantified. This is not an indication of any deficiency in the data beyond the limitations inherent in the analytical method. "J"-qualified results are used freely in this report. Where the "J" qualifier has been assigned for some other reason, that is noted in Appendix B.

Where baseline validation or preliminary review of the data has indicated a need, additional focused data validation has been performed on some of the data discussed in this report. The purpose of focused data validation is specifically to assess the implications (if any) of identified deficiencies in the data for the decisions considered in this report. The results of focused data validation and consequent modifications to the data qualifiers assigned by the baseline validators are discussed in detail in the following subsections.

4.1 Inorganic Analyses

A total of 90 samples were submitted for inorganic analyses, including cyanide for four of the samples. Batch-specific QC samples include at least one matrix spike and duplicate analysis per batch (for which material from one of the customer's samples is used), plus preparation blanks and in some cases laboratory control samples prepared by the analytical laboratory.

QA/QC results for these analytical requests are summarized in Appendix B, Table B-3. The methods used were adequate to detect all analytes at concentrations below their screening action levels, and most within background concentration levels. The QA/QC results were satisfactory for most requests. Exceptions are itemized in Table B-3 and further discussed below. Overall the data are judged to be of adequate quality for the uses to which it is put in Chapter 5 of this report. The remainder of this subsection discusses the results of focused validation and problematic areas in more detail.

Inorganic chemicals that are not readily detected at background concentrations by the methods used are antimony, cadmium, mercury, selenium, silver and thallium. Other chemicals which cannot be well quantified over at least part of their background range are beryllium, nickel, cobalt and sodium. When not reported as undetected, these chemicals are frequently qualified as "B" (estimated) by the analytical laboratory. Another common baseline data qualifier in these cases is "P", often applied because the duplicate analysis was not within control limits (indicated by a laboratory qualifier of "*"). Duplicate recoveries outside control limits are not surprising when the chemical is present at background concentrations and those background levels are near the detection limit for the analytical methods. These "P" qualifiers have been replaced by "J" during focused validation. In general, these "J" qualifiers do not seriously impact the usability of the data because the "estimated" results are well within background levels. The few exceptions are evaluated in site-specific context in Chapter 5.

Low spike recoveries for chromium and lead were reported in request 924, which included samples from PRSs 16-026(v) and 16-030(g). Chromium was identified above background in PRSs 16-026(v) and 16-030(g), but in no case was it greater than 20% of its SAL. Lead was identified above background in PRS 16-026(v), with a maximum value of 25% of SAL in one of the samples from request 924, and above SAL in 16-030(g) in a sample that did not come from request 924.

Low spike recoveries for chromium in request 1392 also led to some results for PRSs 16-026(v) and 16-028(a) being qualified as "J-". However, there is no evidence for a release of chromium at PRS 16-028(a), which also includes 4 samples analyzed in another request. Results for PRS 16-028(a) samples in request 1392 are uniformly below 4 mg/kg.

Mercury was detected in the blank sample for request 981, which included one sample from PRS 16-026(v). Mercury was reported at the quantitation level, 0.1 mg/kg, in this sample; this result was "U" qualified by baseline validation because of the blank contamination. However, mercury was detected at levels of up to 9.2 mg/kg in other samples from this PRS.

Relative standard deviations (RSDs) for inorganic chemicals, as measured by field duplicates and collocated samples, were generally less than 10%, indicating that local heterogeneity and sample collection and handling procedures did not contribute significantly to variability in the results. (RSDs up to 20% in laboratory duplicates are considered acceptable for most inorganic analytes, and field duplicates can be expected to be more variable than laboratory duplicates.)

Iron, magnesium, and zinc were below performance acceptance limits for PE sample 0316-95-2000, whereas antimony, not one of the spiked chemicals, was reported at 11.4 mg/kg. None of these chemicals have been noted as problems at TA-16, however. Mercury was reported about 25% above the upper performance acceptance limit for PE sample 0316-95-2001. This may indicate that mercury observations of 0.09 to 0.17 mg/kg in four samples from PRS 16-006(c), which were included in the same laboratory batch, are spurious results. Mercury was not detected in any of the remaining five samples from PRS 16-006(c). Mercury was also reported as estimated at 0.07 mg/kg (below the EQL) in PRS 11-012(b) sample 0311-95-0014 from this batch, a result which is considered spurious and not reported in Chapter 5.

Calcium, iron, and sodium were reported in both rinsate samples at estimated quantities up to 309 ug/l for calcium in the hand-auger rinsate (0316-95-2021). In the split-spoon rinsate sample (0316-95-2020), 2.1 ug/l of lead was reported, and 34.1 ug/l of zinc was reported in the hand-auger rinsate sample. Imperfect decontamination may have caused slight upward bias in inorganic results for some samples.

4.2 Radiochemical Analyses—

A total of 22 of the field samples discussed in this report were analyzed for total uranium, and 16 for other radionuclides by gamma spectroscopy. Batch-specific QC samples for isotopic analyses usually include a duplicate analysis using material from one of the customer's samples and a preparation blank prepared by the analytical laboratory. Batch-specific QC for total uranium is similar to that used for inorganic analyses.

The methods used were adequate to detect all analytes implicated by historical information below their screening action levels and most within background concentration levels. Baseline validation identified no problems with any of these analyses. Overall the data are judged to be of adequate quality for the decisions in Chapter 5 of this report.

All uranium results but one were below the UTLs for soil and tuff (Qbt4) samples prepared for analysis by a total digestion method such as was used for these samples. The only gamma spectroscopy analytes detected were K-40 and Cs-137. Potassium-40 is naturally present in geologic materials, and is used solely as a radiological process indicator (Environmental Restoration Decision Support Council and Earth Science Council 1997, 1414). Cesium-137 was detected in four samples near the rim of the canyon below outfall PRS 16-006(c), but the reported results for these surface samples were below the background screening level of 1.65 pCi/g, which represents a regional background level due to atmospheric testing in the 1960s.

The relative standard deviations for eight field duplicate pairs measured for total uranium were less than 15%, indicating that local heterogeneity and sample collection and handling procedures did not significantly increase variability in the results.

In the split-spoon rinsate sample (0316-95-2020), 58.4 ug/l of total uranium was reported. Imperfect decontamination may have caused slight upward bias in total uranium results for some samples.

One rinsate sample was analyzed by gamma spectroscopy. This sample did not contain radionuclide contamination.

4.3 Organic Analyses

A total of 85 of the field samples discussed in this report were analyzed for SVOCs, and 39 were analyzed for VOCs. Of the 77 samples analyzed for high explosives, 20 were analyzed for TATB, PETN, nitroguanidine, and nitroglycerin, in addition to the standard HE suite. Qualifications placed on these results by routine data validation are summarized in Appendix B, Tables B-2, B-4, and B-6, of this report.

Volatiles: Laboratory QC samples for volatiles typically include duplicate and matrix spike analyses performed on sample material provided by the customer, and blank and blank spike analyses on samples prepared by the laboratory. Sample-specific indicators-surrogates and internal standards-are also used.

Blank contamination by common laboratory contaminants such as methylene chloride and acetone was noted in the majority of the data packages. Other problems were more sporadic and, overall, did not affect the data used for decision making as described in Chapter 5. The extensive problems mentioned in connection with request number 1391 in Table B-6 are all associated with samples from PRS 16-020, which is not included in this report. Volatile contamination was not a problem for any of the TA-16 PRSs investigated.

Request number 249 listed 1,2,3-trichloropropane as detected in sample 0316-95-0213, associated with PRS-16-021(a). Focused validation showed no analytical evidence of 1,2,3-trichloropropane in the raw data for this sample. The error is being corrected by the laboratory and the electronic information in FIMAD will be altered to show this correction.

Few volatile organic compounds were detected in the field duplicate pairs, but those that were reported (primarily acetone, trichlorofluoromethane, and p-isopropyltoluene) had RSDs of less than 20%, indicating that local heterogeneity, and sample collection and handling procedures did not significantly increase variability in the results.

No volatile organic compounds were detected in the two rinsate samples.

Semivolatiles: Laboratory QC samples for volatiles typically include duplicate and matrix spike analyses performed on sample material provided by the customer, and blank and blank spike analyses on samples prepared by the laboratory. Sample-specific indicators-surrogates and internal standards-are also used.

Phthalate contamination of method blanks was noted in many of the data packages. Phthalates are also common in the environment, at low levels.

The semivolatile data for PRS 16-010(a) samples 0316-97-0383 through -0390 from request 1154 were rejected because holding times were missed by 35 days. However, no semivolatile compounds apart from a phthalate were detected in any sample from this PRS, including five for which the analyses were accepted. Phthalate contamination was reported in the associated method blanks.

PAHs, which were detected in up to five field duplicate pairs, were replicated in such pairs to within 30% (and on average within 10% to 15%). Variability of this magnitude, whether due to local heterogeneity in the soil or to other aspects of the sampling and analysis process, does not significantly affect the usability of the data when results are far below SALs. In other cases, decisions were based on a set of measurements from a site that vary by two orders of magnitude. Relative to this level of variability within a PRS or exposure unit, the observed differences between field duplicate results were insignificant.

Benzo(b)fluoranthene was incorrectly reported as benzo(k)fluoranthene in PE sample 0316-95-2000. As the former compound is more toxic than the latter, this type of error could lead to false negative conclusions at a site. However, the PAHs at TA-16 are invariably found in groups, including several with SALs as low or lower than that of benzo(b)fluoranthene. Risk at these sites is usually driven by benzo(a)pyrene, which was reported within performance acceptance limits in both PE samples. All compounds were within performance acceptance limits in the other PE sample, 0316-95-2001, although, as reported in Table B-4, this sample had to be diluted and reanalyzed due to the presence of compounds at levels outside the calibration range.

No semivolatile organic compounds were detected in the two rinsate samples, apart from bis(2-ethylhexyl)phthalate at low levels that may have been associated with blank contamination. However, surrogate recoveries were low for the split-spoon rinsate (0316-95-2020), and non-detected values are qualified "RPM" (Table B-4, request number 1436.) These rinsate data were not used for decision purposes.

High Explosives: Laboratory QC samples for volatiles typically include a duplicate analysis performed on sample material provided by the customer, and analyses of blank and spiked samples prepared by the laboratory. Matrix spikes are also included in the standard HE analyses, but not in the extended suite. Sample-specific indicators-surrogates and internal standards-are also used. Laboratory control samples are not required and their absence, although noted in many cases by the baseline data validators (see Appendix B), is not considered a deficiency.

Many of the HE results were qualified "P" or "PM" (i.e., professional judgment should be applied prior to using the data) by the baseline data validators. Most of the observed problems related to the high levels of HE contamination in some of the samples batched with the samples discussed in this report. Those samples required numerous dilutions and, in some cases, special sample preparation techniques, which complicated the interpretation of the high performance liquid chromatography (HPLC) chromatograms. Surrogate recoveries were sometimes affected by the high concentrations of TNT and RDX (especially in confirmation column results, where the surrogate elutes at almost the same time as RDX). Quantitative results for samples with low to moderate levels of HE, which includes all samples discussed in this report, are considered valid.

The various forms of dinitrotoluene (DNT) were measured in field duplicate pairs with RSDs ranging up to 40%, whereas HMX, RDX, and TNT had RSDs below 15%. This level of variability could be a problem for 2,4-DNT, which has a very low SAL, but it is acceptable for HMX, RDX, and TNT, which are the most significant HE contaminants at TA-16. Usually at least one of the latter HE contaminants is present when 2,4-DNT is present at levels of concern, so that no decisions will depend solely on unreliable measurements of 2,4-DNT.

Recoveries of 84% to 99% were obtained for five nitroaromatics in PE sample 0316-95-2001. For sample 0316-95-2000, 89% recovery of the 2,4-DNT in a semi-volatile PE material was reported and measured using the standard HE analytical procedure. Spurious RDX, TNT, and tetryl hits on the second column (but not the primary column) were also reported for PE sample 0316-95-2000.

HMX and RDX were detected at less than 0.5 ug/l in the hand-auger rinsate sample (0316-95-2021), and TNT was detected at less than 0.25 ug/l in both rinsate samples. Although those levels of residual contamination would be unlikely to affect field results, they may indicate that it is difficult to remove all traces of HE from sampling equipment. Therefore, HE analyses could be biased high.

5.0 SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

This report discusses the 1995 sampling and analysis for 12 potential release sites (PRSs) located at Technical Area 16 (TA-16). Site information, results of analyses, evaluation of contamination, and human-health no further action (NFA) recommendations for these PRSs are presented in this section. Table 5.0-1 summarizes the PRSs. Figure 5.0-1 shows PRS locations.

TABLE 5.0-1

PRSs IN THIS TA-16 REPORT

SECTION	PRS ID	LOCATION	PRS TYPE	RECOMMENDATION
5.1	11-012(a,b)	TA-11	Magazine footprints	NFA, Criterion 5
5.2	13-003(a)	TA-16-340	Inactive septic tank	NFA, Criterion 1
5.3	16-006(c)	TA-16-370	Septic system	NFA, Criterion 5
5.4	16-006(d)	TA-16-380	Septic system	NFA, Criterion 5
5.5	16-010(a)	Burning Ground	Flash pad	NFA, Criterion 5
5.6	16-021(a)	TA-16-450	Floor-drain outfall	NFA, Criterion 5
5.7	16-026(c)	TA-16-305	HE sump outfall	NFA, Criterion 5
5.8	16-026(d)	TA-16-303	HE sump outfall	NFA, Criterion 5
5.9	16-026(v)	TA-16-460	HE sump outfall	NFA, Criterion 5
5.10	16-028(a)	Burning Ground	Drainage	NFA, Criterion 5
5.11	16-030(g)	TA-16-380	HE sump outfall	NFA, Criterion 5

PRS in this report are proposed for human-health NFA based on two criteria:

- Criterion 1 "The site cannot be located or has been found not to exist, is a duplicate PRS, or is located within and therefore, investigated as part of another PRS."
- Criterion 5 "The PRS has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use."

All PRS discussed in this report remain eligible for further characterization and cleanup based on ecological risk, surface water concerns, or other regulatory criteria. None of the PRSs described in this report are being proposed for removal from the HSWA Module.

Administrative procedure (AP) 4.5 Part B was filled out for all of the PRS presented in this report during August 1997. PRS 16-026(v) and 16-028(a), which appear in this report, were directly identified as high-priority sites for surface water issues. PRS 16-016(c), which is downgradient from PRS 16-010(a), and PRS 16-003(m), which is the sump associated with drainage 16-030(g), are high-priority PRSs for surface water that are associated with PRS presented in this report.

5.0.1 Constituents Without SALs

Constituents without adequate toxicological criteria to calculate SALs were detected at multiple PRSs described in this report. The rationale for eliminating these constituents as COPCs is provided in this section, rather than in the individual PRS write-ups.

5.0.1.1 Polynuclear Aromatic Hydrocarbons

A select group of polynuclear aromatic hydrocarbons (PAHs) without SALs were detected at the PRSs presented in this report at low detection frequencies, and at low concentrations (low parts per million). Infrequent detections of these compounds at low concentrations do not represent a contamination problem posing a potential risk to human health or the environment. SALs are not available for these compounds due to the absence of EPA-accepted toxicity criteria to calculate screening values. In general, the potential impacts from the low concentrations of these compounds is addressed during the evaluation of the PAHs that do have toxicity criteria and SALs. The PAHs consist of a large family of compounds with a rather large range of toxic potency. In calculating site risks, EPA and most state agencies separate the PAH into two categories: carcinogens and noncarcinogens. Carcinogenic PAHs are evaluated by considering the available data on the carcinogenic potency of different PAHs to develop toxicity equivalency factors (TEFs) for the individual PAHs. These TEFs indicate the carcinogenic potency of each compound relative to benzo(a)pyrene (BaP). Consequently, the PAHs analyzed that do have SALs encompass a substantial portion of the risk due to low levels of these compounds in soils.

The list of PAHs without SALs in this report includes benzo(g,h,i)perylene, a noncarcinogenic PAH; phenanthrene, a noncarcinogenic PAHs very similar to pyrene; and 2-methylnaphthalene, a noncarcinogenic PAH very similar to naphthlene. All of the non-carcinogenic PAHs have SALs greater than 1000 mg/kg. The other non-carcinogenic PAHs without SALs are likely to have SALs of equivalent magnitude. Because the PAHs without SALs were detected infrequently and at concentrations that are orders of magnitude below SALs for similar compounds; the evaluation of PAHs is considered to be complete after the evaluation of PAH with SALs available.

5.0.1.2 2-Amino-4,6-dinitrotoluene and 4-Amino-2,6-dinitrotoluene

2-Amino-4,6-dinitrotoluene (2 ADNT) and 4-Amino-2,6-dinitrotoluene (4 ADNT) are microbial reduction products of the nitro groups on the TNT molecule. Hence, they are frequently found at low-levels in association with TNT contamination in soils. Neither 2-ADNT or 4-ADNT are

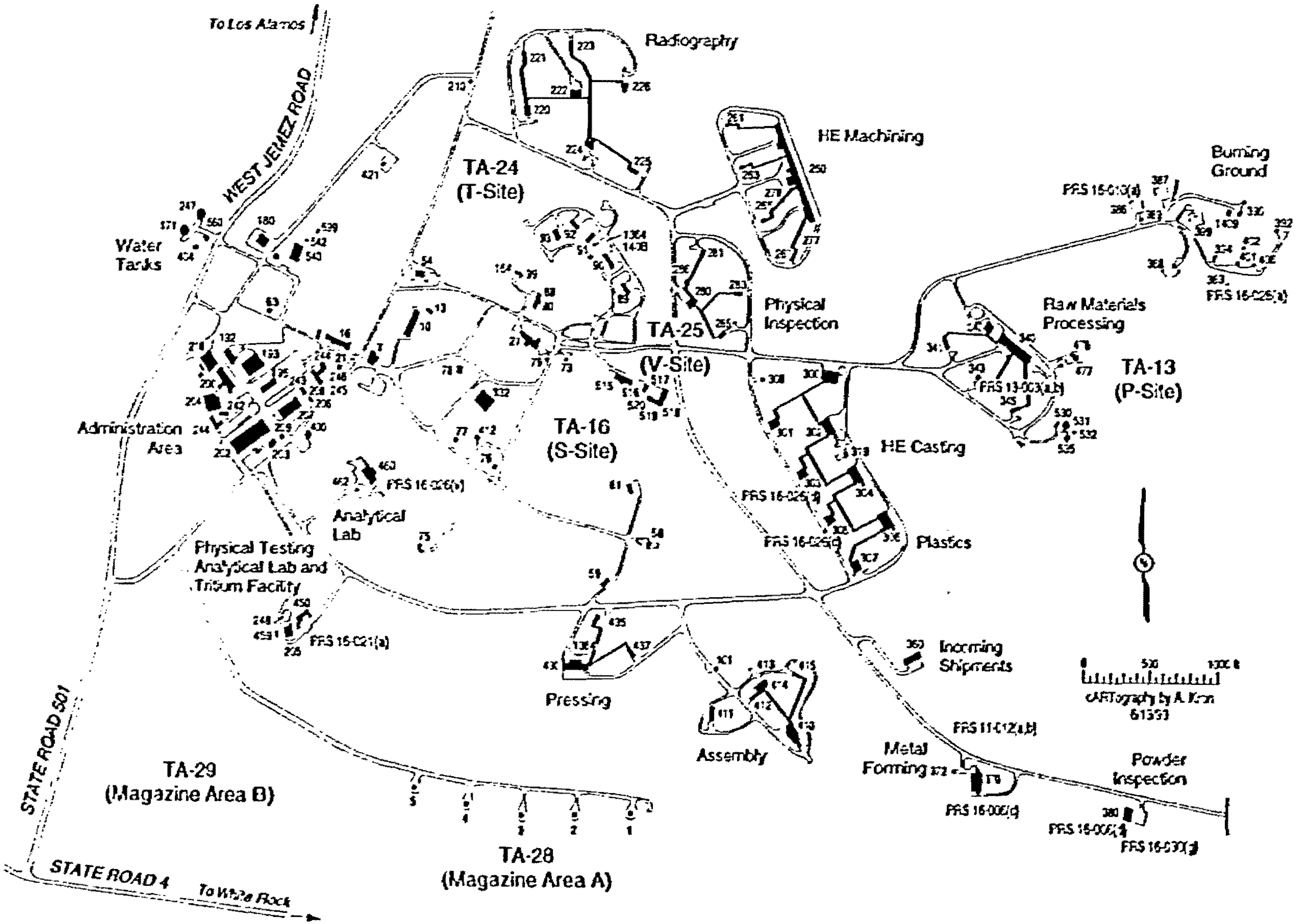


Fig. 5.0-1. Location map of PRSs presented in this report.

used in the synthesis of organic compounds or as industrial products, and there has therefore been little interest in their toxic effects on humans or laboratory animals. The limited amount of data on these compounds suggest that they are less toxic than TNT (Layton et al. 1987, 15-16-447). The TNT SAL is 15 mg/kg. Both 2-ADNT and 4 ADNT are found at levels less than 0.3 mg/kg at all PRSs in this report. The presence of these constituents at these levels do not qualify them as COPCs, nor should the presence of these constituents at those levels significantly affect an MCE.

5.0.1.3 Triaminotrinitrobenzene

Triaminotrinitrobenzene (TATB) is an insensitive high explosive that is extensively used in modern nuclear weapons systems. No toxicological criteria exist for this compound. However, due to its extreme insolubility—it is soluble only in sulfuric acid and a few other superacids (Gibbs and Popolato 1980, 15-16-369)—it is likely to be inert in the human digestive tract. It was not mutagenic when tested with five strains of *Salmonella typhimurium* and in *Escherichia coli* strain WP (Gibbs and Popolato 1980, 15-16-369). Hence, it is likely to present minimal risks to either human or ecological receptors.

5.0.1.4 Volatile Organic Compounds

P-isopropyl toluene was found at levels less than 0.020 mg/kg at one PRS presented in this report (PRS 16-021(a)). P-isopropyltoluene is also known as p-Cymene. This compound is found in nearly 100 volatile oils including lemongrass, sage, thyme, coriander, and cinnamon (Lewis 1992 15-16-646). It is mildly toxic by ingestion (Lewis 1992 15-16-646). It is likely that the presence of this compound is due to natural forest litter present at PRS 16-021(a). It is not likely that this compound presents a significant risk to human health at a level of 0.020 mg/kg.

5.1 PRSs 11-012(a,b)

PRSs 11-012(a,b) are the sites of former HE storage magazines TA-11-7 and TA-11-8, respectively. These PRSs are recommended for human-health NFA because no constituents were detected above SALs.

5.1.1 History

PRSs 11-012(a,b) are discussed in detail in Subsection 5.16 of the RFI Work Plan for OU 1082 (LANL 1993, 1094). The magazines were built in 1944-5 and razed by intentional burning in 1960. Information regarding the plan for demolition is found in Penland (1959 15-16-255). High

Explosives (HE), HE impurities, and HE degradation products were the potential contaminants at these sites. Prior to removal, these magazines were determined to be HE-contaminated (Penland 1959, 15-16-255). No other types of contamination were noted.

5.1.2 Description

These HE storage magazines were 9- x 11-ft wooden structures with earth berms on three sides. They were located approximately 225 ft north of TA-16-370 in a level, semi-wooded region that drains to the east (Figure 5.0-1). Evidence of the driveway that led to the magazines is still visible. The current location of the soil used in the berms is not known.

5.1.3 Previous Investigations

No previous investigations have been performed at these sites.

5.1.4 Field Investigation

The goal of the Phase I investigation was to determine using biased sampling if any constituents were at a level of concern. The sampling design was biased to detect contaminants by collecting samples at locations most likely to be contaminated, according to the site conceptual model. The use of these magazines only for storage of raw HE and finished HE product and the mode of removal of the magazines by burning during decontamination and decommissioning (D&D) activities suggested that residual contamination is extremely unlikely at these PRSs. Therefore limited sampling was proposed to evaluate the presence or absence of contamination.

The site conceptual model for releases at the HE magazines is that contamination is most likely to have occurred via spillage of HE on the floor of the magazine, followed by dispersal of that HE to underlying soils either via leakage from cracks in the wood floors or via sweeping out the doorways of the magazine. It is assumed that such solid-phase discharge would have resulted in the highest constituent concentrations in near-surface soils (0–0.5 ft). Because these structures have no plumbing and are located on level ground, it was hypothesized that little hydrologic head that could have driven constituents into the subsurface would ever have been present at these sites. Minor dispersal of contaminants to shallow depths (< 18 in.) may have occurred during removal or grading of the berms surrounding the magazine. This conceptual model guided sampling and screening locations. Field screening—particularly for the HE, which are the principal constituents likely to be present at this site—was further used to bias sample locations, based on this conceptual model. The intent was to submit samples with positive screening results for laboratory analysis.

The sampling plan for these sites called for analysis of four surface soil samples, at 0 to 18 in. depth, to be collected in the four quadrants of each PRS. Prior to sampling, this plan was modified to collect four samples and field screen each. Samples that screened positive for HE would be sent for analysis. In the absence of positive field screening, one randomly selected sample would be sent for laboratory analysis. This deviation is consistent with approved sampling plans for other similar HE magazines at TA-16 and was proposed verbally to the EPA Region 6 representatives by the DOE and LANL, and in writing prior to sampling (Jansen and Taylor 1995, 15-16-627).The EPA representative gave verbal concurrence to these changes.

Table 5.1.4-1 lists the samples analyzed at these PRSs. Figure 5.1.4-1 shows the locations of the screening and laboratory samples at these PRSs.

TABLE 5.1.4-1

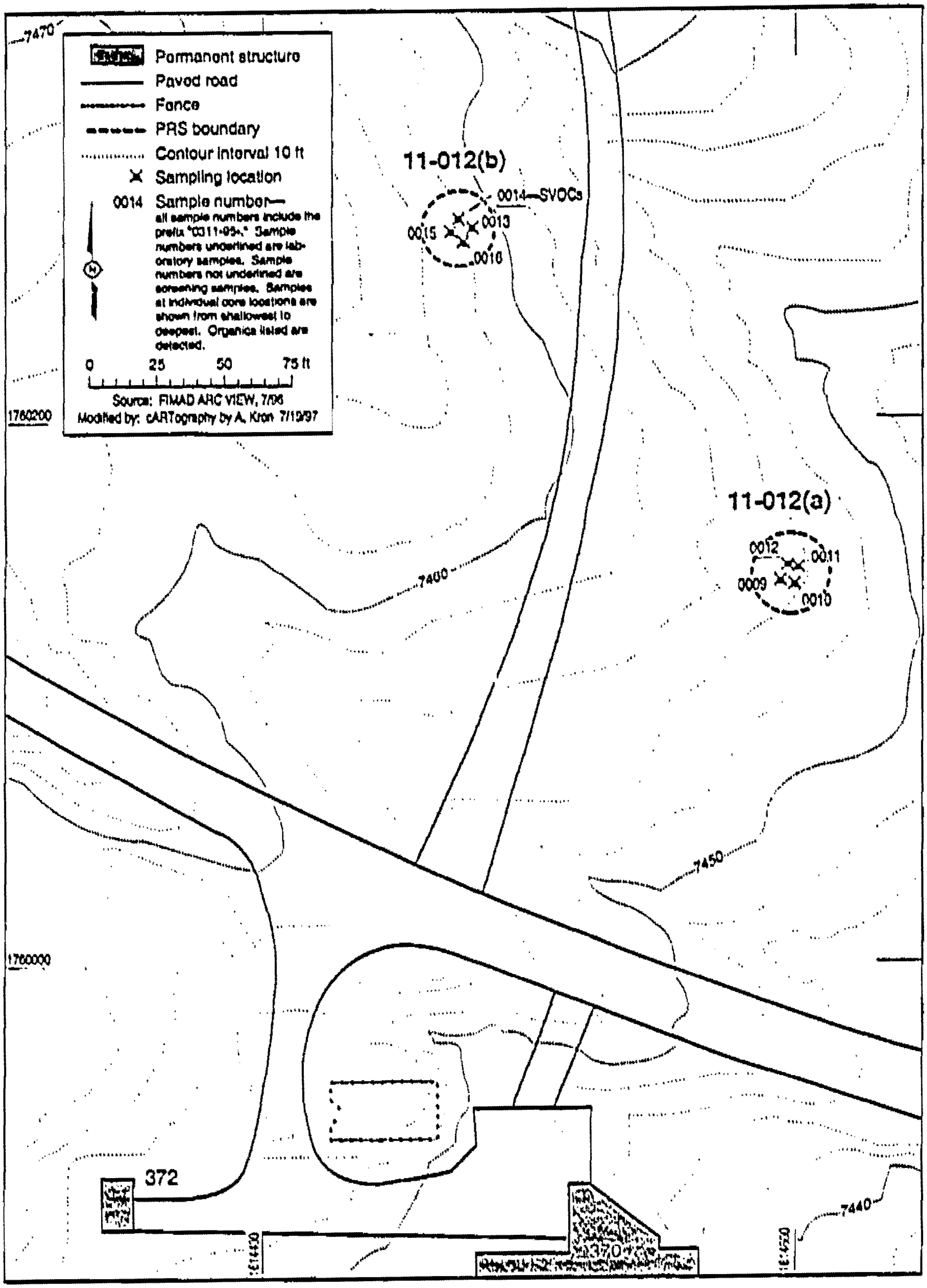
SUMMARY OF REQUEST NUMBERS FOR LABORATORY SAMPLES
TAKEN AT PRSs 11-012(a,b)

SAMPLE ID	LOCATION ID	PRS No.	DEPTH (ft)	SAMPLE MATRIX	SVOCs	INORGs	HE
0311-95-0012	11-0008	11-012(a)	1-1.5	Soil	1251[a]	1252	1251
0311-95-0014	11-0010	11-012(b)	0.5-1	Soil	328	329	328

a. ER analytical request number

The PRS locations were determined based on the presence of gravel roadways and on topographic indications of the presence of the former magazines.

Four screening samples to a depth of 1.5 ft were collected at each PRS with a hand auger. These samples were field screened using the HE spot test kit, a sodium iodide detector, and a PID. The lower limit of detection for the HE spot test kit is 100 ppm. Since this detection limit exceeds the SALs for most HE, these results can be used to bias the selection of samples for laboratory analysis but not to qualify the site as uncontaminated. Positive screening results from any of these three field methods would be used to bias the selection of samples for laboratory analysis. The HE and radiation field measurements were negative for all samples. Four of the eight samples had positive results with the PID. Table 5.1.4-2 identifies these samples and their values. The samples with the highest PID readings from each PRS were selected for laboratory analysis. It is important to note that PID is a generic analysis technique. These instruments often give positive responses to naturally occurring soil gases. Laboratory analysis of soil samples is necessary to distinguish between soil gas interferences and the presence of contaminants.



Source: FIMAD ARC VIEW, 7/96
Modified by: cARTography by A. Kron 7/19/97

Fig. 5.1.4-1. Screening and laboratory sample locations at PRSs 11-012(a,b).

TABLE 5.1.4-2

SUMMARY OF POSITIVE PID SCREENING RESULTS

SAMPLE ID	LOCATION ID	PRS NUMBER	DEPTH (ft)	RESULT (ppm)
0311-95-0009	11-0005	11-012(a)	0-1.5	8.0
0311-95-0011	11-0007	11-012(a)	0-1.5	1.5
0311-95-0012	11-0008	11-012(a)	1-1.5	15.0
0311-95-0014	11-0010	11-012(b)	0.5-1	5.0

Some minor deviations from field activities as described in the accepted work plan (LANL 1993, 1094) were required during field sampling. The depth to tuff at some of the sampling locations was less than that in the approved work plan. Additionally, cobbles and boulders at the site interfered with sampling from the surface to the soil tuff interface with hand augers.

5.1.5 Evaluation of Inorganic Chemicals

Inorganics were not present at levels greater than UTLs at PRSs 11-012(a,b).

5.1.6 Evaluation of Radionuclides

Radionuclides were not analyzed for at PRSs 11-012(a,b) because historical evidence indicates that radioactive material was not stored in HE magazines.

5.1.7 Evaluation of Organic Chemicals

No HE was detected at either of these two sites. Trace levels of organic constituents were present above detection levels at PRS 11-012(b) only. Table 5.1.7-1 indicates the levels of the constituents.

TABLE 5.1.7-1

PRS 11-012(b) SOIL CONCENTRATIONS FOR DETECTED ORGANIC ANALYTES

SAMPLE ID	DEPTH (ft)	BENZOIC ACID (mg/kg)	BIS-(2-ETHYLHEXYL) PHTHALATE (mg/kg)	DI-N-BUTYL PHTHALATE (mg/kg)
SAL	N/A	100 000	32	6500
EQL	N/A	3.3	0.33	0.33
0311-95-0014	0.5-1	0.056	2.9	0.061

The levels of organic constituents detected were far below SALs and do not present a hazard at this site. Di-n-butylphthalate and bis-(2-ethylhexyl) phthalate are common plasticizers. Bis-(2-ethylhexyl) phthalate was found in the blank. The concentration found in the sample was greater than 10 times the value in the blank and it is therefore listed as present in the sample.

5.1.8 Risk-Based Screening Assessment

No chemicals were present at levels above SALs. Visual inspection of the data indicates that multiple chemical evaluation (MCE) screening would yield a value far less than the target limit of 1.

5.1.9 Human Health Risk Assessment

No human health risk assessment was performed for PRSs 11-012(a,b) because there were no constituents above SALs.

5.1.10 Preliminary Ecological Assessment

In cooperation with the New Mexico Environment Department (NMED) and EPA Region 6, the Laboratory Environmental Restoration (ER) Project is developing an approach for ecological risk assessment. Further ecological risk assessment at this site will be deferred until this site can be assessed as part of the ecological exposure unit methodology currently being developed. When completed, the ecological risk assessment will be provided as an attachment.

5.1.11 Conclusions and Recommendation

Each PRS was divided into quadrants and one sample was collected from each quadrant for a total of eight samples for the two PRSs. Of the three field screening techniques employed, only PID gave positive results. The sample selected for laboratory analysis from each PRS was the sample with the highest PID measurement value. No inorganic or organic contamination was found above SALs in these samples. No COPCs were identified. Based on these results, there is no significant risk to human health at these sites. Because of the lack of hazardous constituents, these PRSs are recommended for human-health NFA based on NFA Criterion 5.

5.2 PRSs 13-003(a,b)

PRS 13-003(a) is the septic tank associated with a septic system that also includes a leach field (PRS 13-003[b]). PRS 13-003(a) is structure TA-16-486. These PRSs served TA-16-475 at TA-13 (P-Site) during the 1940s and early 1950s. Potential Release Site 13-003(a) is proposed for human-health NFA based upon NFA Criteria 1. PRS 13-003(b) has been partially investigated; however, addtional sampling will be proposed in a future Phase II sampling and analysis plan.

5.2.1 History

PRSs 13-003(a,b) are discussed in detail in Subsection 5.4 of the RFI work plan (LANL 1993, 1094).

This septic system served an office and shop building (TA-16-475) associated with implosion and initiator testing. Engineering drawing ENG-C- 1641, sheet 1 of 7, shows that in 1944 the building, which had a toilet, lavatory, and small darkroom, was southwest of the septic tank and leach field. The discharge to this septic system is unknown, although a report states that either HE or radionuclide contamination might be present in the subsurface soil near the septic system (Buckland 1948, 15-13-011). Engineering drawing ENG-R-5111, sheet 2 of 7, indicates removal of septic tank TA-16-486 and building TA-16-475 took place in 1951, but does not indicate removal of the leach field. Building TA-16-475 will be investigated as C-16-049.

According to a 1944 construction drawing, ENG-C 1641, sheet 1 of 7, the leach field was approximately 100 ft northeast of the septic tank. The septic tank was located northeast of TA-16-343. The PRS boundary was determined on the basis of this 1944 engineering drawing. The entire area was leveled in the early 1950s when TA-16-340 and its associated structures were built. Portions of TA-16-340 and its associated structures were built on top of the original location of the septic tank. Potential contaminants at this site were identified as: HE, HE degradation products and impurities, metals (particularly silver and barium), uranium, and laboratory chemicals such as solvents.

5.2.2 Description

The septic tank discharged to the leach field through 4-in. vitreous-clay tile. PRSs 13-003(a,b) are located in a level and highly industrialized area near TA-16-340 (Figure 5.0-1).

5.2.3 Previous Investigations

No previous investigations have been performed at this site.

5.2.4 Field Investigation

The objective of Phase I sampling at this site was to determine via biased sampling if a release had occurred from the septic system and drain line and if that release caused contamination above action levels. The sampling design was biased to detect contaminants by collecting samples at locations most likely to be contaminated, according to the site conceptual model. The sampling and analysis plan was also designed to: (1) delineate any contamination above action levels in both a vertical and downgradient directions to support cleanup activities; and (2) provide sufficient data to support a preliminary risk assessment. If contamination did occur, Phase I investigation would also identify all COPCs.

The site conceptual model for releases at this septic system is that the primary release mechanism to the PRS is by discharge of constituents through the septic tank to the associated leach field. Locations just below drainlines or drain tiles in the leach field and locations beneath the drainfield at the soil-tuff interface were hypothesized to represent locales of maximum potential contamination. It is assumed that discharge in such systems will result in the highest constituent concentrations either at the proximal or distal ends of the leach field system. The soil-tuff interface, a location of variation in hydrogeologic properties and a possible site of interflow, is likely to be a zone of contaminant concentration. This conceptual model guided selection of sampling and screening localities. Field screening was further used to bias sample locations, based on this conceptual model.

The conceptual model for this septic system also assumed that the septic system, if it was not entirely located beneath TA-16-340, could be located using geophysical methods or potholing.

Table 5.2.4-1 lists the samples analyzed at PRSs 13-003(a,b). Figure 5.2.4-1 shows the locations of the screening and laboratory samples taken at in support of investigation at these PRSs. As noted below, these samples may not have been taken within the septic system because no evidence confirming the location of this system was found.

TABLE 5.2.4-1

SUMMARY OF REQUEST NUMBERS FOR LABORATORY SAMPLES TAKEN AT PRSs 13-003(a,b)

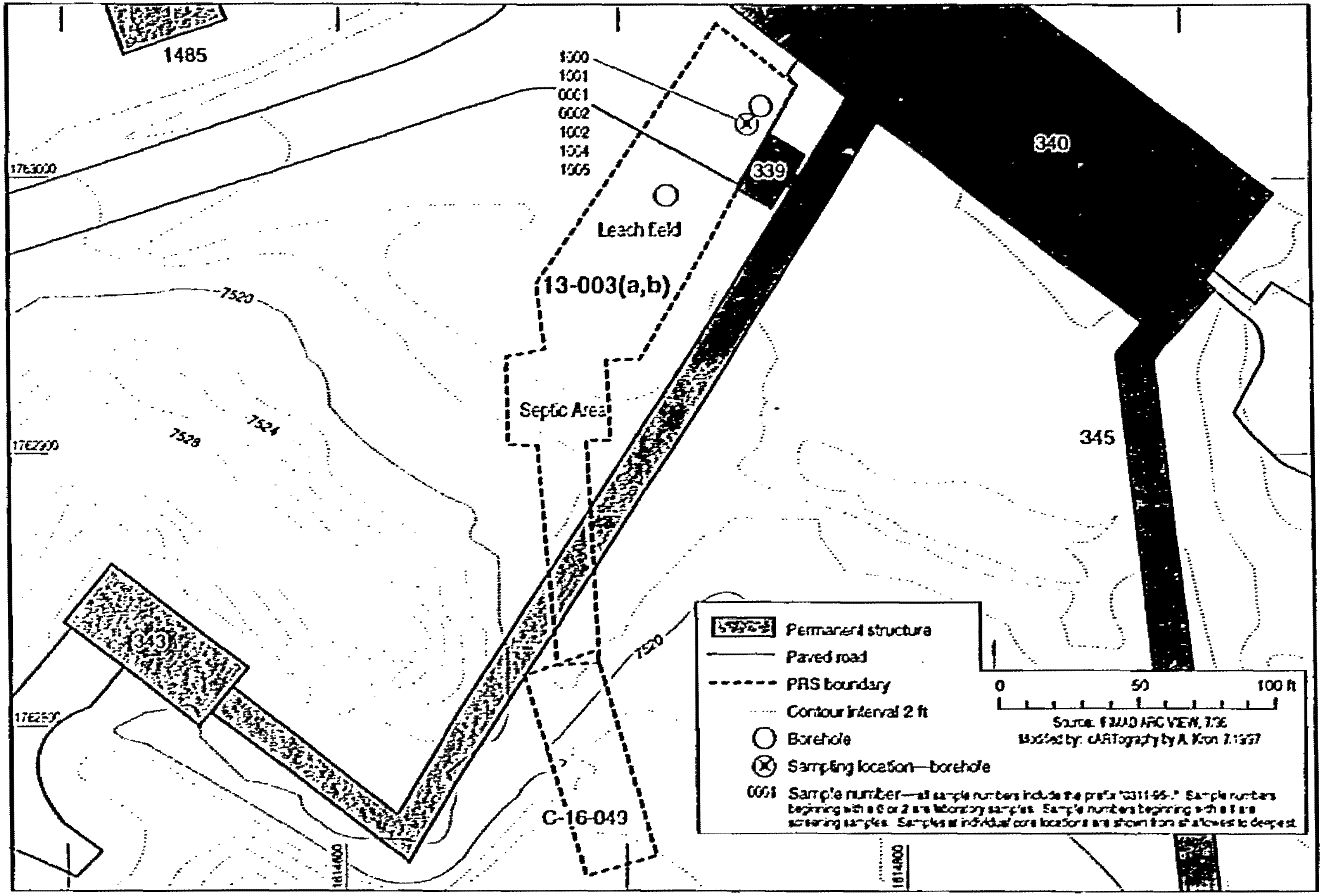
SAMPLE ID	LOCATION ID	DEPTH (ft)	SAMPLE MATRIX	VOCs	SVOCs	INORGs	HE	URANIUM
0313-95-0001	13-0001	1.5-2.5	Soil	1242[a]	1242	1243	1242	1244
0313-95-0002	13-0001	3-4	Soil	1242	1242	1243	1242	1244

a. ER analytical request number

The sampling plan for a septic system required two boreholes to be drilled at the proximal and distal end of the leach field. Two ground penetrating radar (GPR) geophysical surveys were conducted at this site to locate the drain lines. The survey identified subsurface anomalies at a depth of 2.5 to 3.5 feet, but these signatures could be due either to the leach field or to utility trenches in the area. Two drill holes were advanced at the distal end of the PRS and one hole was advanced and the proximal end of the PRS. These locations did not provide evidence of the leach field such as engineered fill. Drilling tools could not be safely advanced in other locations due to the density of underground utilities.

Laboratory samples were collected from the deeper (6.5 ft) distal borehole. Split spoon samplers were used to collect seven screening samples, two of which were sent for laboratory analysis. Sample 0313-95-0001 was collected from the depth where the drain line was expected to be located based on GPR surveys. Sample 0313-95-0002 was collected from the interval containing the soil-tuff interface. These samples consist of one foot intervals of the soil column instead of 6 inches as specified in the RFI work plan. This is because the smaller samples yield insufficient material for the requested analytical suites. All samples were field screened for HE with the spot test, for radiation with a sodium iodide detector, and for volatiles with a PID. All field screening results were negative.

Because no other boreholes can be safely drilled in this area, further drilling cannot take place at this site. Available technology was used to locate the drain lines and septic tank without success. Analytical samples were collected from the location most likely to have intersected the drain line. These limited analytical results are not sufficient for making an assessment of the leach field PRS. Further investigations will require sampling via hand excavation, vacuum removal of soil, and other less aggressive methods than drilling.



Sample number—all sample numbers include the prefix "0311-96-." Sample numbers beginning with a 0 or 2 are laboratory samples. Sample numbers beginning with a 1 are screening samples. Samples at individual core locations are shown from shallowest to deepest.

Fig. 5.2.4-1. Screening and laboratory sample locations at PRSs 13-003(a,b).

5.2.5 Evaluation of Inorganic Chemicals

Inorganics were not present at levels greater than UTLs at PRSs 13-003(a,b).

5.2.6 Evaluation of Radionuclides

Radionuclides were not present at levels near SALs or UTLs.

5.2.7 Evaluation of Organic Chemicals

Organic constituents were not present above detection levels at PRSs 13-003(a,b).

5.2.8 Risk-Based Screening Assessment

No COPCs were identified during the investigation.

5.2.9 Human Health Risk Assessment

No human health risk assessment was performed for PRSs 13-003(a,b) because there were no constituents above SALs or UTLs.

5.2.10 Preliminary Ecological Assessment

In cooperation with the New Mexico Environment Department (NMED) and EPA Region 6, the Laboratory Environmental Restoration (ER) Project is developing an approach for ecological risk assessment. Further ecological risk assessment at this site will be deferred until this site can be assessed as part of the ecological exposure unit methodology currently being developed. When completed, the ecological risk assessment will be provided as an attachment.

5.2.11 Conclusions and Recommendation

PRSs 13-003(a,b) are located in a highly industrialized area. The most likely location of these PRSs is in an area where significant soil disturbance would have occurred during the construction of TA-16-340 and its associated utilities. The density of subsurface structures has made sampling at this site very difficult. Ground penetrating radar was used to locate these PRSs without success. Sampling was conducted at locations most likely to intersect the septic system without damaging the active utilities in the leach field PRS. The leach field was not located, based upon the results of the boreholes.

The septic tank, PRS 13-003(a),has been removed according to engineering drawing ENG-R 5111, sheet 2 or 7, and the Engineering Structure list. No evidence of the leach field was found during drilling. Consequently, PRS 13-003(a) is proposed for human-health NFA based upon NFA criterion 1. The leach field, PRS 13-003(b), has not been located. Existing active utilities prevent further drilling investigations without incurring unacceptable worker risks. LANL cannot assure that this unit has been removed and that this unit has been adequately investigated. A Phase II SAP for PRS 13-003(b), which proposes investigation using less aggressive methods than drilling, will be provided.

5.3 PRS 16-006(C)

PRS 16-006(c) comprises a septic tank, TA-16-371, and its associated 4-in. vitreous clay pipe drainline and drainage (LANL 1990, 0145). This septic tank served TA-16-370, which was a facility used for barium nitrate grinding and non-HE machining. Potential contaminants include barium, volatile organics, and semivolatile organics originating from machining and barium nitrate grinding activities in TA-16-370. It is recommended for human-health NFA because the contamination present at the site is below human-health based levels of concern.

5.3.1 History

PRS 16-006(c) is discussed in detail in Subsection 5.4 of the RFI Work Plan (LANL 1993, 1094).

Septic tank TA-16-371 was installed in 1953. It served six floor drains, three bathrooms, and two sinks on the third floor of TA-16-370 (WX Outfall Drawing 13Y-192147). The septic tank is currently used as a holding tank for water from floor drains and the third floor restrooms. It is regularly pumped when the building is operational. Building TA-16-370 is currently inactive. Potential contaminants at this site were identified as: HE, HE impurities and degradation products, metals (particularly barium from barium nitrate grinding), uranium, and laboratory chemicals such as solvents.

5.3.2 Description

PRS 16-006(c) is a 1 200-gal., reinforced-concrete septic tank located west of TA-16-370 (Figure 5.0-1). A 4-in. vitreous-clay pipe drain line empties to daylight at the rim of Water Canyon approximately 260 ft south of the septic tank. The clay pipe drains to a soil/cobble surface for a few feet before discharging into the canyon. The drainline is currently plugged at the septic tank. It is not known when the drainline was plugged.

5.3.3 Previous Investigations

No previous investigations have been performed at this site.

5.3.4 Field Investigation

The objective of Phase I sampling at this site was to determine via biased sampling if a release had occurred from the septic system and drain line outfall and if that release caused contamination above action levels. The sampling design was biased to detect contaminants by collecting samples at locations most likely to be contaminated, according to the site conceptual model. The sampling and analysis plan was also designed to: 1) delineate any contamination above action levels in both a vertical and downgradient directions to support cleanup activities; and 2) provide sufficient data to support a preliminary risk assessment. If contamination did occur, Phase I investigation would also identify all COPCs.

The site conceptual model for releases at this septic system is that the primary release mechanism to the PRS is by discharge of constituents through the septic tank to the associated drainline and outfall. Locations just below drainlines, locations beneath the drainline at the soil-tuff interface, and sediment samples directly downgradient from the outfall were hypothesized to represent locales of maximum potential contamination. It is assumed that discharge in such systems will result in the highest constituent concentrations either at the proximal or distal ends of the drainline. The soil-tuff interface, a location of variation in hydrogeologic properties and a possible site of interflow, is likely to be a zone of contaminant concentration. Non-volatile constituents (e.g. SVOCs, HE, inorganics) are hypothesized to decrease in concentration vertically into tuff and downgradient from the outfall. Volatile organics are likely to be at higher concentrations in subsurface samples because they are likely to volatilize in near-surface samples due to temperature fluctuations. This conceptual model guided selection of sampling and screening localities. Field screening was further used to bias sample locations, based on this conceptual model.

Subsurface samples were collected at the proximal and distal ends of the septic pipe. Sediment samples were collected at the outfall of the pipe as well as at 2.5 ft and 5 ft downgradient from the outfall. Boreholes were sampled with a split spoon. The borehole at the proximal end was drilled to a depth of 8 ft, with the soil-tuff interface at 5 ft. The distal borehole was drilled to a depth of 3.5 ft, with the soil-tuff interface at 2 ft. Two samples were collected from each hole, one at the soil-tuff interface and one at the estimated depth of the drain line.

The proximal borehole location was determined by examining the exit pipe location in the septic tank itself. The drill rig was then placed over the estimated location, slightly downgradient from the septic tank. During drilling there was a grinding noise that is characteristic of drilling through clay pipe. The drill met refusal temporarily and then advanced as if passing through a pipe. However, no clay pipe cuttings were retrieved when collecting samples. The field team believes that the drain pipe was encountered during drilling and samples were collected at the depth of the pipe.

The drain line pipe was not located while drilling the distal borehole. Physical evidence at the site, including cobbles and clay pipe fragments, indicate that the field investigation had located the original pipe alignment and that the drain line probably had been removed in this area. The expected location of the distal borehole was determined by line of sight from the outfall to the septic tank. Five borings (potholes) were drilled to a depth of 1 ft into tuff in a line perpendicular to the expected location to search for backfill or other evidence of the drain line. The initial pothole was located by line of sight with the outfall and tank. This location had PID readings slightly above background, which were the highest readings at this site. Based on these results, the distal borehole analytical sample was collected from this location.

Each core was field screened for HE, radioactivity, and for VOCs at 1 ft intervals. All screening results except for the PID reading mentioned above, were negative. These screening intervals were used because 0.5-ft intervals in boreholes did not provide sufficient material for sampling. Surface samples were collected using the spade and scoop method, and were collected to a depth of 0.5 ft.

Supplemental sampling was conducted in September 1996 after the RFI Phase I investigation was complete. Because the Phase I data did not bound the downgradient extent of the contamination from the outfall, one more downgradient sample (0316-96-0170) was collected and analyzed for metals and SVOCs. Three locations downgradient from sample 0316-95-0296 were field screened for barium using XRF. The location with the highest field screening result was selected for laboratory analysis (0316-96-0170).

Table 5.3.4-1 contains information about all samples collected at this site. Figure 5.3.4-1 shows the sample locations.

TABLE 5.3.4-1

SUMMARY OF REQUEST NUMBERS FOR LABORATORY SAMPLES TAKEN AT PRS 16-006(c)

SAMPLE ID	LOCATION ID	DEPTH (ft)	SAMPLE MATRIX	SVOCs	VOCs	RAD	INORGs
0316-95-0289	16-1615	2.5–4	Soil	1192[a]	1192	1194	1193
0316-95-0290	16-1615	5–6	Qbt4	1192	1192	1194	1193
0316-95-0291	16-1616	0–1	Soil	1251	1251	1253	1252
0316-95-0292	16-1616	1–3.5	Qbt4	1251	1251	1253	1252
0316-95-0293	16-1614	0–0.5	Soil	328	328	330	329
0316-95-0294	16-1614	0.5–0.6	Soil	328	328	330	329
0316-95-0295	16-1612	0–0.5	Soil	328	328	330	329
0316-95-0296	16-1613	0–0.5	Soil	328	328	330	329
0316-96-0170	16-2640	0–0.5	Soil	2634	N/A	N/A	2636

a. ER analytical request number

5.3.5 Evaluation of Inorganic Chemicals

Barium was present in one location at a concentration greater than SAL (Table 5.3.5-1). All other inorganics were at levels less than SALs. Samples 0316-95-0294 and -0295 showed slightly elevated levels of mercury. The PE sample associated with this sample batch also had an elevated value for mercury. This suggests that the mercury results are higher than the actual concentrations due to an artifact in the analysis of the samples. In any event, these data are well below the mercury SAL.

The furthest downgradient sample, 0316-96-0170, did not contain barium at a level above the UTL. This was an extra sample beyond those prescribed in the RFI work plan. It was designed to bound the barium contamination in the downgradient direction. Manganese, chromium, and aluminum were P-qualified due to poor duplicate results. These data should be considered estimated. With the exception of chromium, these constituents are not known to be potential

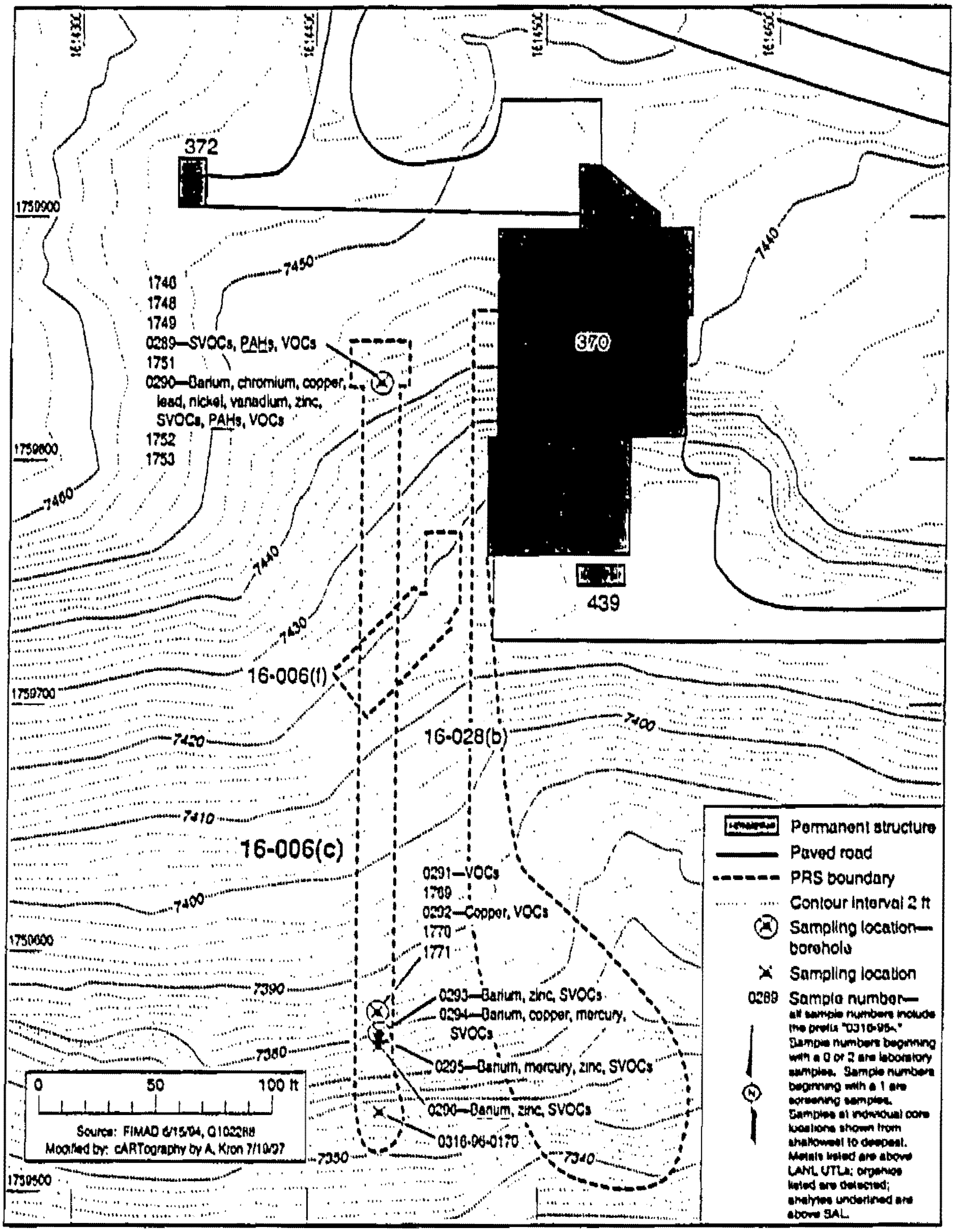


Fig. 5.3.4-1. Sample locations for PRS 16-006(c).

TABLE 5.3.5-1

INORGANICS WITH CONCENTRATIONS GREATER THAN BACKGROUND UTL FOR PRS 16-006(c)

SAMPLE ID	DEPTH (ft)	SOIL/ROCK UNIT	BARIUM (mg/kg)	CHROMIUM (mg/kg)	COPPER (mg/kg)	LEAD (mg/kg)	MERCURY (mg/kg)	NICKEL (mg/kg)	VANADIUM (mg/kg)	ZINC (mg/kg)
LANL UTL (all soil)	N/A^a	N/A	315	19.3	15.5	23.3	0.1	15.2	41.9	50.8
LANL UTL (Qbt4)	N/A	N/A	56.6	10.9	6.4	11	NC^b	8.7	9.5	75.4
SAL	N/A	N/A	5 300	210	2 800	400	23	1 500	540	23 000
0316-95-0290	5-6	Qbt4	133	50.1 (P^c)	334	11.2	0.05 (U^d)	89.2 (J+^{e})	17.4	206
0316-95-0292	1-3.5	Qbt4	18.1	3.1	21.9	1.6	0.05 (U)	1.6	3.7	36.6
0316-95-0293	0-0.5	Soil	668	5.2	10.4	22.8	0.09 (U)	2.8 (U)	6.2 (U)	65.5
0316-95-0294	0.5-0.7	Soil	2 610	13.6	18.2	17.7	0.17	4.7 (U)	9.1	47.8
0316-95-0295	0-0.5	Soil	4 590	7.9	12.6)	23	0.15	1.9 (U)	8.9	55
0316-95-0296	0-0.5	Soil	6 540	10.2	25.1	23.3	0.11 (U)	5.3 (U)	14.2	107

a. N/A = Not Applicable
b. NC = Not Calculated
c. P = Professional judgment should be applied, depending on proposed use of the data
d. U = Undetected. The listed value is the detection limit
e. J+ = Estimated value likely to be high

5.3.6 Evaluation of Radionuclides

Radionuclides were analyzed at PRS 16-006(c). All radionuclides, except potassium-40, were at levels below SALs. The value for potassium-40 was at a level greater than SAL. However, this element is a naturally occurring isotope. There is no evidence that it has been used at LANL. Potassium-40 is only included in the gamma spectroscopy analysis to serve as a QC measure of the analysis and will not be considered further in the screening analysis.

5.3.7 Evaluation of Organic Chemicals

Benzo(a)pyrene is the only organic compound present above SALs at PRS 16-006(c) (Table 5.3.7-1). Other organic constituents were present at levels above detection limits, including a large number of PAHs and phthalates. Phthalates are commonly used plasticizers.

Table 5.3.7-2 lists the VOCs detected at this PRS. Very few VOCs were detected and all were present at low levels, some qualified as estimated.

TABLE 5.3.7-1

PRS 16-006(c) SOIL CONCENTRATIONS FOR DETECTED SVOC ANALYTES

SAMPLE ID	DEPTH (FT)	ACENAPHTHENE (mg/kg)	ANTHRACENE (mg/kg)	BENZO(A)-ANTHRACENE (mg/kg)	BENZO(A)-PYRENE (mg/kg)	BENZO(B)-FLUORANTHENE (mg/kg)	BENZO-(G,H,I)-PERYLENE (mg/kg)	BENZOIC ACID (mg/kg)	BENZO(K)-FLUORANTHENE (mg/kg)	BIS(2-ETHYLHEXYL)-PHTHALATE (mg/kg)
SAL	N/A	2 200	18 000	0.61	0.061	0.61	NC[b]	100 000	6.1	32
EQL	N/A	0.33	0.33	0.33	0.33	0.33	0.33	3.3	0.33	0.33
0316-95-0283	2.5-4	0.35 (U[c])	0.063 (J[d])	0.17 (J)	0.15 (J)	0.13 (J)	0.08 (J)	3.5 (U)	0.068 (J)	N/A[d]
0316-95-0283DL	2.5-4	NA[e]	NA	NA	NA	NA	NA	NA	NA	16
0316-95-0290	5-6	0.058 (J)	0.12 (J)	0.21 (J)	0.19 (J)	0.22 (J)	0.039 (J)	3.5 (U)	0.093 (J)	0.11 (J)
0316-95-0293	0-0.5	0.44 (U)	0.44 (U)	0.44 (U)	0.44 (U)	0.44 (U)	0.44 (U)	0.2 (J)	0.44 (U)	0.28 (J)
0316-95-0294	0.5-0.7	2.4 (U)	2.4 (U)	2.4 (U)	2.4 (U)	2.4 (U)	2.4 (U)	0.62 (J)	2.4 (U)	1.8 (J)
0316-95-0295	0-0.5	0.42 (U)	0.42 (U)	0.42 (U)	0.42 (U)	0.42 (U)	0.42 (U)	0.35 (J)	0.42 (U)	0.16 (J)
0316-95-0296	0-0.5	0.93 (U)	0.93 (U)	0.93 (U)	0.93 (U)	0.93 (U)	0.93 (U)	0.67 (J)	0.93 (U)	0.42 (J)

CHRYSENE (mg/kg)	DIBENZOFURAN (mg/kg)	1,4-DICHLOROBENZENE (mg/kg)	DI-N-BUTYLPHTHALATE (mg/kg)	FLUORANTHENE (mg/kg)	FLUORENE (mg/kg)	INDENO(1,2,3-CD) PYRENE (mg/kg)	NAPHTHALENE (mg/kg)	PHENANTHRENE (mg/kg)	PYRENE (mg/kg)
61	250	3.6	6 500	2 600	2 300	0.61	1 000	NC	19 000
0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
0.24 (J)	0.35 (U)	0.35 (U)	0.35 (U)	0.38	0.35 (U)	0.063 (J)	0.033 (J)	0.26 (J)	0.26 (J)
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
0.28 (J)	0.038 (J)	0.35 (U)	0.35 (U)	0.43	0.065 (J)	0.1 (J)	0.064 (J)	0.44	0.41
0.44 (U)	0.44 (U)	0.05 (J)	0.054 (J)	0.048 (J)	0.44 (U)	0.44 (U)	0.44 (U)	0.44 (U)	0.44 (U)
2.4 (U)	2.4 (U)	2.4 (U)	2.4 (U)	2.4 (U)	2.4 (U)	2.4 (U)	2.4 (U)	2.4 (U)	2.4 (U)
0.42 (U)	0.42 (U)	0.42 (U)	0.42 (U)	0.42 (U)	0.42 (U)	0.42 (U)	0.42 (U)	0.42 (U)	0.42 (U)
0.93 (U)	0.93 (U)	0.93 (U)	0.93 (U)	0.93 (U)	0.93 (U)	0.93 (U)	0.93 (U)	0.93 (U)	0.93 (U)

[a] N/A = Not Applicable
[b] NC = Not Calculated
[c] U = Undetected—the listed value is the detection limit
[d] J = Estimated quantity—result is above the detection limit but below the estimated quantitation limit
[e] NA = Not Analyzed

TABLE 5.3.7-2

PRS 16-006(c) SOIL CONCENTRATIONS FOR DETECTED VOC ANALYTES

SAMPLE ID	DEPTH (ft)	ACETONE (mg/kg)	METHYLENE CHLORIDE (mg/kg)	P-ISOPROPYL-TOLUENE (mg/kg)
SAL	N/A[a]	2 100	7.8	NC[b]
EQL	N/A	0.02	0.005	0.005
0316-95-0289	2.5-4	0.021 (U[c])	0.004 (J[d])	0.005 (U)
0316-95-0290	5-6	0.021 (U)	0.003 (J)	0.005 (U)
0316-95-0291	0-1	0.012 (J)	0.005 (U)	0.014
0316-95-0292	1-3.5	0.02 (U)	0.008 (U)	0.024

a. N/A = Not Applicable
b. NC = Not Calculated
c. U = Undetected—the listed value is the detection limit
d. J = Estimated quantity—result is above the detection limit but below the estimated quantitation limit

5.3.8 Risk-Based Screening Assessment

Eight inorganic and sixteen organic chemicals were carried forward from the background comparison and organic constituent evaluation. As described in Chapter 3 of this RFI Report, analytes are divided into two classes, noncarcinogens and carcinogens, for screening assessment (depending on which toxicological effect forms the basis of their SAL). This separation is required in order to evaluate possible additive effects within each class of chemical.

Barium exceeded its SAL value in surface sample 0136-95-0296. Benzo(a)pyrene exceeded its SAL value in subsurface samples 0316-95-0289 and 0316-95-0290. The sample results that exceeded the SAL values are highlighted by black backgrounds in the previous tables. These two compounds are retained for further evaluation as COPCs.

An MCE calculation was performed using the sum of the maximum concentrations of constituents detected at levels greater than background UTLs but below SALs. The MCE calculations are presented in Table 5.3.8-1. The MCE results for noncarcinogens and carcinogens are 0.37 and 1.2, respectively. The MCE value for noncarcinogens is less than unity; therefore, a potential human health risk based on additive effects is not identified for this class of chemical. The carcinogenic COPCs that have a normalized value of more than 0.1 at this PRS are chromium, benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene. These compounds are, therefore, also retained as COPCs for further evaluation.

TABLE 5.3.8-1

MCE CALCULATION FOR PRS 16-006(c)

ANALYTE	MAX CONC. (mg/kg)	SAL (mg/kg)	NORMALIZED VALUE
Noncarcinogenic Effects			
Copper	334	2800	0.12
Lead	11.2	400	0.03
Mercury	0.17	23	0.01
Nickel	89.2	1500	0.06
Vanadium	17.4	540	0.03
Zinc	206	23 000	0.01
Acenaphthene	0.058	2 200	<0.01
Anthracene	0.12	18 000	<0.01
Fluoranthene	0.49	2600	<0.01
Fluorene	0.065	2 300	<0.01
Naphthalene	0.064	1 000	<0.01
Benzoic Acid	0.67	100 000	<0.01
Dibenzofuran	0.038	250	<0.01
Di-n-butylphthalate	0.054	6500	<0.01
Naphthalene	0.064	1000	<0.01
Pyrene	0.41	19 000	<0.01
Acetone	0.012	2 10000	<0.01
TOTAL			0.37
Carcinogenic Effects			
Chromium	50.1	210	0.24
Benzo(a)anthracene	0.21	0.61	0.34
Benzo(b)fluoranthene	0.22	0.61	0.36
Benzo(k)fluoranthene	0.093	6.1	0.02
Chrysene	0.28	61	<0.01
1,4-Dichlorobenzene	0.05	3.6	0.01
Indeno(1,2,3-cd)pyrene	0.1	0.61	0.16
Bis(2-ethylhexyl)phthalate	0.42	32	0.01
Methylene Chloride	0.004	7.8	<0.01
TOTAL			1.2

5.3.9 Human Health Risk Assessment

Six COPCs were identified in the screening assessment from Subsection 5.3.8. They are benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, chromium, and barium. A quantitative human health risk assessment was not performed for this PRS. However, a qualitative evaluation of these COPCs is presented.

One PAH, benzo(a)pyrene, was detected at twice its SAL in two subsurface samples at the proximal end of the septic pipe. The other PAHs were also detected in the subsurface and range from 16% to 36% of their respective SALs. Additionally, the chromium result for sample 0316-95-0290 is 24% of its SAL. This value was qualified due to poor duplicate recovery. Barium exceeded SAL by 23% in one surface sample near the pipe outfall as shown in Figure 5.3.4-1.

The basis of the SALs is residential exposure to soil contaminants via dermal contact, inhalation and ingestion over a 0.5 acre contaminant source area. These values are computed using dose response estimates for children because they are the most susceptible subset of the human population.

The samples that have contaminant concentrations of concern were collected at 2.5-4 ft and 5-6 ft below the ground surface. There is no current viable pathway that could result in exposure of humans to soils at these depths.

This PRS is located in a heavily industrialized area. This landuse will continue into the foreseeable future. A more reasonable population to assess for potential exposure from this PRS is industrial workers. All of the COPCs at this PRS are below the EPA Region IX industrial scenario Preliminary Remediation Goal (PRG) values. This includes the surface soil value for barium near the pipe outfall.

This PRS is recommended for human-health NFA. The basis for the recommendation is current landuse extending into the foreseeable future, the lack of an exposure pathway for 5 of the 6 COPCs, the acceptability of potential barium exposure under the industrial scenario, and the limited spatial extent of surface contamination within the PRS relative to the exposure model assumption of 0.5 acres.

5.3.10 Preliminary Ecological Assessment

In cooperation with NMED and EPA Region 6, the Laboratory ER Project is developing an approach for ecological risk assessment. Further ecological risk assessment at this site will be deferred until this site can be assessed as part of the ecological exposure unit methodology currently being developed. When completed, the ecological risk assessment will be provided as an Attachment.

5.3.11 Conclusions and Recommendation

RFI sampling was conducted at locations biased to represent the area of greatest contamination. Barium was the only inorganic constituent found at PRS 16-006(c) above SAL. Benzo(a)pyrene was the only organic constituent found at PRS 16-006(c) above SAL. The COPCs identified in the human health screening assessment were eliminated in a qualitative risk assessment. Therefore, PRS 16-006(c) is recommended for human-health NFA.

Contaminant levels are low and the data generally appear to support the site conceptual model. Soil-tuff interface samples typically show slightly elevated levels relative to shallower samples. Barium concentrations in sediments at the outfall are at lowest abundances in the farthest downgradient sample.

The extent of contamination in the downgradient direction has been bounded. The furthest downgradient sample contains no constituents at levels greater than SAL. Residual PAH at depth are at very low levels - less than Industrial PRGs. Conservative, biased sampling locations revealed no hazardous constituents. Based on sampling results, there is little risk to human health or to the environment at this site. Because of the low levels of hazardous constituents, this PRS is recommended for human-health NFA based on NFA Criterion 5

5.4 PRS 16-006(d)

PRS 16-006(d) is a septic tank, with associated drain lines, distribution box, and tile leach field, that serves TA-16-380, a high explosives inspection building. Sampling results identified nc contaminants above SALs at the site and this PRS is recommended for human-health NFA.

5.4.1 History

PRS 16-006(d) is discussed in detail in Subsection 5.4 of the RFI work plan (LANL 1993, 1094). TA-16-380 was used to inspect raw HE powder prior to its formulation into HE components. It is currently used only for storage. The septic tank was constructed in 1952 to serve five floor drains, two lavatories, and one deep sink on the first floor of TA-16-380 (LANL 1990, 0145; WX Outfall Drawing 13Y-192091). Small amounts of HE and other contaminants could have entered the septic system from any of these drains. This septic system is still in active use.

Potential contaminants at this site were identified as: HE, HE impurities and degradation products, metals (particularly barium from barium nitrate), uranium, and laboratory chemicals such as solvents.

5.4.2 Description

PRS 16-006(d) is a 540-gal., reinforced-concrete septic tank with associated drain lines, distribution box, and tile leach field located south of TA-16-380 (Figure 5.0-1). It is located in a relatively flat, vegetated area that gradually slopes south and east toward Water Canyon. According to the engineering drawings, the septic leach field consists of two branches that run east-west and slightly south of the distribution box. The boundaries for this PRS shown in Figure 5.4.4.1 do not coincide with the plan view of the septic tank and leach field lines as determined based on field surveys. In particular, a geophysics survey showed no evidence for the west branch of this leach field.

5.4.3 Previous Investigations

No previous investigations have been performed at this site.

5.4.4 Field Investigation

The objective of Phase I sampling at this site was to determine via biased sampling if a release had occurred from the septic system and leach field and if that release caused contamination above action levels. The sampling design was biased to detect contaminants by collecting samples at locations most likely to be contaminated, according to the site conceptual model. The sampling and analysis plan was also designed to: 1) delineate any contamination above action levels in the vertical direction to support cleanup activities; and 2) provide sufficient data to support a preliminary risk assessment. If contamination did occur, Phase I investigation would also identify all COPCs.

The site conceptual model for releases at this septic system is that the primary release mechanism to the PRS is by discharge of constituents through the septic tank to the associated leach field. Locations just below leach-field tiles and locations beneath the leach field at the soil-tuff interface were hypothesized to represent locales of maximum potential contamination. It is assumed that discharge in such systems will result in the highest constituent concentrations either at the proximal or distal ends of the leach field. The soil-tuff interface, a location of variation in hydrogeologic properties and a possible site of interflow, is likely to be a zone of contaminant concentration. Both heavy-organic contaminants such as high explosives and

SVOCs, and inorganic contaminants, are hypothesized to decrease in concentration vertically into tuff. This conceptual model guided selection of sampling and screening localities. Field screening was further used to bias sample locations, based on this conceptual model.

Samples were collected at the distribution box and at the distal end of the east branch of the leach field (2 boreholes). A geophysics survey located the east branch of the leach field, but showed no evidence for the west branch of the leach field. Three boreholes were sampled with a split spoon and two samples were collected from each hole. The two samples were collected at the soil-tuff interface and at the depth where the drain tiles would be. The borehole at the distribution box was 6.5 ft deep and penetrated 2.5 ft into tuff. The borehole at the north end of the leach field was 8.5 ft deep and 4.5 ft into tuff. The borehole at the south end of the leach field was 9 ft deep and 4.5 ft into tuff. Engineering fill was encountered during sampling. The vitreous-clay pipe of the leach field was located at a depth of 2 ft.

Each sample was field screened for HE, radioactivity, VOCs, and metals. The samples with positive PID field- screening results are tabulated below in Table 5.4.4-1. All of the HE screening results were negative. The metals and radioactivity screening results were not different from background ranges.

TABLE 5.4.4-1

POSITIVE FIELD SCREENING RESULTS USING A PID FOR ORGANIC VAPOR ANALYSIS

SAMPLE ID	LOCATION ID	DEPTH (FT)	RESULT (ppm)
0316-95-1674	16-1617	1-2	2
0316-95-1689	16-1618	1-2	30
0316-95-1690	16-1618	2-3	160
0316-95-1694	16-1618	6.5-7	14
0316-95-1695	16-1618	7-8.5	14

The borehole at location 16-1617 is not located at the distribution box itself, but is 11 ft downgradient from the estimated location of the distribution box. Two attempts to drill closer to the distribution box resulted in significant volumes of engineering fill gravel in the sample, as well as difficulty drilling to depth due to subsurface structures associated with the distribution box. The drilling location represents a likely biased location to find high levels of contamination, if contamination is present.

Although the RFI work plan called for collecting a sample at the depth of the drain line itself, this sample was not collected at the borehole near the southern distal end. The sample at the depth of the drain line could not be recovered, so a sample from the interval directly below the drain line was sent for laboratory analysis.

The RFI Work Plan called for screening cores at 6-in. intervals. During sampling, cores were screened on 12-in. intervals in order to provide enough material for a full suite analysis.

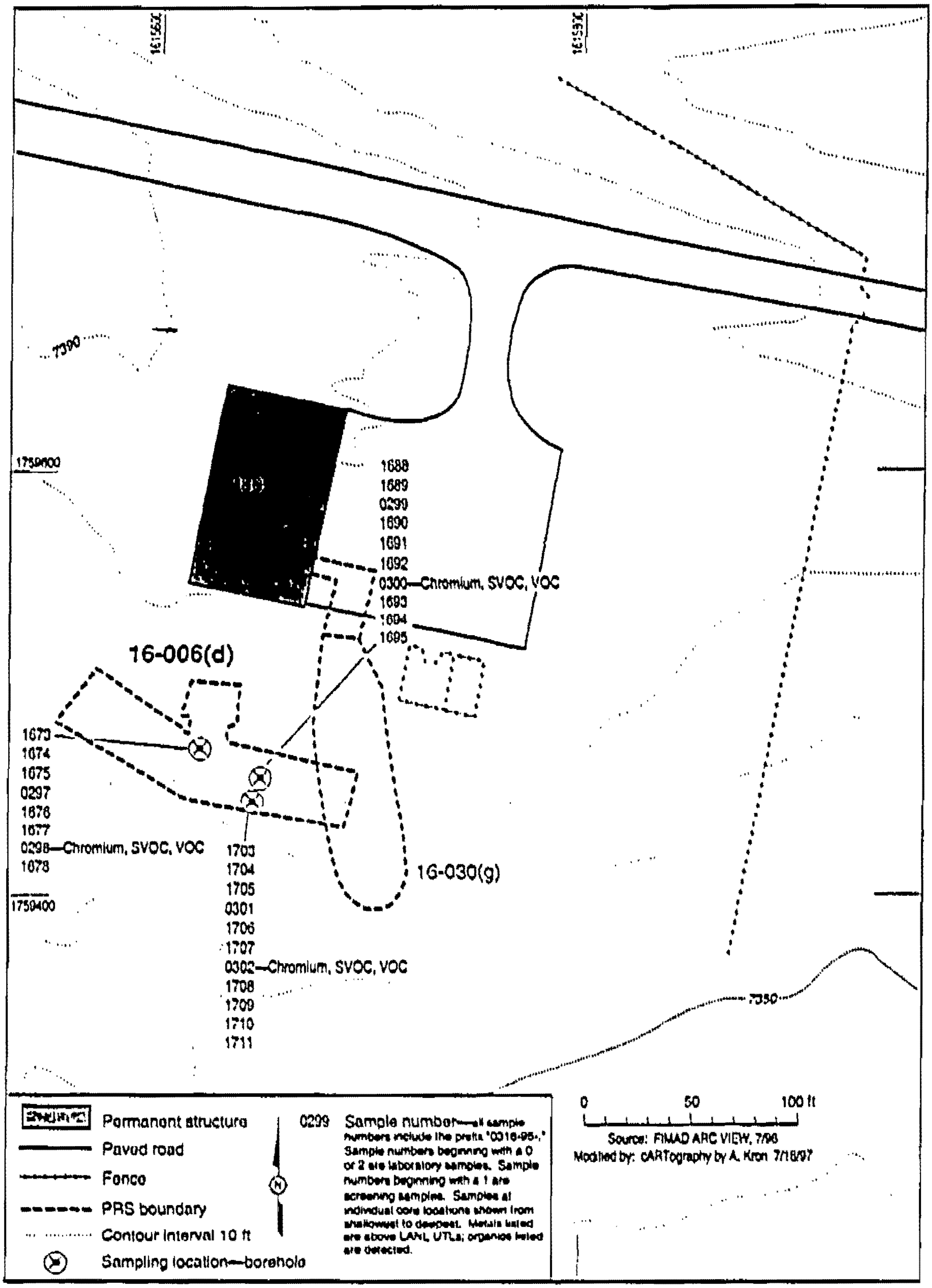
Table 5.4.4-2 contains information about all samples collected at this site. Figure 5.4.4-1 shows the sample locations.

TABLE 5.4.4-2

SUMMARY OF REQUEST NUMBERS FOR LABORATORY SAMPLES TAKEN AT PRS 16-006(d)

SAMPLE ID	LOCATION ID	DEPTH (ft)	SAMPLE MATRIX	SVOCs	VOCs	RAD	INORGs	HE
0316-95-0297	16-1617	2-4	Soil	1102[a]	1102	1108	1106	1102
0316-95-0298	16-1617	4-6.5	Qbt4	1102	1102	1108	1106	1102
0316-95-0299	16-1618	2-3	Soil	1102	1102	1108	1106	1102
0316-95-0300	16-1618	4.5-6.5	Qbt4	1102	1102	1108	1106	1102
0316-95-0301	16-1619	3-4	Soil	1102	1102	1108	1106	1102
0316-95-0302	16-1619	4.5-7	Qbt4	1102	1102	1108	1106	1102

[a] ER analytical request number.



Source: FIMAD ARC VIEW, 7/96
Modified by: cARTography by A. Kron 7/18/97

Fig. 5.4.4-1. Screening and laboratory sample locations at PRS 16-006(d).

5.4.5 Evaluation of Inorganic Chemicals

Table 5.4.5-1 presents the results for inorganic compounds present above UTLs. Three samples contained chromium at a level greater than UTLs. No other inorganics were present at levels greater than UTLs at PRS 16-006(d).

TABLE 5.4.5-1

INORGANICS WITH CONCENTRATIONS GREATER THAN BACKGROUND UTL FOR PRS 16-006(d)

SAMPLE ID	DEPTH (ft)	SOIL/ROCK UNIT	CHROMIUM (mg/kg)
LANL UTL (Qbt4)	N/A[a]	N/A	10.9
SAL	N/A	N/A	210
0316-95-0298	4-6.5	Qbt4	21.1
0316-95-0300	4.5-6.5	Qbt4	23.8
0316-95-0302	4.5-7	Qbt4	17

[a] N/A = Not applicable.

5.4.6 Evaluation of Radionuclides

Radioactivity due to isotopes associated with operations at the facilities were not detected in the samples. Potassium-40 is a naturally occurring isotope and was detected in these samples. Radioactive potassium is very common in soil samples all over the world and is often used by analytical laboratories to confirm that their equipment is functioning properly. There is no process knowledge at LANL to suggest that potassium-40 was ever used at LANL, much less at TA-16-380, which was used for HE powder inspection. Potassium-40 will not be considered further in the screening analysis.

5.4.7 Evaluation of Organic Chemicals

One sample contained bis(2-ethylhexyl)phthalate and acetone at levels above detection limits but well below SALs. Two samples contained trichlorofluoromethane at levels above detection limits but well below SALs. Two samples contained bis(2-ethylhexyl) phthalate at levels above detection limits but well below SALs. Acetone, bis(2-ethylhexyl)phthalate, and trichlorofluoromethane were all found in the blanks, so the result are probably due to blank contamination. No other organic constituents, including HE, were present above detection levels at PRSs 16-006(d). The sample results are presented in Table 5.4.7-1.

TABLE 5.4.7-1

PRS 16-006(d) SOIL CONCENTRATIONS FOR DETECTED ORGANIC ANALYTES

SAMPLE ID	DEPTH (ft)	ACETONE (mg/kg)	BIS(2-ETHYLHEXYL)-PHTHALATE (mg/kg)	TRICHLOROFLUORO-METHANE (mg/kg)
SAL	N/A[a]	2 100	32	380
EQL	N/A	0.02	0.33	0.005
0316-95-0298	4-6.5	0.011 (U[b])	0.35	5.3
0316-95-0300	4.5-6.5	0.023	0.41	5.3 (U)
0316-95-0302	4.5-7	0.011 (U)	0.35	6.4

a. N/A = Not Applicable
b. U = Undetected—the listed value is the detection limit

5.4.8 Risk-Based Screening Assessment

No chemicals were present at levels above SALs. Visual inspection of the data indicated that an MCE would not result in a value near unity. No COPCs were identified during the screening assessment.

5.4.9 Human Health Risk Assessment

No human health risk assessment was performed for PRS 16-006(d) because no COPCs were identified during Phase I sampling.

5.4.10 Preliminary Ecological Assessment

In cooperation with NMED and EPA Region 6, the Laboratory ER Project is developing an approach for ecological risk assessment. Further ecological risk assessment at this site will be deferred until this site can be assessed as part of the ecological exposure unit methodology currently being developed. When completed, the ecological risk assessment will be provided as an Attachment.

5.4.11 Conclusions and Recommendation

RFI sampling was conducted at locations biased to represent the area of greatest potential contamination. The original sampling plan was carried out as accurately as the physical restrictions of the site would allow. No contamination was found above SALs during Phase I sampling. No COPCs were identified at PRS 16-006(d). Samples at greatest depth and furthest downgradient are well-below SALs, so constituents are bounded relative to SALs. Based on sampling results, there is no significant risk to human health or to the environment at this site.

Because of the low levels of hazardous constituents, this PRS is recommended for human-health NFA based on NFA Criterion 5.

5.5 PRS 16-010(a)

Potential Release Site16-010(a), TA-16-386, is an inactive flash pad now used for storage. This structure was a storage site for a large pile of barium nitrate during the 1950s through 1970s. The barium nitrate pile itself has been designated as PRS 16-016(c). Potential Release Sites 16-010(a) and 16-016(c) overlap. Two sample locations associated with PRS 16-010(a) contained barium at levels above SAL. These two sample locations are located in or near PRS 16-016(c) and will be attributed to PRS 16-016(c) because it is the principal suspected source of barium contamination. Since the PRSs overlap, it is recommended that the contaminated portion of 16-010(a) be administratively associated with 16-016(c). All of the contamination at this location will then be addressed in the planning for 16-016(c), which will be cleaned up in a Voluntary Corrective Measure (VCM) or Voluntary Corrective Action (VCA). PRS 16-010(a) is recommended for human-health NFA.

5.5.1 History

PRS 16-010(a) is discussed in detail in Subsection 5.8 of the RFI work plan (LANL 1993, 1094). Potential contaminants at this site were thought to originate from the former barium nitrate pile (PRS 16-016(c)) and from the burning of HE contaminated material, a source of HE, HE burn products, and barium. This burn pad was built in 1951. It is not known how long this pad was used for burning.

5.5.2 Description

PRS 16-010(a) is located at the burning ground at TA-16 (Figure 5.0-1). It is a fenced, level region of bare soil covering approximately 215 ft x 180 ft. It is sparsely vegetated. The level area drops off steeply to the north. Drainage is to the north toward Cañon de Valle through PRS 16-016(c).

5.5.3 Previous Investigations

No previous investigations have been performed at this site.

5.5.4 Field Investigation

The objective of Phase I sampling was to determine, using biased sampling, the nature and extent of contamination at and around the flash pad. The sampling design was biased to detect contaminants by collecting samples at locations most likely to be contaminated, according to the site conceptual model. Existing data from the TA-16 Burning Ground and knowledge that a barium nitrate pile had been located at this site for roughly 20 years suggested that contamination at levels greater than SAL for barium was likely. The sampling and analysis plan was also designed to: 1) delineate any contamination above action levels in both vertical and downgradient directions to support cleanup activities; and 2) provide sufficient data to support a preliminary risk assessment. If contamination did occur, Phase I investigation would also identify all COPCs.

The site conceptual model for releases at this flash pad is that the primary release mechanism to the PRS was by burning of waste materials and by storage activities in the flash pad. Because the PRS overlaps with PRS 16-016(c), the barium nitrate pile, barium leaching from that pile to this PRS was anticipated. Both heavy-organic contaminants such as high explosives and SVOCs, and inorganic contaminants, are hypothesized to decrease in concentration both vertically into tuff and downgradient from the PRS. Downgradient localities were part of PRS 16-016(c) sampling. This conceptual model guided sampling and screening locations. Field screening — particularly for barium, which is the principal constituent likely to be present at this site — was further used to bias sample locations, based on this conceptual model. The intent was to submit samples with positive screening results for laboratory analysis.

The EPA approved sampling plan called for a field randomized grid with 20 ft spacing that covered the PRS area. Field screening was used to locate three sites with the highest barium concentrations. Radiation and HE screening, as well as visual inspection for stains, were used to bias sample analysis. At each location selected for laboratory analysis, samples were collected from the 0 to 0.5-ft, 2-ft, and 5-ft depth intervals. There were no deviations from this sampling plan.

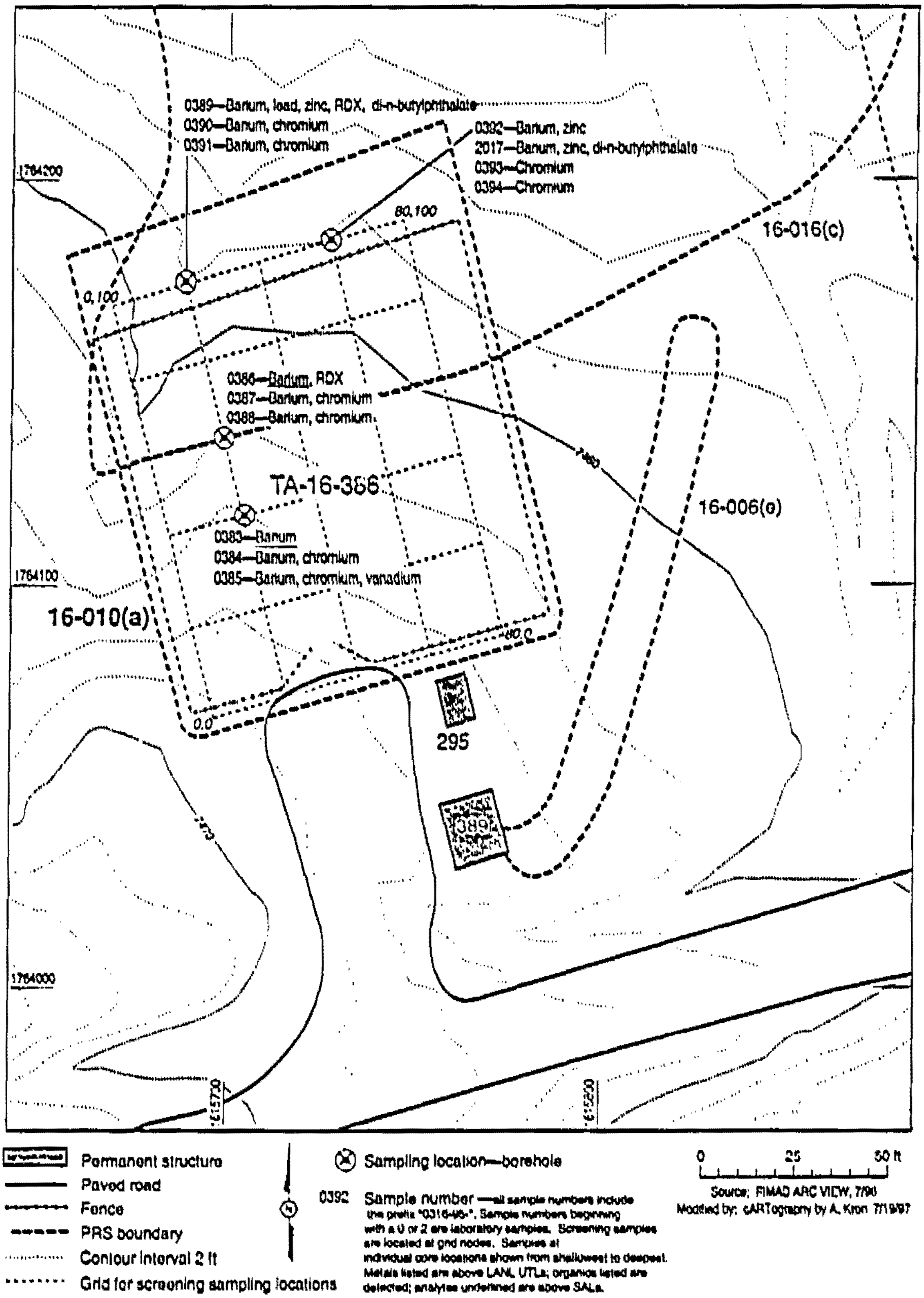
Table 5.5.4-1 contains information about all laboratory samples collected at this site. Figure 5.5.4-1 shows the sample locations. The results of the field screening are shown in Table 5.5.4-2.

TABLE 5.5.4-1

SUMMARY OF REQUEST NUMBERS FOR LABORATORY SAMPLES TAKEN AT PRS 16-010(a)

SAMPLE ID	LOCATION ID	DEPTH (ft)	SAMPLE MATRIX	SVOCs	HE	INORGs
0316-95-0383	16-1343	0-0.5	Soil	1154[a]	1154	1155
0316-95-0384	16-1343	2-3	Qbt4	1154	1154	1155
0316-95-0385	16-1343	4-5	Qbt4	1154	1154	1155
0316-95-0386	16-1344	0-0.5	Soil	1154	1154	1155
0316-95-0387	16-1344	2-3	Qbt4	1154	1154	1155
0316-95-0388	16-1344	4.5-5.5	Qbt4	1154	1154	1155
0316-95-0389	16-1345	0-0.5	Soil	1154	1154	1155
0316-95-0390	16-1345	2-3	Qbt4	1154	1154	1155
0316-95-0391	16-1345	4-5.5	Qbt4	1154	1154	1155
0316-95-0392	16-2167	0-0.5	Soil	1183	1183	1184
0316-95-0393	16-2167	2-3	Qbt4	1154	1154	1155
0316-95-0394	16-2167	5-6	Qbt4	1154	1154	1155
0316-95-2017	16-2167	0-0.5	Soil	1183	1183	1184

[a] ER analytical request number.



—all sample numbers include the prefix "0316-96-". Sample numbers beginning with a 0 or 2 are laboratory samples. Screening samples are located at grid nodes. Samples at individual core locations shown from shallowest to deepest. Metals listed are above LANL UTLs; organics listed are detected; analytes underlined are above SALs.

Source: FIMAD ARC VIEW, 7/90
Modified by: cARTography by A. Kron 7/19/97

Fig. 5.5.4-1. Screening and laboratory sample locations at PRS 16-010(a).

TABLE 5.5.4-2

SCREENING RESULTS FOR PRS 16-010(a)

SAMPLE ID	Location ID	XRF: Ba	LIBS: Ba	HE Spot Test
0316-95-1496	Grid: 0,0	386 ppm	207 ppm	Negative
0316-95-1497	Grid: 0,20	292 ppm	178 ppm	Negative
0316-95-1498	Grid: 0,40	690 ppm	383 ppm	Negative
0316-95-1499	Grid: 0,60	3318 ppm	2 935 ppm	Negative
0316-95-1500	Grid: 0,80	1 182 ppm	868 ppm	Negative
0316-95-1501	Grid: 0,100	268 ppm	186 ppm	Negative
0316-95-1502	Grid: 20,0	294 ppm	159 ppm	Negative
0316-95-1503	Grid: 20, 20	370 ppm	214 ppm	Negative
0316-95-1504	16-1343	4 624 ppm	2 884 ppm	Negative
0316-95-1505	16-1344	4 258 ppm	2 038 ppm	Negative
0316-95-1506	Grid: 20, 80	1 473 ppm	1 435 ppm	Negative
0316-95-1507	16-1345	3 645 ppm	2 073 ppm	Negative
0316-95-1508	Grid: 40, 0	470 ppm	127 ppm	Negative
0316-95-1509	Grid: 40,20	434 ppm	65 ppm	Negative
0316-95-1510	Grid: 40, 40	370 ppm	145 ppm	Negative
0316-95-1511	Grid: 40, 60	1 612 ppm	1 322 ppm	Negative
0316-95-1512	Grid: 40, 80	2 753 ppm	2 365 ppm	Negative
0316-95-1513	Grid: 40, 100	3 455 ppm	293 ppm	Negative
0316-95-1514	Grid: 60, 0	433 ppm	200 ppm	Negative
0316-95-1515	Grid: 60, 20	432 ppm	157 ppm	Negative
0316-95-1516	Grid: 60, 40	584 ppm	212 ppm	Negative
0316-95-1517	Grid: 60, 60	457 ppm	231 ppm	Negative
0316-95-1518	Grid: 60, 80	482 ppm	326 ppm	Negative
0316-95-1519	16-2167	237 ppm	1 336 ppm	Positive
0316-95-1520	Grid: 80, 0	388 ppm	95 ppm	Negative
0316-95-1521	Grid: 80, 20	338 ppm	84 ppm	Negative
0316-95-1522	Grid: 80, 40	632 ppm	262 ppm	Negative
0316-95-1523	Grid: 80, 60	522 ppm	244 ppm	Negative
0316-95-1524	Grid: 80, 80	543 ppm	235 ppm	Negative
0316-95-1525	Grid: 80, 100	487 ppm	194 ppm	Negative

5.5.5 Evaluation of Inorganic Chemicals

Inorganics were present at levels greater than UTLs at PRS 16-010(a) (Table 5.5.5-1). Two samples contained barium at levels greater than SALs. Those two sample locations are very near PRS 16-016(c).It is recommended that these locations and their data be administratively transferred to 16-016(c). No other inorganics were present at levels above SALs.

TABLE 5.5.5-1

INORGANICS WITH CONCENTRATIONS GREATER THAN BACKGROUND UTLs FOR PRS 16-010(a)

SAMPLE ID	DEPTH (ft)	SOIL/ROCK UNIT	BARIUM (mg/kg)	CHROMIUM (mg/kg)	LEAD (mg/kg)	VANADIUM (mg/kg)	ZINC (mg/kg)
LANL UTL (all soil)	N/A[a]	N/A	315	19.3	23.3	41.9	50.8
LANL UTL (Qbt4)	N/A	N/A	56.6	10.9	11	9.5	75.4
SAL	N/A	N/A	5 300	210	400	540	23 000
0316-95-0383	0-0.5	all soil	6 680	6.4	10.7	17.7	24.3
0316-95-0384	2-3	Qbt4	3 040	20.8	3.4	8.6	20.7
0316-95-0385	4-5	Qbt4	3 370	36.9	4.2	10.1	30.2
0316-95-0386	0-0.5	all soil	9 580	9.8	12.6	25.4	32.6
0316-95-0387	2-3	Qbt4	1 790	15.7	3.6	5.2	19.6
0316-95-0388	4.5-5.5	Qbt4	1 370	15.6	3.1	4.5	20.5
0316-95-0389	0-0.5	all soil	5 220	7.4	27.7	25	68.2
0316-95-0390	2-3	Qbt4	1 010	32.6	1.9	4.4	17.6
0316-95-0391	4-5.5	Qbt4	966	12.8	2.4	4.7	18.3
0316-95-0392	0-0.5	all soil	1 090	5.2 (J+[b])	7.3	14.8	121
0316-95-0393	2-3	Qbt4	42.8	18.2	3.5	4.4	26.9
0316-95-0394	5-6	Qbt4	29.1	23.9	5.4	5.3	29.6
0316-95-2017	0-0.5	all soil	1 150	3.9 (J+)	8.3	10.2	126

[a] N/A = Not applicable.

[b] J+ = Estimated value likely to be high.

5.5.6 Evaluation of Radionuclides

Radionuclides were not analyzed for at this PRS because process knowledge and historic records give no indication that radionuclides were ever associated with this facility.

5.5.7 Evaluation of Organic Chemicals

Very few organic constituents were present above detection levels at PRS 16-010(a). They are shown in Table 5.5.7-1. Samples 0316-95-0383 through -0390 missed holding times for SVOC analysis by approximately 35 days. The SVOC data for these samples were PM-qualified as a result of missing holding times. These data should be considered as rejected. The rejected data are included in FIMAD to maintain a complete information record. They were not used to decide the outcome of this PRS. The remaining SVOC data that did not fail holding times was used to determine the likelihood of SVOC contamination at this site.

Phthalate contamination was present in the method blank during the SVOC analysis. Samples 0316-95-2017 and 0316-95-0392 were PM-qualified for HE analysis due to the use of a non-standard HE laboratory control standard. Only seven HE compounds were included in the laboratory control standard instead of the requested fifteen HE compounds. The analytical results of these seven compounds were all in the acceptable range. The non-standard laboratory control sample did not affect the use of these samples for decision-making purposes. The data are considered acceptable without qualification.

Sample 0316-95-0392 tested positive in the screening test for HE and was sent for on-site laboratory screening. The on-site laboratory screening results indicated that this sample contained less than 5 ppm of HE; the off-site laboratory analysis for HE showed all non-detects. Sample heterogeneity or nitrite interferences could explain the difference between the spot test results, the on-site laboratory results, and the off-site laboratory results (see Appendix C).

TABLE 5.5.7-1

PRS 16-010(a) SOIL CONCENTRATIONS FOR DETECTED ORGANIC ANALYTES

SAMPLE ID	DEPTH (ft)	RDX (mg/kg)	DI-N-BUTYL-PHTHALATE (mg/kg)
SAL	N/A[a]	4	6 500
EQL	N/A	1	0.33
0316-95-0386	0-0.5	0.495	0.4 (U[b])
0316-95-0389	0-0.5	0.256	0.064 (J[c])
0316-95-2017	0-0.5	0.175 (U)	0.68

a. N/A = Not Applicable
b. U = Undetected—the listed value is the detection limit.
c. J = Estimated quantity—result is above the detection limit but below the estimated quantitation limit.

5.5.8 Risk-Based Screening Assessment

Five inorganic and two organic chemicals were carried forward from the background comparison and organic constituent evaluation. As described in Chapter 3 of this RFI Report, analytes are divided into two classes, noncarcinogens and carcinogens, for the screening assessment, depending on which toxicological effect forms the basis of their SAL. This separation is required to evaluate possible additive effects within each class of chemical.

Barium exceeded its SAL value in surface samples 0316-95-0383 and 0316-95-0386. These two sample locations are very near the boundary for PRS 16-016(c) (Figure 5.5.4-1). The barium nitrate pile, PRS 16-016(c) is the most likely source of barium contamination in this area. Because these two PRSs share a common history and similar contaminants, these two locations with high levels of barium will be associated with PRS 16-016(c) and will not be retained for this assessment. All barium at greater than cleanup levels will be cleaned up in a PRS 16-016(c) voluntary corrective measure (VCM). The locations where barium was detected above UTL but below SAL will also be attributed to PRS 16-016(c) and will not be retained for this assessment.

Visual inspection of the noncarcinogenic (excluding barium) data for constituents that exceed background UTLs but are less than SALs indicated that MCE screening would yield a value far less than the target limit of 1. Therefore, these constituents will not be retained for this assessment. An MCE calculation was performed for carcinogens using the sum of the maximum concentrations of constituents present at levels greater than background UTLs but less than SALs. The MCE calculation is presented in Table 5.5.8-1. The MCE result for carcinogens is 0.3. The MCE value for carcinogens is less than unity; therefore, a potential human health risk based on additive effects is not identified for this class of chemical. Chromium and RDX will not be retained as COPCs at this unit.

TABLE 5.5.8-1

MCE CALCULATION FOR PRS 16-010(a)

ANALYTE	MAX CONC. (mg/kg)	SAL (mg/kg)	NORMALIZED VALUE
Carcinogenic Effects			
Chromium	36.9	210	0.176
RDX	0.495	4	0.124
		TOTAL	0.3

5.5.9 Human Health Risk Assessment

No human health risk assessment was performed for PRS 16-010(a). The locations containing constituents at levels above SALs have been attributed to PRS 16-016(c), the most likely source of barium in this area, and will be cleaned up as part of the VCM for 16-016(c). The remaining locations associated with PRS 16-010(a) do not contain any constituents at levels above SALs.

5.5.10 Preliminary Ecological Assessment

In cooperation with NMED and EPA Region 6, the Laboratory ER Project is developing an approach for ecological risk assessment. Further ecological risk assessment at this site will be deferred until this site can be assessed as part of the ecological exposure unit methodology currently being developed. When completed, the ecological risk assessment will be provided as an Attachment.

5.5.11 Conclusions and Recommendation

RFI sampling was conducted at locations biased to represent the area(s) of greatest contamination. Although barium was found in two samples at levels above SAL, the two samples are being attributed to PRS 16-016(c), the most likely source of the barium contamination. Of the remaining samples, none contained inorganic compounds at levels above SALs. RDX was found above detection limits, but was well below SAL. Therefore, PRS 16-010(a) is recommended for human-health NFA.

Data generally support the site-conceptual model. Barium levels are above SALs, and barium concentrations are highest in surface samples collected near the former location of the barium nitrate pile.

The extent of contamination associated with PRS 16-010(a) has been bounded. Barium levels at depth were well below SALs. PRS 16-016(c) received any runoff of contamination that might otherwise be associated with downgradient contaminant migration from 16-010(a). Biased analysis of sampling locations revealed no hazardous constituents above SALs other than barium, now attributed to PRS 16-016(c). Based on sampling results, there is little risk to human health or to the environment at this site. Because of the low levels of hazardous constituents, this PRS is recommended for human-health NFA based on NFA Criterion 5.

5.6 PRS 16-021(a)

PRS 16-021(a) is an outfall associated with TA-16-450, a materials testing laboratory. This outfall received effluent from the basement floor drains in the building. This PRS is recommended for human-health NFA because no contamination was detected above SALs.

5.6.1 History

PRS 16-021(a) is discussed in detail in Subsection 5.5 of the RFI work plan (LANL 1993, 1094). PRS 16-021(a) is associated with floor drains in a materials testing laboratory, TA-16-450. TA-16-450 was built in 1953 to house electroplating operations, although these plans were later revised. It may have been used as a chemical engineering laboratory and a paint shop, and recently this building has functioned as a materials testing laboratory. Discharges from this facility may have included metals, cyanide, acids, paints, solvents, and oils. Potential contaminants at this site were identified as: HE, HE impurities and degradation products, metals, and laboratory chemicals.

5.6.2 Description

PRS 16-021(a) discharges east of TA-16-450 to an overgrown area that gently slopes southeast toward Water Canyon (Figure 5.0-1). Visual inspection of the area surrounding the discharge point indicates that, although the drain is still present, it has not been actively used for some time. The area at the mouth of the outfall is overgrown and the drain is not in use. No stream channel has been cut into the soils, so it is reasonable to expect that small volumes of waste have been discharged via this drain system.

5.6.3 Previous Investigations

No previous investigations have been performed at this site.

5.6.4 Field Investigation

The objectives of Phase I sampling at this site were to confirm the location of the outfall and to determine via biased sampling if a release had occurred from the drain line causing contamination above action levels. The sampling design was biased to detect contaminants by collecting samples at locations most likely to be contaminated, according to the site conceptual model. Contamination was not anticipated at this site. If contamination did occur, Phase I investigation would identify any COPCs. Fragments of vitrified clay pipe were found during the investigation, indicating that the outfall was properly located.

The site conceptual model for releases at this outfall is that the primary release mechanism to the PRS is by discharge of constituents from the outfall pipe to the downgradient area. It is assumed that such discharge will result in the highest constituent concentrations near the outfall. The lack of a well-defined drainage from the outfall suggest that flow rates were small, and that minimal transport of constituents from the outfall area is likely to have occurred. Non-volatile constituents (e.g. SVOCs, HE, inorganics) are hypothesized to decrease in concentration vertically into tuff and downgradient from the outfall. Volatile organics are likely to be at higher concentrations in subsurface samples because they are likely to volatilize in near-surface samples due to temperature fluctuations. The soil-tuff interface consists of a transition in both material and hydrogeologic properties that can act as a collection and transport zone for contaminants. Field screening was further used to bias sample locations, based on this conceptual model.

The EPA-approved RFI sampling plan called for two hand-augered sample holes: one to be located at the mouth of the outfall and one to be 5 ft downgradient from the outfall. The location at the outfall was augered to a depth of 5.5 ft and the downgradient location was augered to a depth of 5.1 ft. The soil-tuff interface was located at the bottom of each core hole. A sample was collected near the surface and at the bottom of each core. The area between the building and outfall was not sampled because the conceptual model suggests that maximum contamination would be likely at the outfall location.

Five laboratory samples, including a collocated QA/QC sample, were collected from two locations at this site. Samples are presented in Table 5.6.4-1 and their locations are shown in Figure 5.6.4-1. Sample 0316-95-2010 was collected at the same location as sample 0316-95-0210. All samples were collected with a hand auger. Samples were screened for VOCs only; all positive screening samples are presented in Table 5.6.4-2.

TABLE 5.6.4-1

SUMMARY OF REQUEST NUMBERS FOR LABORATORY SAMPLES TAKEN AT PRS 16-021(a)

SAMPLE ID	LOCATION ID	DEPTH (ft)	SAMPLE MATRIX	VOCs	SVOCs	INORGs
0316-95-0210	16-1526	0.8-1.5	Soil	249[a]	249	252
0316-95-0211	16-1526	5-5.5	Soil	249	249	252
0316-95-0212	16-1527	0.8-1.5	Soil	249	249	252
0316-95-0213	16-1527	4.6-5.1	Soil	249	249	252
0316-95-2010	16-1526	0.8-1.5	Soil	249	249	252

[a] ER analytical request number.

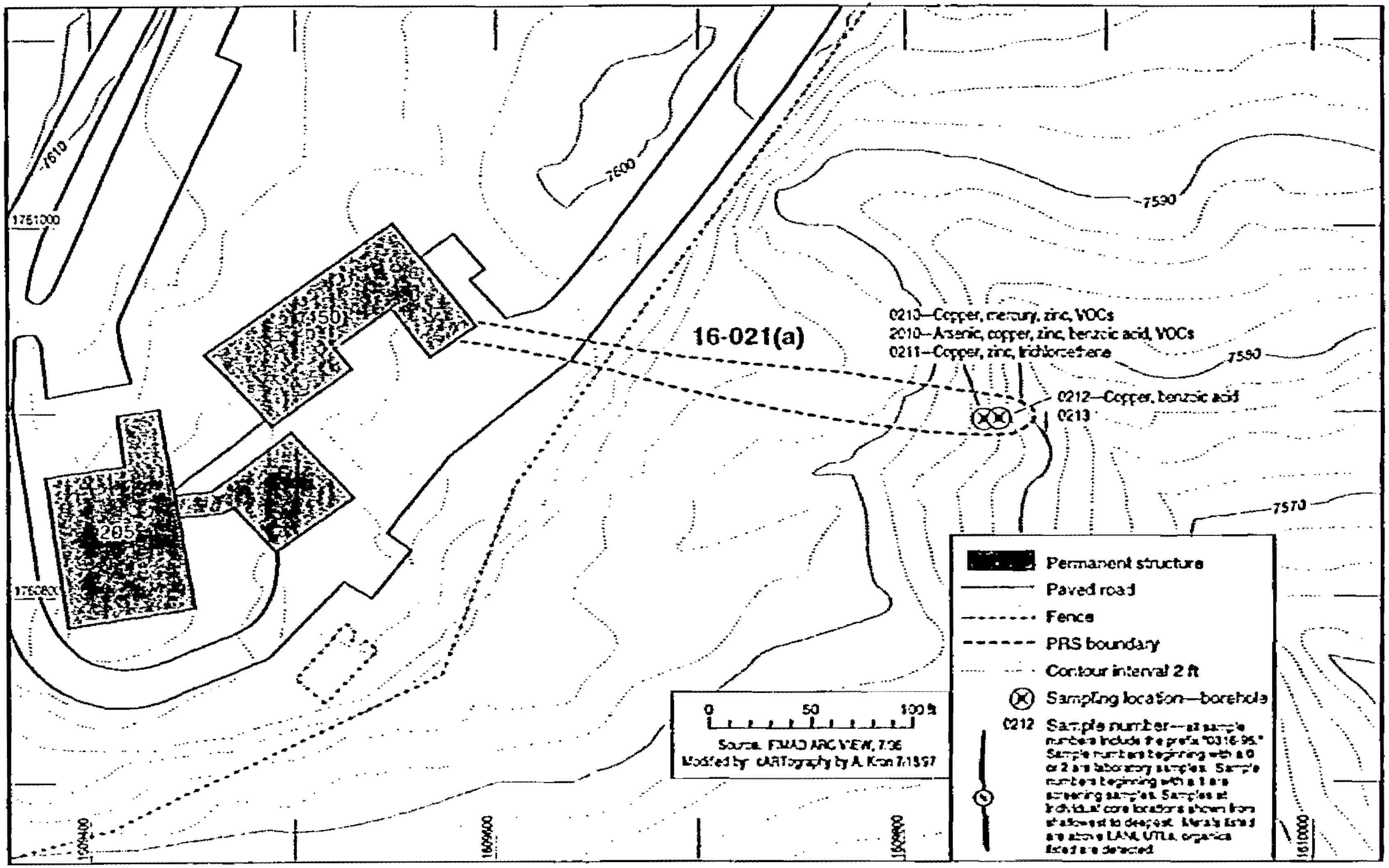


Fig. 5.6.4-1. Sample locations at PRS 16-021(a)

TABLE 5.6.4-2

POSITIVE SCREENING VALUES

SAMPLE ID	LOCATION ID	DEPTH (ft)	PID READING (ppm)
0316-95-0210	16-1526	0.8-1.5	20
0316-95-0211	16-1526	5-5.5	50
0316-95-0212	16-1527	0.8-1.5	30
0316-95-0213	16-1527	5-5.5	30
0316-95-2010	16-1526	0.8-1.5	20

Due to the elevated PID values, more volatile aliquots (5) were collected at this site than had been planned (1). An aliquot for volatile analysis was collected from both sample locations, at 2 depths at each location. One duplicate was taken. These aliquots were collected from the 0.8- to 1.5-ft interval, rather than the 0- to 0.5-ft interval, to increase the likelihood of detecting VOCs, if present. This deviation from the original sampling plan is considered to be an improvement to the original plan.

5.6.5 Evaluation of Inorganic Chemicals

Samples containing inorganics at levels above UTLs are presented in Table 5.6.5-1. The only inorganics found at levels above UTLs were arsenic, copper, mercury, and zinc. All values were well below SALs. Arsenic, for which the UTL is used as a screening level, is present only slightly above the UTL (8 vs. 7.82 ppm). Arsenic in the duplicate of this sample is below the UTL (5.6 vs. 7.82). The mercury measurement had poor laboratory control during analysis, but these data were validated without qualification for use in evaluating this PRS.

TABLE 5.6.5-1

INORGANICS WITH CONCENTRATIONS GREATER THAN BACKGROUND UTL FOR PRS 16-021(a)

SAMPLE ID	DEPTH (ft)	ARSENIC (mg/kg)	COPPER (mg/kg)	MERCURY (mg/kg)	ZINC (mg/kg)
LANL UTL (all soil)	N/A[a]	7.82	15.5	0.1	50.8
SAL	N/A	NC[b]	2 800	23	23 000
0316-95-0210	0.75-1.5	5.6	37.2	0.14	318
0316-95-0211	5-5.5	0.23 (U[c])	70.2	0.08 (U)	70
0316-95-0212	0.75-1.5	2.3	26.6	0.09 (U)	43.9
0316-95-2010	0.75-1.5	8	34.6	0.10 (U)	302

[a] N/A = Not applicable.
[b] NC = Not calculated.
[c] U = Undetected. The listed value is the detection limit.

5.6.6 Evaluation of Radionuclides

Samples from this PRS were not analyzed for radioactive compounds because process knowledge and facility history do not suggest any use of radionuclides at this PRS.

5.6.7 Evaluation of Organic Chemicals

Organic constituents found at levels above detection limits are listed in Table 5.6.7-1. Note that the laboratory values are much less than the semi-quantitative readings from the PID during field screening. All organic constituents levels were well below SALs.

Initially, 1,2,3-trichloropropane was detected at a level above its SAL. However, focused validation of the data showed that this compound was not detected during analysis and the reported presence of this compound has been attributed to a typographical error made at the laboratory. 1,2,3-trichloropropane will not be considered in the analysis of this site.

TABLE 5.6.7-1

PRS 16-021(a) SOIL CONCENTRATIONS FOR DETECTED ORGANIC ANALYTES

SAMPLE ID	DEPTH (ft)	Benzoic acid (mg/kg)	p-Isopropyltoluene (mg/kg)	Trichloroethene (mg/kg)
SAL	N/A[a]	100 000	NC[b]	3.2
EQL	N/A	3.3	0.005	0.005
0316-95-0210RE[e]	0.75-1.5	NA[c]	0.006 (J[d])	0.015 (J)
0316-95-0211RE	5-5.5	NA	0.006 (U[e])	0.003 (J)
0316-95-0212	0.75-1.5	0.2 (J)	0.006 (U)	0.04 (U)
0316-95-0213	4.6-5.1	3.6 (U)	0.006 (U)	0.006 (U)
0316-95-2010	0.75-1.5	0.33 (J)	NA	NA
0316-95-2010RE	0.75-1.5	NA	0.01	0.003 (J)

[a] N/A = Not applicable.
[b] NC = Not calculated.
[c] NA = Not analyzed.
[d] Estimated quantity. Result is above the detection limit but below the estimated quantitation limit.
[e] U = Undetected. The listed value is the detection limit.

5.6.8 Risk-Based Screening Assessment

No compounds were present at levels near SALs. Arsenic is present in a single sample at a level only slightly higher than the UTL. The duplicate of this sample is below the UTL. Arsenic will not be retained as a COPC. Visual inspection of the data indicated that an MCE would result in a value well-below unity. No COPCs were identified during the screening assessment.

5.6.9 Human Health Risk Assessment

No risk assessment was performed for this PRS.

5.6.10 Preliminary Ecological Assessment

In cooperation with NMED and EPA Region 6, the Laboratory ER Project is developing an approach for ecological risk assessment. Further ecological risk assessment at this site will be deferred until this site can be assessed as part of the ecological exposure unit methodology currently being developed. When completed, the ecological risk assessment will be provided as an attachment.

5.6.11 Conclusions and Recommendations

Low flow volumes are believed to have come from this outfall because no drainage channel was cut into the area surrounding the outfall. RFI sampling was conducted at locations biased to represent the area(s) of greatest contamination. Sampling results from two surface and two subsurface locations near this outfall showed little evidence of contamination at hazardous levels. Pipe fragments and low levels of anthropogenic organic compounds confirmed that samples were collected near the site of the outfall.

Because of the very low levels of compounds found during analysis, this PRS is recommended for human-health NFA under NFA Criterion 5.

5.7 PRS 16-026(c)

PRS 16-026(c) is the outfall from two inactive sumps at TA-16-305. The sumps are PRS 16-029(b) and will be investigated in a later field campaign. There was no contamination above SALs in the outfall that was attributed to facility activity. Therefore, this PRS is recommended for human-health NFA.

5.7.1 History

PRS 16-026(c) is discussed in detail in Subsection 5.2 of the RFI work plan (LANL 1993, 1094).

TA-16-305 is a rest house that serves TA-16-304 and TA-16-306, both of which are used in the production of plastic components for nuclear weapons. This facility was built in 1953. The rest house is used for storing raw materials used in the plastics fabrication process, finished plastic products, and for filament winding of developmental components (LANL 1989, 15-16-362).

Potential contaminants at this site were identified as: HE, HE impurities and degradation products, metals, and laboratory chemicals associated with plastics manufacturing.

5.7.2 Description

PRS 16-026(c) is located south of TA-16-305 (Figure 5.0-1). The outfall drains into a well-defined drainage ditch that parallels the access road. Runoff from the adjacent roadway drains into the drainage ditch. The area is grassy and slopes gradually to the southeast. The HE sumps that discharged into this PRS are plugged.

5.7.3 Previous Investigations

A study of HE contamination in soils associated with outfalls was conducted in June 1970 (Baytos 1970, 15-16-278). This study included the analysis of one soil sample from the outfall at TA-16-305. The analytical results showed no TNT, RDX, or HMX in the soil sample, although there may have been some unknown HE decomposition products present at low levels.

5.7.4 Field Investigation

The objective of Phase I sampling at this site was to determine via biased sampling if a release had occurred from the drain line outfall and if that release caused contamination above action levels. The sampling design was biased to detect contaminants by collecting samples at locations most likely to be contaminated, according to the site conceptual model. The sampling and analysis plan was also designed to: 1) delineate any contamination above action levels in both a vertical and downgradient directions to support any cleanup activities; and 2) provide sufficient data to support a preliminary risk assessment. If contamination did occur, Phase I investigation would also identify all COPCs.

The site conceptual model for releases at this outfall is that the primary release mechanism to the PRS is by discharge of constituents from the outfall pipe to the downgradient drainage area. It is assumed that such discharge will result in the highest constituent concentrations near the outfall and in the downgradient sediment traps, particularly the sediment traps nearest the outfall. Non-volatile constituents (e.g. SVOCs, HE, inorganics) are hypothesized to decrease in concentration vertically into tuff and downgradient from the outfall. Volatile organics are likely to be at higher concentrations in subsurface samples because they are likely to volatilize in near-surface samples due to temperature fluctuations. The soil-tuff interface consists of a transition in both material and hydrogeologic properties that can act as a collection and transport zone for contaminants. This conceptual model guided sampling and screening locations by emphasizing samples near the outfall, surface samples, and soil-tuff interface samples. Field screening — particularly for the HE, which are the principal constituents likely to be present at this site — was further used to bias sample locations, based on this conceptual model. The intent was to submit samples with positive screening results for laboratory analysis.

The EPA approved RFI sampling plan for this site called for two boreholes to be drilled near the outfall. The first borehole was drilled at the outfall. The second borehole was drilled at the next downstream sediment trap. Samples were collected from the surface interval, the interval bounding the soil-tuff interface, and the bottom of each borehole. The bottom of each borehole was located at least 2.5 ft below the soil-tuff interface.

All analytical samples were collected with a hand auger except for the two samples at depth in the boreholes near the outfall. These were collected with a split spoon. The depth of the boreholes was 4.5 ft. The soil-tuff interface was located at a depth of 2 ft at the borehole at the outfall, and 1.3 ft at the borehole 13 ft downgradient from the outfall.

Beyond the boreholes, surface locations were screened for HE. All locations screened negative; a total of three surface laboratory samples were collected at 20-ft intervals. Two additional surface laboratory samples were collected further downgradient.

One screening sample located 325 ft from the outfall was not collected on the specified interval because the location was beneath an access road. Instead, it was collected from the exit of a culvert. This screening location was not selected as a laboratory sample location.

All samples from this site were screened for HE, radiation, and volatiles. All samples screened negative.

Table 5.7.4-1 lists the laboratory samples analyzed at PRS 16-026(c). Figure 5.7.4-1 shows the locations of the screening and laboratory samples taken at this PRS.

TABLE 5.7.4-1

SUMMARY OF REQUEST NUMBERS FOR LABORATORY SAMPLES TAKEN AT PRS 16-026(c)

SAMPLE ID	LOCATION ID	DEPTH (ft)	SAMPLE MATRIX	VOCs	SVOCs	HE	INORGs
0316-95-0121	16-1459	0-0.5	Soil	NA[a]	621[b]	621	622
0316-95-0122	16-1459	1.7-2.3	Qbt4	621	621	621	622
0316-95-0123	16-1459	3.5-4.5	Qbt4	874	874	874	875
0316-95-0124	16-1655	0-0.5	Soil	NA	621	621	622
0316-95-0125	16-1655	1-1.5	Qbt4	621	621	621	622
0316-95-0126	16-1655	3.5-4.5	Qbt4	874	874	874	875
0316-95-0127	16-1460	0-0.5	Soil	NA	116	116	120
0316-95-0128	16-1461	0-0.5	Soil	NA	116	116	120
0316-95-0129	16-1462	0-0.5	Soil	NA	116	116	120
0316-95-0130	16-1463	0-0.5	Soil	NA	116	116	120
0316-95-0131	16-1474	0-0.5	Soil	NA	116	116	120

a. NA = Not Analyzed
b. ER analytical request number

5.7.5 Evaluation of Inorganic Chemicals

Data for soil samples were compared to soil UTLs and tuff samples were compared to the tuff UTLs. Inorganics were present at levels greater than UTLs but less than SALs at PRS 16-026(c). Table 5.7.5-1 presents the analytical results for inorganics at levels above UTLs. Some inorganic values are P-qualified because the duplicate recovery was outside the acceptable range. These data should be considered estimated. This qualification does not affect the decision made on the basis of these data.

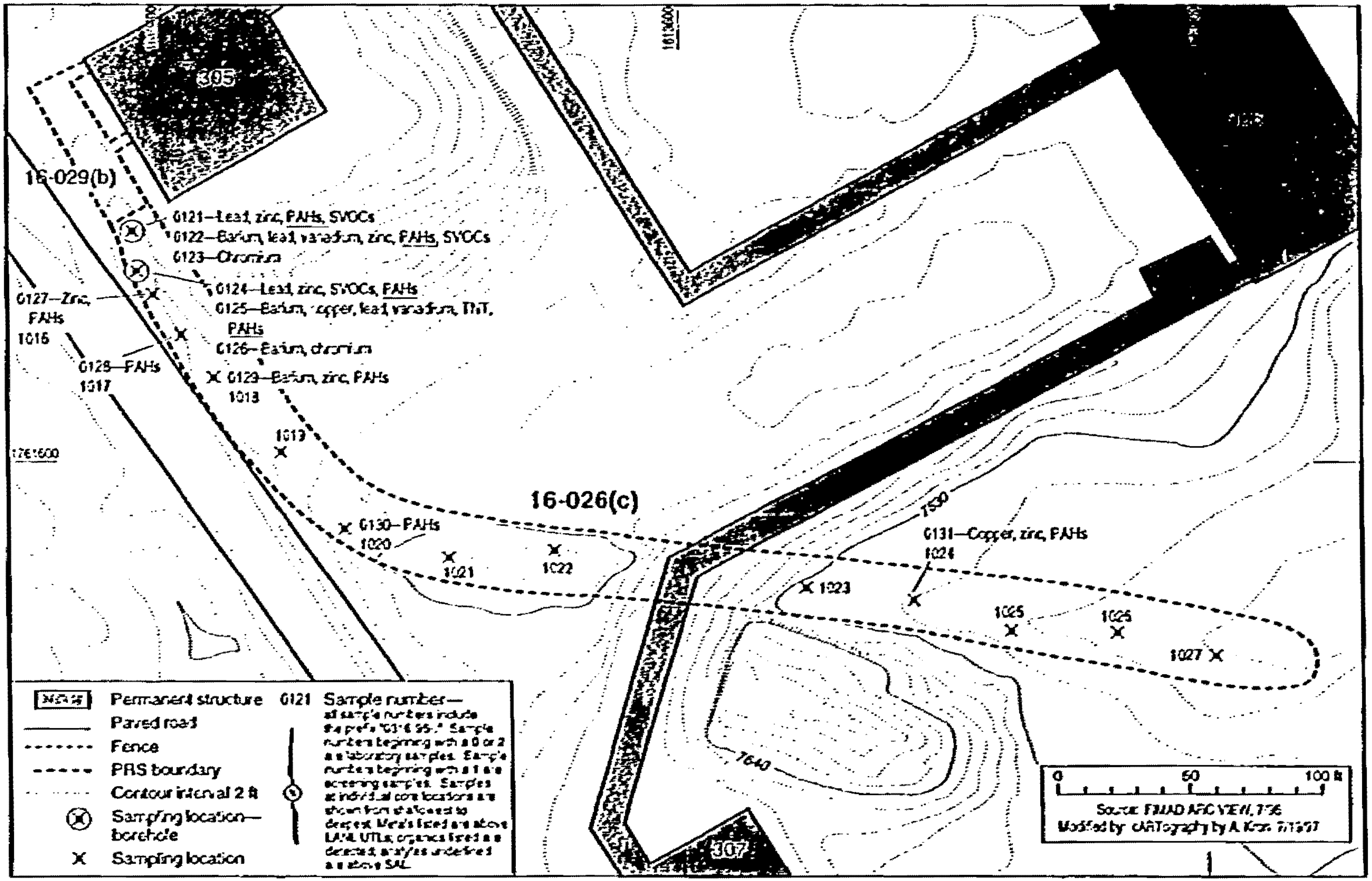


Fig. 5.7.4-1. Screening and laboratory sample locations associated with PRS 16-026(c).

TABLE 5.7.5-1

INORGANICS WITH CONCENTRATIONS GREATER THAN BACKGROUND UTLs FOR PRS 16-026(c)

SAMPLE ID	DEPTH (ft)	SOIL/ROCK UNIT	BARIUM (mg/kg)	CHROMIUM (mg/kg)	COPPER (mg/kg)	LEAD (mg/kg)	VANADIUM (mg/kg)	ZINC (mg/kg)
LANL UTL (all soil)	N/A[a]	N/A	315	19.3	15.5	23.3	41.9	50.8
LANL UTL (Qbt4)	N/A	N/A	56.6	10.9	6.4	11	9.5	75.4
SAL	N/A	N/A	5 300	210	2 800	400	540	23 000
0316-95-0121	0-0.5	soil	254	8.1	11.8 (P)	33.5 (P[b])	16	148 (J-[c],P)
0316-95-0122	1.7-2.3	Qbt4	183	3.9	5.6 (P)	15.2 (P)	9.6	60.1 (J-,P)
0316-95-0123	3.5-4.5	Qbt4	31.2	22.7 (P)	1.4	0.96	3	17.9
0316-95-0124	0-0.5	soil	156	4.5	6.5(P)	47.6 (P)	— 11.7	58.1 (J-,P)
0316-95-0125	1-1.5	Qbt4	245	5.7	7.3 (P)	18.1 (P)	11.6	51.9 (J-,P)
0316-95-0126	3.5-4.5	Qbt4	128	15 (P)	2.3	2.8	4.4	24.7
0316-95-0127	0-0.5	soil	140	5.4	6	18.2	13.3	52.3
0316-95-0129	0-0.5	soil	633	9.4	11.2	16.7	24.1	73.5
0316-95-0131	0-0.5	soil	170	6.6	42	14.9	19.7	142

a. N/A = Not Applicable
b. P = Professional judgment should be applied, depending on proposed use of the data
c. J- = Estimated value likely to be low

5.7.6 Evaluation of Radionuclides

Samples taken from this PRS were not analyzed for radioactive compounds because process knowledge and facility history does not suggest any use of radionuclides associated with this PRS.

5.7.7 Evaluation of Organic Chemicals

Table 5.7.7-1 presents the analytical results for SVOCs in the samples. A number of samples contained PAHs above SAL. No other organic compounds were present at levels above SALs. Two samples analyzed for SVOCs were PM-qualified due to poor response of the internal standards. Sample 0316-95-0124RE had one internal standard that deviated from the acceptable range by less than 5%. Sample 0316-95-0122RE had three internal standards that were outside the acceptable range, indicating there were sample matrix problems. Detected compounds in both samples were PM-qualified and should be considered estimated. This qualification does not affect the use of these data for decision-making purposes, particularly since only two of a total of eleven samples were qualified for problems associated with QA/QC analysis. No VOCs were detected at this PRS. TNT was detected in sample 0316-95-0125 at 0.133 mg/kg, which is well below the SAL of 15 mg/kg (Table 5.7.7-2).

TABLE 5.7.7-1

PRS 16-026(c) SOIL CONCENTRATIONS FORDETECTED SEMIVOLATILE ORGANIC COMPOUNDS

SAMPLE ID	DEPTH (ft)	Acenaphthene (mg/kg)	Anthracene (mg/kg)	Benzo(a) anthracene (mg/kg)	Benzo(b) fluoranthene (mg/kg)	Benzo(k) fluoranthene (mg/kg)	Benzo(g,h,i) perylene mg/kg)	Benzo(a)pyrene (mg/kg)	Benzoic Acid (mg/kg)	Chrysene (mg/kg)	Dibenzofuran (mg/kg)	Dibenzo (a,h) anthracene (mg/kg)	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Indeno(1,2,3-cd) pyrene (mg/kg)	2-Methylnaphthalene (mg/kg)	Naphthalene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)
SAL	N/A[a]	2 200	18 000	0.61	0.61	6.1	NC[b]	0.061	100 000	61	260	0.061	2 600	2 300	0.61	NC	1 000	NC	19 000
EQL	N/A	0.33	0.33	0.33	0.33	0.33	0.33	0.33	3.3	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
0316-95-0121	0-0.5	0.12 (J[c])	0.19 (J)	0.57	0.89	0.38 (J)	0.28 (J)	0.62	4 (U[d])	0.75	0.043 (J)	0.079 (U)	1.6	0.11 (J)	0.31 (J)	0.4 (U)	0.05 (J)	1.1	1.5
0316-95-0122RE	1.7-2.3	0.18 (J,PM[e])	0.5 (J,PM)	0.72	0.92	0.34 (J)	0.43	0.74	3.9 (U)	0.79	0.96 (J,PM)	0.12 (J)	1.6 (J,PM)	0.17 (J,PM)	0.44	0.47 (J,PM)	0.065 (J,PM)	1.2 (J,PM)	1.8
0316-95-0124RE	0-0.5	0.06 (J)	0.0.96 (J)	0.33 (J)	0.59 (J,PM)	0.25 (J,PM)	0.2 (J,PM)	0.39 (J,PM)	0.082 (J)	0.52	1.8 (U)	0.056 (J,PM)	0.92	0.047 (J)	0.21 (J,PM)	0.38 (U)	0.38 (U)	0.68	1.1
0316-95-0125	1-1.5	0.44 (U)	0.07 (J)	0.14 (J)	0.19 (J)	0.44 (U)	0.089 (J)	0.12 (J)	4.4 (U)	0.17 (J)	0.44 (U)	0.44 (U)	0.35 (J)	0.44 (U)	0.078 (J)	0.44 (U)	0.44 (U)	0.28 (J)	0.39 (J)
0316-95-0127	0-0.5	0.38 (U)	0.38 (U)	0.068 (J)	0.12 (J)	0.38 (U)	0.38 (U)	0.084 (J)	0.38 (U)	0.93 (J)	0.38 (U)	0.38 (U)	0.2 (J)	0.38 (U)	0.38 (U)	0.38 (U)	0.38 (U)	0.11 (J)	0.116 (J)
0316-95-0128	0-0.5	0.36 (U)	0.36 (U)	0.36 (U)	0.36 (U)	0.36 (U)	0.36 (U)	0.36 (U)	3.6 (U)	0.36 (U)	0.36 (U)	0.36 (U)	0.051 (J)	0.36 (U)	0.36 (U)	0.36 (U)	0.36 (U)	0.36 (U)	0.048 (J)
0316-95-0129	0-0.5	0.37 (U)	0.37 (U)	0.37 (U)	0.37 (U)	0.37 (U)	0.37 (U)	0.37 (U)	3.7 (U)	0.06 (J)	0.37 (U)	0.37 (U)	0.11 (J)	0.37 (U)	0.37 (U)	0.37 (U)	0.37 (U)	0.074 (J)	0.07 (J)
0316-95-0130	0-0.5	0.36 (U)	0.36 (U)	0.087 (J)	0.36 (U)	0.36 (U)	0.36 (U)	0.36 (U)	3.6 (U)	0.12 (J)	0.36 (U)	0.36 (U)	0.21 (J)	0.36 (U)	0.36 (U)	0.36 (U)	0.36 (U)	0.15 (J)	0.36 (J)
0316-95-0131RE	0-0.5	0.39 (U)	0.39 (U)	0.39 (U)	0.39 (U)	0.39 (U)	0.39 (U)	0.39 (U)	3.9 (U)	0.39 (U)	0.39 (U)	0.39 (U)	0.12 (J)	0.39 (U)	0.39 (U)	0.39 (U)	0.39 (U)	0.068 (J)	0.14 (J)

a. N/A = Not Applicable
b. NC = Not Calculated
c. J = Estimated quantity—result is above the detection limit but below the estimated quantitation limit.
d. U = Undetected—the listed value is the detection limit.
e. PM = Professional judgment should be applied prior to using the data.

TABLE 5.7.7-2

PRS 16-026(c) SOIL CONCENTRATIONS FOR HIGH EXPLOSIVES

SAMPLE ID	DEPTH (ft)	TNT (mg/kg)
SAL	N/A[a]	15
EOL	N/A	0.25
0316-95-0125	1-1.5	0.133

a. N/A = Not Applicable

5.7.8 Risk-Based Screening Assessment

PAHs were detected at levels above SALs, although all were at concentrations of less than 1 ppm. Inorganics were present at levels less than SALs. The PAHs present above SALs included benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and Dibenzo(a,h)anthracene. These PAHs will be retained as COPCs for further evaluation. Visual inspection of the data for constituents present at levels greater than background UTLS but less than SALs indicated that an MCE would not approach a target value of 1. Therefore, multiple constituent effects for contaminants below SALs are not considered for this PRS.

5.7.9 Human Health Risk Assessment

Three PAHs were identified in the screening assessment presented in Section 5.7.8. PAHs were detected above SALs at this PRS. The sampling locations where PAHs were detected also receive storm-water runoff from asphalt paved areas such as the road that parallels this PRS boundary. The presence of PAHs in the analytical data from this site is not unexpected because PAHs are found in asphalt and are products of incomplete combustion from motor vehicles. The low concentrations of PAHs at this PRS (less than 1 ppm) are likely to be associated with runoff from the nearby paved areas rather than due to PRS-related contamination.

Thus, the most likely explanation for the observation of PAHs in these soil samples is that they represent nonspecific contamination associated with general industrial activities. The "Toxicological Profile for Polycyclic Aromatic Hydrocarbons (PAHs)" (ATSDR 1995, 55663) by the Agency of Toxic Substances and Disease Registry shows that soil concentrations of PAHs in urban/industrial areas commonly range in the tens to hundreds of mg/kg. The source of these constituents includes combustion products from organic materials and fossil fuels and runoff from asphalt and roofing tar.

Process knowledge and history for the facilities associated with 16-026(c) suggests that PAHs were not used in processes in this area. Asphalt is a common source of PAHs that is present upgradient from the surface soils of this outfall. This material and vehicle emissions are the likely sources for these contaminant signatures. This constitutes a continuing source of contaminants and consequently is not within the scope of the Environmental Restoration project. The PAHs will be dropped as COPCs for this PRS.

5.7.10 Preliminary Ecological Assessment

In cooperation with NMED and EPA Region 6, the Laboratory ER Project is developing an approach for ecological risk assessment. Further ecological risk assessment at this site will be deferred until this site can be assessed as part of the ecological exposure unit methodology currently being developed. When completed, the ecological risk assessment will be provided as an attachment.

5.7.11 Conclusions and Recommendations

Biased Phase I sampling located sample points likely to show evidence of a release. Inorganic chemicals were identified above UTL values at this PRS, but are present at levels well-below SALs. Organic chemicals were detected above SALs, but are associated with continuing releases from the nearby asphalt roadway. In general, the data collected supports the site conceptual model. The highest constituent concentrations are generally near the outfall discharge point rather than in the further downgradient samples or in the samples at the greatest depth.

Constituents have been bounded relative to SALs. Samples collected at depth and downgradient within the drainage are well below SALs. This PRS is recommended for human-health NFA based on NFA Criterion 5.

5.8 PRS 16-026(d)

PRS 16-026(d) is the outfall from two inactive sumps at TA-16-303. The sumps are PRS 16-029(c) and will be investigated during a later field campaign. There was no contamination above SALs, other than PAHs derived from a continuing source; therefore, this PRS is recommended for human-health NFA.

5.8.1 History

PRS 16-026(d) is discussed in detail in Subsection 5.2 of the RFI work plan (LANL 1993, 1094).

TA-16-303 is a rest house that serves TA-16-302, an HE casting facility. This facility was built in 1953. The rest house is used for storing raw materials used in the casting process, and HE castings produced in TA-16-302 (LANL 1989, 15-16-362). Potential contaminants at this site were identified as: HE, HE impurities and degradation products, metals, particularly barium from baratol casting, and laboratory chemicals such as solvents.

5.8.2 Description

PRS 16-026(d) is located south of TA-16-303 (Figure 5.0-1). The outfall drains into a well-defined drainage ditch that parallels the access road. Runoff from the adjacent road drains into the drainage ditch. The area is grassy and slopes gradually to the southeast. The HE sumps that discharged into this PRS are plugged.

5.8.3 Previous Investigations

Beginning in 1970, Baytos conducted an extensive study of HE in outfalls at TA-16. One sample from the TA-16-303 outfall was collected in April 1970. This sample contained 0.02% (by weight) of HMX and/or RDX, and no TNT (Baytos 1970, 15-16-278). Another sample collected in December 1970 contained 1.8% (by weight) of HMX and/or RDX, and 0.3% of TNT (Baytos 1970, 15-16-0017).

5.8.4 Field Investigation

The objective of Phase I sampling at this site was to determine via biased sampling if a release had occurred from the drain line outfall and if that release caused contamination above action levels. The sampling design was biased to detect contaminants by collecting samples at locations most likely to be contaminated, according to the site conceptual model. The sampling and analysis plan was also designed to: 1) delineate any contamination above action levels in both a vertical and downgradient directions to support cleanup activities; and 2) provide sufficient data to support a preliminary risk assessment. If contamination did occur, Phase I investigation would also identify all COPCs.

The site conceptual model for releases at this outfall is that the primary release mechanism to the PRS is by discharge of constituents from the outfall pipe to the downgradient drainage area. It is assumed that such discharge will result in the highest constituent concentrations near the outfall and in the downgradient sediment traps, particularly the sediment traps nearest the outfall. Non-volatile constituents (e.g. SVOCs, HE, inorganics) are hypothesized to decrease in concentration vertically into tuff and downgradient from the outfall. Volatile organics are likely to be at higher concentrations in subsurface samples because they are likely to volatilize in near-surface samples due to temperature fluctuations. The soil-tuff interface consists of a transition in both material and hydrogeologic properties that can act as a collection and transport zone for contaminants. This conceptual model guided sampling and screening locations by emphasizing samples near the outfall, surface samples, and soil-tuff interface samples. Field screening — particularly for the HE, which are the principal constituents likely to be present at this site — was further used to bias sample locations, based on this conceptual model. The intent was to submit samples with positive screening results for laboratory analysis.

The EPA-approved RFI sampling plan for this site called for two boreholes to be drilled near the outfall. The first borehole was drilled at the outfall. The second borehole was drilled approximately 25 ft downstream at the next sediment trap. Samples were collected from the surface interval, the interval bounding the soil-tuff interface, and the bottom of each borehole. The bottom of each borehole was located at least 2.5 ft below the soil-tuff interface.

Beyond the boreholes, surface sample locations were screened for HE. At the first negative HE screening location, a total of three surface laboratory samples were collected at 20-ft intervals. Two additional surface laboratory samples were collected further downgradient in sediment traps.

Out of 18 screening samples, 11 analytical samples were collected at this site. All samples were collected with a hand auger except for the two samples at depth in the boreholes near the outfall. These were collected with a split spoon. The depth of the borehole at the outfall itself was 5 ft. The depth of the borehole downgradient from the outfall was 6.5 ft. The soil-tuff interface is located at a depth of 0.8 ft in the area of this PRS.

All samples from this site were screened for HE, radiation, and volatiles. All samples screened negative.

Because this PRS is located near other similar PRSs, the full 500 ft of this drainage could not be sampled as described in the original plan. This PRS runs into the drainage from PRS 16-026(c) after 289 ft. Therefore, only 289 ft of PRS 16-026(d) was sampled. This does not affect the outcome of this investigation because any contamination located more than 289 ft away are captured in the investigation of downgradient PRS 16-026(c).

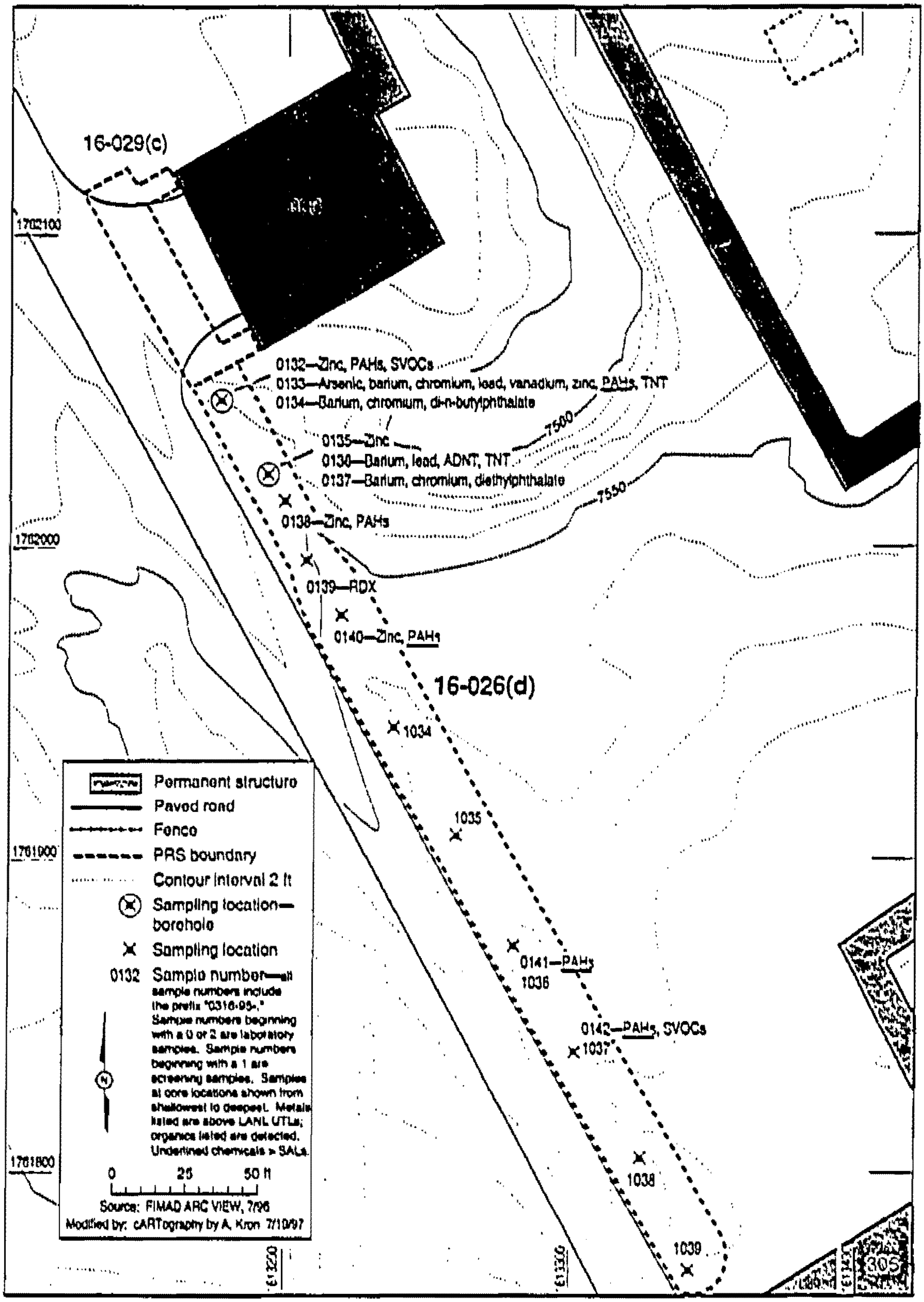
Table 5.8.4-1 lists the samples analyzed at PRS 16-026(d). Figure 5.8.4-1 shows the locations of the screening and laboratory samples taken at PRS 16-026(d).

TABLE 5.8.4-1

SUMMARY OF REQUEST NUMBERS FOR LABORATORY SAMPLES TAKEN AT PRS 16-026(d)

SAMPLE ID	LOCATION ID	DEPTH (ft)	SAMPLE MATRIX	VOCs	SVOCs	HE	INORGs
0316-95-0132	16-1465	0-0.5	Soil	NA[a]	546[b]	546	547
0316-95-0133	16-1465	0.6-1	Qbt4	546	546	546	547
0316-95-0134	16-1465	3-5	Qbt4	546	546	546	547
0316-95-0135	16-1656	0-0.5	Soil	NA	546	546	547
0316-95-0136	16-1656	0.5-0.9	Qbt4	546	546	546	547
0316-95-0137	16-1656	5-6.5	Qbt4	546	546	546	547
0316-95-0138	16-1466	0-0.5	Soil	NA	121	121	122
0316-95-0139	16-1467	0-0.5	Soil	NA	121	121	122
0316-95-0140	16-1468	0-0.5	Soil	NA	121	121	122
0316-95-0141	16-1469	0-0.5	Soil	NA	121	121	122
0316-95-0142	16-1470	0-0.5	Soil	NA	121	121	122

a. NA = Not Analyzed
b. ER analytical request number



Source: FIMAD ARC VIEW, 7/96
Modified by: cARTography by A. Kron 7/10/97

Fig. 5.8.4-1. Screening and laboratory sample locations at PRS 16-026(d).

5.8.5 Evaluation of Inorganic Chemicals

Inorganics were present at levels greater than UTLs but less than SALs at PRS 16-026(d). Because samples collected at the soil-tuff interface are conservatively compared to the Qbt4 UTL, this can cause certain analytes, such as arsenic, to appear elevated. Table 5.8.5-1 presents the analytical results for inorganics present at levels above UTLs.

TABLE 5.8.5-1

INORGANICS WITH CONCENTRATIONS GREATER THAN BACKGROUND UTL FOR PRS 16-026(d)

SAMPLE ID	DEPTH (ft)	SOIL/ROCK UNIT	ARSENIC (mg/kg)	BARIUM (mg/kg)	CHROMIUM (mg/kg)	LEAD (mg/kg)	VANADIUM (mg/kg)	ZINC (mg/kg)
LANL UTL (all soil)	N/A[a]	N/A	7.82	315	19.3	23.3	41.9	50.8
LANL UTL (Qbt4)	N/A	N/A	2.18	56.6	10.9	11	9.5	75.4
SAL	N/A	N/A	NC[b]	5 300	210	400	540	23 000
0316-95-0132	0-0.5	soil	1.3	267	5.3 (J[c])	21.0	10.3	134 (J)
0316-95-0133	0.5-1	Qbt4	2.2	263 (J)	17 (J)	60.5	10.2	132 (J)
0316-95-0134	3-5	Qbt4	0.35 (U)	100 (J)	40.1 (J)	1.1	1.1 (U)	20.4 (J)
0316-95-0135	0-0.5	soil	1.2	129 (J)	1.9 (J)	17	5.9	57.8 (J)
0316-95-0136	0.5-0.8	Qbt4	1.7	190 (J)	4.3 (J)	79.8	7.6	55.0 (J)
0316-95-0137	5-6.5	Qbt4	0.55 (U)	292 (J)	72.7 (J)	1.3	1.7 (U)	23.1 (J)
0316-95-0138	0-0.5	soil	1.9	196	4.4	11.9	14.2	80.3
0316-95-0140	0-0.5	soil	1.4	155	3.1	5.2	8.3	68.3

a. N/A = Not Applicable
b. NC = Not Calculated
c. J = Estimated quantity—result is above the detection limit but below the estimated quantitation limit.

5.8.6 Evaluation of Radionuclides

Radionuclides were not analyzed for at this PRS because process knowledge and facility history suggests that there were no radionuclides associated with this PRS.

5.8.7 Evaluation of Organic Chemicals

Table 5.8.7-1 presents the analytical results for SVOCs in the samples. A number of samples contained PAHs, although the only organic compound present at levels above SALs was benzo(a)pyrene. Sample 0316-95-0139 had elevated detection limits due to matrix effects in the sample.

TABLE 5.8.7-1

PRS 16-026(d) SOIL CONCENTRATIONS FOR DETECTED SEMIVOLATILE ORGANIC COMPOUNDS

SAMPLE ID	DEPTH (ft)	Acenaphthene (mg/kg)	Anthracene (mg/kg)	Benzo(a) anthracene (mg/kg)	Benzo(a)pyrene (mg/kg)	Benzoic Acid (mg/kg)	Chrysene (mg/kg)	Diethyl phthalate (mg/kg)	Di-n-butyl phthalate (mg/kg)	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Naphthalene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)
SAL	N/A^a	2 200	18 000	0.61	0.061	100 000	61	52 000	6 500	2 600	2 300	1 000	NC^b	19 000
EQL	N/A	0.33	0.33	0.33	0.33	3.3	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
0316-95-0132RE	0-0.5	0.064 (J^c)	0.095 (J)	0.21 (J)	0.38 (U)	0.15 (J)	0.3 (J)	0.38 (U^d)	0.38 (U)	0.56	0.059 (J)	0.04 (J)	0.42	1.2
0316-95-0133	0.6-1	0.095 (J)	0.14 (J)	0.31 (J)	0.16 (J)	3.8 (U)	0.410	0.38 (U)	0.38 (U)	0.82	0.078 (J)	0.058 (J)	0.65	0.970
0316-95-0134DL	3-5	0.74 (U)	0.74 (U)	0.74 (U)	0.37 (U)	7.4 (U)	0.74 (U)	0.74 (U)	0.17 (J)	0.74 (U)	0.74 (U)	0.74 (U)	0.74 (U)	0.74 (U)
0316-95-0137	5-6.5	0.35 (U)	0.35 (U)	0.35 (U)	0.35 (U)	3.5 (U)	0.35 (U)	0.80	0.35 (U)	0.35 (U)	0.35 (U)	0.35 (U)	0.35 (U)	0.35 (U)
0316-95-0138RE	0-0.5	0.36 (U)	0.36 (U)	0.36 (U)	0.38 (U)	3.6 (U)	0.36 (U)	0.38 (U)	0.36 (U)	0.36 (U)	0.36 (U)	0.36 (U)	0.36 (U)	0.037 (J)
0316-95-0140	0-0.5	0.34 (U)	0.34 (U)	0.059 (J)	0.082 (J)	3.4 (U)	0.074 (J)	0.34 (U)	0.34 (U)	0.12 (J)	0.34 (U)	0.34 (U)	0.13 (J)	0.28 (J)
0316-95-0141	0-0.5	0.38 (U)	0.38 (U)	0.072 (J)	0.092 (J)	3.8 (U)	0.089 (J)	0.38 (U)	0.38 (U)	0.18 (J)	0.38 (U)	0.38 (U)	0.12 (J)	0.28 (J)
0316-95-0142HE	0-0.5	0.4 (U)	0.071 (J)	0.23 (J)	0.26 (J)	4 (U)	0.3 (J)	0.054 (J)	0.4 (U)	0.63	0.04 (J)	0.4 (U)	0.47	0.810

a. N/A = Not Applicable
b. NC = Not Calculated
c. J = Estimated quantity—result is above the detection limit but below the estimated quantitation limit.
d. U = Undetected—the listed value is the detection limit.

The only VOCs detected during analysis were methylene chloride and trichlorofluoromethane. However, they were not present in levels greater than the EQL and were also found during analysis of the analytical blank sample.

Table 5.8.7-2 presents the data for high explosives detected during analysis. RDX is the only HE present at a level near SAL.

TABLE 5.8.7-2

PRS 16-026(d) SOIL CONCENTRATIONS FOR HIGH EXPLOSIVES

SAMPLE ID	DEPTH (ft)	4-ADNT (mg/kg)	RDX (mg/kg)	TNT (mg/kg)
SAL	N/A[a]	NC[b]	4	15
EQL	N/A	NC	1	0.25
0316-95-0133	0.6-1	0.091 (U[c])	0.174 (U)	0.24
0316-95-0136	0.5-0.9	0.168	0.173 (U)	0.196
0316-95-0139	0-0.5	0.091 (U)	2.42	0.079 (U)

a. N/A = Not Applicable
b. NC = Not Calculated
c. U = Undetected—the listed value is the detection limit.

5.8.8 Risk-Based Screening Assessment

The PAH benzo(a)pyrene was detected at levels above SALs. It is a COPC. Other SVOCs were reported at levels above detection limits but less than SALs.

Arsenic is not included in the MCE since there is no calculated SAL. In addition, only one sample out of eleven was slightly above UTL. Therefore, arsenic will not be retained as a COPC. Inorganics were present at levels less than SALs. An MCE was calculated for this PRS using values for constituents greater than UTLs but below SALs. The results are shown in Table 5.8.8-1.

The MCE calculation was performed using the sum of the maximum concentrations at this PRS. The MCE results for noncarcinogens and chemical carcinogens were 0.3 and 1.5, respectively. Because the MCE value for noncarcinogens is less than unity, a potential human health risk based on additive effects is not identified for this class of chemical. The carcinogenic COPCs that have a normalized value of more than 0.1 in the MCE at this PRS are chromium, benzo(a)anthracene, and RDX. These compounds are, therefore, retained as COPCs for further evaluation.

TABLE 5.8.8-1

MCE FOR PRS 16-026(d)

ANALYTE	MAX CONC. (mg/kg)	SAL (mg/kg)	NORMALIZED VALUE
Noncarcinogenic Effects			
Barium	292	5 300	0.055
Lead	79.8	400	0.200
Vanadium	14.2	540	0.026
Zinc	134	23 000	0.006
Acenaphthene	0.095	2 200	<0.001
Anthracene	0.14	18 000	<0.001
Benzoic Acid	0.15	100 000	<0.001
Di-n-butylphthalate	0.17	6 500	<0.001
Diethyl phthalate	0.8	52 000	<0.001
Fluoranthene	0.82	2 600	<0.001
Fluorene	0.079	2 300	<0.001
Naphthalene	0.058	1 000	<0.001
Pyrene	1.2	19 000	<0.001
		TOTAL	0.3
Carcinogenic Effects			
Chromium	72.7	210	0.346
Benzo(a)anthracene	0.31	0.61	0.508
Chrysene	0.41	61	0.007
RDX	2.42	4	0.605
TNT	0.321	15	0.021
		TOTAL	1.5

5.8.9 Human Health Risk Assessment

Two PAHs were identified as COPCs in the screening assessment presented in Section 5.8.8. One PAH was detected above SALs at this PRS. The sampling locations where PAHs were detected also receive storm-water runoff from asphalt paved areas such as the road that parallels this PRS's boundary. The presence of PAHs in the analytical data from this site is not unusual because PAHs are found in asphalt and are products of incomplete combustion from motor vehicles. The low concentrations of PAHs at this PRS (less than 1 ppm) are likely to be associated with runoff from the nearby paved areas rather than due to PRS-related contamination.

Thus, the most likely explanation for the observation of PAHs in these soil samples is that they represent nonspecific contamination associated with general industrial activities. The "Toxicological Profile for Polycyclic Aromatic Hydrocarbons (PAHs)" (ATSDR 1995, 55663) by the Agency of Toxic Substances and Disease Registry shows that soil concentrations of PAHs

In urban/industrial areas commonly range in the tens to hundreds of mg/kg. The source of these constituents includes combustion products from organic materials and fossil fuels and runoff from asphalt and roofing tar.

Process knowledge and history for the facilities associated with 16-026(d) suggests that PAHs were not used in processes in this area. Asphalt is a common source of PAHs that is present upgradient from the surface soils of this outfall. This material and vehicle emissions are the likely sources for these contaminant signatures. This constitutes a continuing source of contaminants and consequently is not within the scope of the Environmental Restoration project. The PAHs will be dropped as COPCs for this PRS.

The carcinogenic chemicals analyzed in the MCE had a normalized sum of 1.5. The COPCs that have a normalized contribution of more than 0.1 relative to SALs at this PRS other than PAHs are chromium and RDX. Comparison of the maximum concentrations detected for these two chemicals to preliminary remediation goals (PRGs) for industrial soil published by USEPA Region IX indicate that concentrations of these carcinogenic compounds in the soil around this outfall are well below concentrations that would potentially impact human health under an industrial exposure scenario (Table 5.8.9.1-1). Region IX PRGs for industrial soil are conservatively based on 250 days per year of exposure, an assumption that is highly conservative for an outfall area along a roadside at TA-16. In addition, the SAL-based MCE calculation performed in Section 5.8.8 assumes additivity of toxicity endpoints. These maximum values occur at different locations and depths making simultaneous exposure to these concentrations extremely unlikely. Based on this qualitative evaluation for the carcinogenic chemicals detected at this PRS, further human health risk analyses for these chemicals is not justified. Use of an MCE-type approach, where COPC concentrations are normalized to industrial PRGs, also suggest little significant carcinogenic risk at this site under and industrial scenario (Table 5.8.9.1-1).

TABLE 5.8.9.1-1

COMPARISON OF NONCARCINOGENIC COPCs TO INDUSTRIAL SOIL PRGs

Chemical	Maximum Concentration (mg/kg)	Industrial Soil PRG (mg/kg)	Normalized Concentration relative to Industrial PRGs
Chromium	73	450	0.16
RDX	2	17	0.12
Sum			0.28

The COPC data collected at this PRS demonstrate that COPCs other than PAHs are bounded relative to SALs. Downgradient samples have levels of COPCs and other constituents much less than SALs. The PAHs are an exception, but they are due to non-point source discharge from the nearby road. The deepest borehole samples are also less than SALs, although elevated chromium and barium are present at depth. Similar anomalous chromium at depth, at locations where there has not been a widespread chromium release, are observed in several drainages described in this report.

5.8.10 Preliminary Ecological Assessment

In cooperation with NMED and EPA Region 6, the Laboratory ER Project is developing an approach for ecological risk assessment. Further ecological risk assessment at this site will be deferred until this site can be assessed as part of the ecological exposure unit methodology currently being developed. When completed, the ecological risk assessment will be provided as an Attachment.

5.8.11 Conclusions and Recommendations

Biased Phase I sampling located sample points likely to show evidence of a release. Analytical results established only a single COPC above SALs, the PAH benzo(a)pyrene. PAHs are due to runoff from the roadway that is adjacent to the PRS. Qualitative evaluation of other COPCs that are derived from an MCE calculation suggest that the risk to human health is acceptable under an industrial scenario. These data generally support the site-conceptual model, except for the anomalous barium and chromium values observed in the deepest samples. These elevated values may be due to natural high values of these constituents in the subunit of the Bandelier tuff that underlies this PRS.

Constituents other than PAHs are bounded at depth and downgradient relative to SALs. Only low levels of PRS-related constituents were found in samples at depth and in the farthest downgradient samples. Because no constituents are present at levels of concern, this PRS is recommended for human-health NFA under Criterion 5.

5.9 PRS 16-026(v)

PRS 16-026(v) is an outfall associated with sumps at TA-16-460, a decommissioned analytical laboratory. Although HE, metals, and PAHs were found in this outfall, they were not found at levels that pose a threat to human health. Therefore this PRS is recommended for human-health NFA.

5.9.1 History

PRS 16-026(v) is discussed in detail in Subsection 5.2 of the RFI work plan (LANL 1993, 1094).

PRS 16-026(v) is the outfall from an inactive sump associated with TA-16-460. TA-16-460 was constructed in 1952. Because this building was an analytical chemistry laboratory, a number of chemicals could be present in the outfall. In 1968, a small mercury spill occurred in one of the laboratories, although there was no record that mercury entered the drain system. Although it is no longer used as an HE laboratory, it is actively used to support bioremediation studies in greenhouses nearby. Potential contaminants at this site were identified as: HE, HE impurities and degradation products, metals, and laboratory chemicals such as solvents.

5.9.2 Description

PRS 16-026(v) is located southeast of TA-16-460 (Figure 5.0-1). The outfall received effluent from the HE sump, floor drains, bench drains, sink drains, steam drains, and a drinking fountain drain. The outfall is currently controlled under National Pollutant Discharge Elimination System (NPDES) permit, EPA 05A072. The sump outfall has been plugged and no longer receives effluent. The outfall is in the process of being deleted from the NPDES Permit. The outfall discharged into a well-defined drainage. Roof drains also discharge into the drainage from a separate outfall. Parking lot runoff discharges to the drainage.

5.9.3 Previous Investigations

An inventory of the wide range of chemicals used in TA-16-460 was compiled in 1971 (Panowski and Salgado 1971, 15-16-038). The studies and the inventory are discussed in detail in the RFI Work Plan for OU 1082 (LANL 1993, 1094).

Several studies of effluent from TA-16 sumps have been performed over the last 30 years. Two studies involved the outfall associated with PRS 16-026(v). A study of soils in this drainage showed no barium, HMX, RDX, or TNT (Turner and Schwartz 1971, 15-16-284). In 1988, Baytos analyzed water samples from this outfall that were released over 10 consecutive working days. This study showed that 8 ppm of acetone was present in the sump on one day and 2.2 ppm of methyl ethyl ketone was present in the sump on another day. Suspended solids ranged from 0 ppm to 2.5 ppm.

5.9.4 Field Investigation

The objective of Phase I sampling at this site was to determine via biased sampling if a release had occurred from the drain line outfall and if that release caused contamination above action levels. The sampling design was biased to detect contaminants by collecting samples at locations most likely to be contaminated, according to the site conceptual model. The sampling and analysis plan was also designed to: 1) delineate any contamination above action levels in both a vertical and downgradient directions to support cleanup activities; and 2) provide sufficient data to support a preliminary risk assessment. If contamination did occur, Phase I investigation would also identify all COPCs. ...

The site conceptual model for releases at this outfall is that the primary release mechanism to the PRS is by discharge of constituents from the outfall pipe to the downgradient drainage area. It is assumed that such discharge will result in the highest constituent concentrations near the outfall and in the downgradient sediment traps, particularly the sediment traps nearest the outfall. Non-volatile constituents (e.g. SVOCs, HE, inorganics) are hypothesized to decrease in concentration vertically into tuff and downgradient from the outfall. Volatile organics are likely to be at higher concentrations in subsurface samples because they are likely to volatilize in near-surface samples due to temperature fluctuations. The soil-tuff interface consists of a transition in both material and hydrogeologic properties that can act as a collection and transport zone for contaminants. This conceptual model guided sampling and screening locations by emphasizing samples near the outfall, surface samples, and soil-tuff interface samples. Field screening — particularly for the HE, which are the principal constituents likely to be present at this site — was further used to bias sample locations, based on this conceptual model. The intent was to submit samples with positive screening results for laboratory analysis.

The RFI sampling plan for this site called for two boreholes to be drilled near the outfall. The first borehole was drilled at the outfall. The second borehole was drilled at the next downstream sediment trap. Borehole samples were collected from the surface interval, the interval bounding the soil-tuff interface, and the bottom of each borehole. The bottom of each borehole was located at least 2.5 ft below the soil-tuff interface.

The field team was required to deviate slightly from this original plan. Only two samples were collected in the borehole farther from the outfall because the sediment profile overlaying the soil-tuff interface was too thin to yield sufficient sample for analysis of two samples. Therefore, the surface and the soil-tuff interface samples were combined into one sample. This sample was collected from the 0- to 0.5-ft depth. At the outfall itself, the soil-tuff interface was found to be very shallow as well; however, a surface sample from the 0- to 0.5-ft interval and an interface sample from the 0.2- to 1-ft interval were collected.

Beyond the boreholes, sample locations were screened for HE at 10-ft intervals. At the first negative HE screening location, a total of three *surface laboratory samples* were collected at 20-ft intervals. Two additional *surface laboratory samples* were collected further downgradient.

Out of 14 screening samples, 10 analytical samples were collected at this site. Samples at the outfall were collected with a Minute Man^{TM} drill rig. The samples in the second borehole were collected with a split spoon. The depth of the borehole at the outfall itself was 3.5 ft. The depth of the borehole located 6 ft downgradient from the outfall was 4 ft.

All samples from this site were screened for HE, radiation, and volatiles. Samples 0316-95-0189 and -0190 screened positive for 2 ppm of VOCs. All other screening results were negative.

Table 5.9.4-1 summarizes the laboratory samples collected at PRS 16-026(v). Figure 5.9.4-1 shows the locations of these samples.

TABLE 5.9.4-1

SUMMARY OF REQUEST NUMBERS FOR LABORATORY SAMPLES TAKEN AT PRS 16-026(v)

SAMPLE ID	LOCATION ID	DEPTH (ft)	SAMPLE MATRIX	VOCs	SVOCs	HE	INORGs	U
0316-95-0188	16-1513	0-0.5	Soil	NA[a]	923[b]	923	924	925
0316-95-0189	16-1513	0.2-1	Qbt4	1391	1391	1391	1392	1393
0316-95-0190	16-1513	2-3.5	Qbt4	1391	1391	1391	1392	1393
0316-95-0191	16-1660	0-0.5	Soil	NA	923	923	924	925
0316-95-0193	16-1660	2.5-4	Qbt4	980	980	980	981	982
0316-95-0194	16-1514	0-0.5	Soil	NA	140	140	141	142
0316-95-0195	16-1515	0-0.5	Soil	NA	140	140	141	142
0316-95-0196	16-1516	0-0.5	Soil	NA	140	140	141	142
0316-95-0197	16-1517	0-0.5	Soil	NA	140	140	141	142
0316-95-0198	16-1518	0-0.5	Soil	NA	140	140	141	142

a. NA = Not Analyzed
b. ER analytical request number

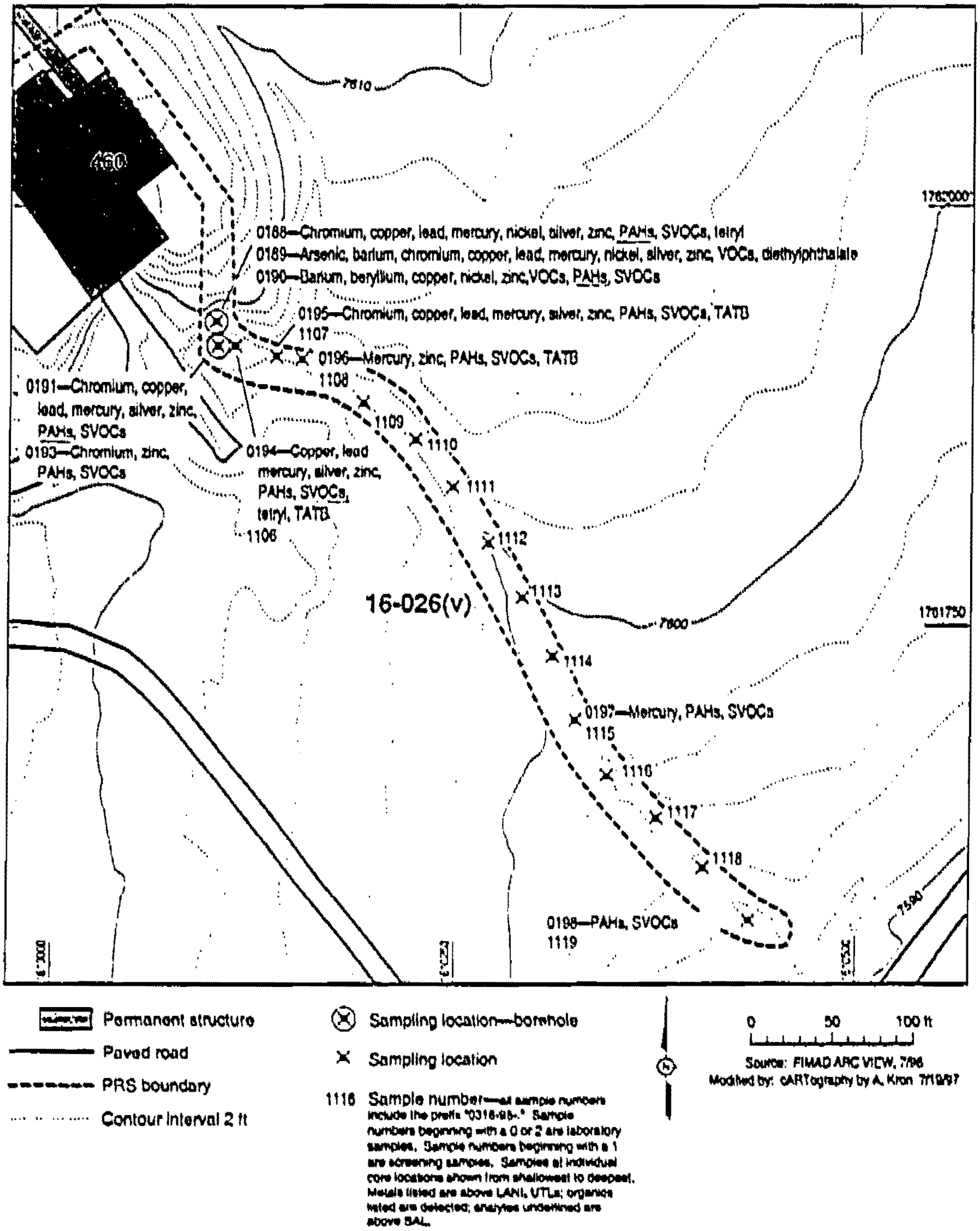


Fig. 5.9.4-1. Sample locations at PRS 16-026(v).

5.9.5 Evaluation of Inorganic Chemicals

Several metals were found at levels greater than UTLs (Table 5.9.5-1). The number of metals exceeding UTLs decreases with distance from the outfall. Chromium , lead, and zinc were P-qualified in some samples because of poor duplicate spike recovery. Those data should be considered estimated. Mercury was detected in the blanks associated with samples 0316-95-0190 and -0193. However, the mercury in the analytical samples was below the UTL in sample -0190 and not detected in sample -0193. Therefore, blank contamination apparently did not affect these samples.

TABLE 5.9.5-1

INORGANICS WITH CONCENTRATIONS GREATER THAN BACKGROUND UTLs FOR PRS 16-026(v)

SAMPLE ID	DEPTH (ft)	SOIL/ROCK UNIT	ARSENIC (mg/kg)	BARIUM (mg/kg)	BERYLLIUM (mg/kg)	CHROMIUM (mg/kg)	COPPER (mg/kg)	LEAD (mg/kg)	MERCURY (mg/kg)	NICKEL (mg/kg)	SILVER (mg/kg)	ZINC (mg/kg)
LANL UTL (all soil)	N/A[a]	N/A	7.82	315	1.95	19.3	15.5	23.3	0.1	15.2	NC[b]	50.8
LANL UTL (Qbt4)	N/A	N/A	2.18	56.5	1.82	10.9	6.4	11	NC	8.73	<1	75.4
SAL	N/A	N/A	NC	5 300	NC	210	2 800	400	23	1 500	380	23 000
0316-95-0188	0-0.5	soil	3.6	194	0.71(U[c])	26.5	412	103	4.1	26.1	5.3	321
0316-95-0189	0.1-1	Qbt4	2.6	317	0.51	19.6(J-[d],P[e])	65.6	79.9	4.3	9.9	5.3	101(P)
0316-95-0190	2-3.5	Qbt4	1.9	190	2	5.5(J-,P)	50.4	8.4	0.09	22	0.57(U)	73.4(P)
0316-95-0191	0-0.3	soil	1.4	118	0.88(U)	24.4	120	84.7	4.2	14.4	7.8	187
0316-95-0193	2.5-4	Qbt4	1.2	14.8	0.57	160	2.4	1.7(J-,P)	0.11(U)	3.8	0.55	21.3(J-,P)
0316-95-0194	0-0.5	soil	2.1(U)	63.5	1.2(U)	14.8	32.8	33.6	9.2	5.2	4.1	141
0316-95-0195	0-0.5	soil	1.5(U)	68.7	1.2(U)	23.8	53.3	43	4.8	8.2(U)	5	157
0316-95-0196	0-0.5	soil	2.3	128	1.1(U)	14.2	19.3	23	1.4	7.3(U)	1.7(U)	71.9
0316-95-0197	0-0.5	soil	2.1	142	1.1	10.1	11.1	13.4	0.30	8.2(U)	0.88(U)	43.9
0316-95-0198	0-0.5	soil	3.2	167	0.68	8.8	8.3	14.1	0.09(U)	8.2	0.65(U)	33.3

a. N/A = Not Applicable
b. NC = Not Calculated
c. U = Undetected—the listed value is the detection limit.
d. J- = Estimated value likely to be low.
e. P = Professional judgment should be applied, depending on proposed use of the data.

5.9.6 Evaluation of Radionuclides

Uranium was the only radionuclide analyzed for at this PRS. Uranium was not present at a level above UTL in any sample.

5.9.7 Evaluation of Organic Chemicals

Table 5.9.7-1 presents the results for VOC analysis at this PRS. Methylene chloride and trichlorofluoromethane are the only volatile compounds detected. Both were detected at low levels and the data are qualified as estimated.

TABLE 5.9.7-1

PRS 16-026(v) SOIL CONCENTRATIONS FOR DETECTED VOLATILE ORGANIC ANALYTES

SAMPLE ID	DEPTH (ft)	METHYLENE CHLORIDE (mg/kg) →	TRICHLOROFLUOROMETHANE (mg/kg)
SAL	N/A[a]	7.8	380
EQL	N/A	0.005	0.005
0316-95-0189	0.1-1	0.004 (J[b])	0.007 (J)
0316-95-0190	2-3.5	0.004 (J)	0.013 (J)

a. N/A = Not Applicable
b. J = Estimated quantity—result is above the detection limit but below the estimated quantitation limit.

Several locations contained SVOCs at levels greater than SALs. Many samples analyzed for SVOCs have J-qualified data. In general, the internal standard responses were poor for most of the samples in this PRS. Reanalyzed data have been used for two samples. In addition, one sample was diluted and reanalyzed because one analyte exceeded the calibration range. Samples 0316-95-0195 and -0196 had high detection limits due to interference from matrix effects. The data to be used in the assessment of this PRS are shown in Table 5.9.7-2.

Table 5.9.7-3 shows the HE present in the analytical samples from this site. PRS 16-026(v) is one of the few sites where triaminotrinitrobenzene (TATB) has been detected. TATB is an explosive used at TA-16 in large quantities; however, it is highly insoluble and therefore not frequently found in soils associated with HE sumps.

TABLE 5.9.7-2
PRS 16-026(v) SOIL CONCENTRATIONS FOR DETECTED SEMIVOLATILE ORGANIC ANALYTES

SAMPLE ID	DEPTH (FT)	ACENAPHTHENE (mg/kg)	ANTHRACENE (mg/kg)	BENZO(A)-ANTHRACENE (mg/kg)	BENZO(A)-PYRENE (mg/kg)	BENZO(B)-FLUORANTHENE (mg/kg)	BENZO(G,H,I)-PERYLENE (mg/kg)	BENZOIC ACID (mg/kg)	BENZO(K)-FLUORANTHENE (mg/kg)	BIS(2-ETHYL-HEXYL)PHTHALATE (mg/kg)	CHRYSENE (mg/kg)
SAL	NA[a]	2 200	18 000	0.61	0.061	0.61	NC[b]	100 000	6.1	32	61
EQL	NA	0.33	0.33	0.33	0.33	0.33	0.33	3.3	0.33	0.33	0.33
0316-95-0188	0-0.5	0.32 (J[c])	1.3	4.9	3.4	6.5	1.2	4.8 (U[d])	2.3	1.3 (U)	5.8
0316-95-0188DL	0-0.5	NA[e]	NA	NA	NA	NA	NA	NA	NA	NA	NA
0316-95-0189	0.1-1	0.37 (U)	0.37 (U)	0.37 (U)	0.37 (U)	0.37 (U)	0.37 (U)	3.7 (U)	0.37 (U)	0.37 (U)	0.37 (U)
0316-95-0190	2-3.5	0.18 (J)	0.36 (J)	1.4	1.6	2.4	0.81	3.8 (U)	0.86	0.5 (U)	1.9
0316-95-0191RE	0-0.3	1.3 (J)	2.6 (J)	4.6	4.4	6.4	2.3 (J)	30 (U)	2.7 (J)	3 (U)	6.9
0316-95-0193RE	2.5-4	0.37 (U)	0.1 (J)	0.37 (UJ[e])	0.37 (UJ)	0.37 (UJ)	0.37 (UJ)	3.7 (U)	0.37 (UJ)	0.24 (J)	0.041 (J)
0316-95-0194	0-0.5	0.33 (J)	0.72 (J)	1.9	2	2.2	1.2	0.59 (J)	1	2	2.2
0316-95-0195	0-0.5	16 (U)	16 (U)	16 (U)	16 (U)	2.5 (J)	16 (U)	160 (U)	16 (U)	2.9 (J)	16 (U)
0316-95-0196	0-0.5	3.7 (U)	3.7 (U)	3.7 (U)	3.7 (U)	3.7 (U)	3.7 (U)	37 (U)	3.7 (U)	0.44 (J)	3.7 (U)
0316-95-0197	0-0.5	0.58 (U)	0.58 (U)	5.8 (U)	0.58 (U)	0.58 (U)	0.56 (U)	0.56 (U)	0.58 (U)	17	0.58 (U)
0316-95-0198	0-0.5	0.44 (U)	0.44 (U)	0.44 (U)	0.44 (U)	0.44 (U)	0.44 (U)	4.4 (U)	0.44 (U)	0.098 (J)	0.074 (J)

SAMPLE ID	DIBENZO(A,H)-ANTHRACENE (mg/kg)	DIBENZOFURAN (mg/kg)	DIETHYLPHTHALATE (mg/kg)	FLUORANTHENE (mg/kg)	FLUORENE (mg/kg)	INDENO-(1,2,3-CD)-PYRENE (mg/kg)	2-METHYL-NAPHTHALENE (mg/kg)	4-METHYLPHENOL (mg/kg)	NAPHTHALENE (mg/kg)	PHENANTHRENE (mg/kg)	PYRENE (mg/kg)
SAL	0.061	250	52 000	2 600	2 300	0.61	NC	300	1000	NC	19 000
EQL	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
0316-95-0188	0.36 (J)	0.13 (J)	0.43 (U)	NA[d]	0.34 (J)	1.4	0.43 (U)	0.43 (U)	0.08 (J)	45	73
0316-95-0188DL	NA	NA	NA	10	NA	NA	NA	NA	NA	NA	NA
0316-95-0189	0.37 (U)	0.37 (U)	0.093 (J)	0.37 (U)	0.37 (U)	0.37 (U)	0.37 (U)	0.37 (U)	0.37 (U)	0.37 (U)	0.37 (U)
0316-95-0190	0.24 (J)	0.071 (J)	0.33 (U)	3.3	0.16 (J)	0.93	0.33 (U)	0.33 (U)	0.07 (J)	1.7	2.9
0316-95-0191RE	0.61 (J)	0.83 (J)	3 (U)	13	1.6 (J)	2.7 (J)	0.46 (J)	3 (U)	1.2 (J)	9.3	9.7
0316-95-0193RE	0.37 (UJ)	0.37 (U)	0.37 (U)	0.058 (J)	0.37 (U)	0.37 (U)	0.37 (U)	0.37 (U)	0.37 (U)	0.48 (J)	0.058 (J)
0316-95-0194	0.31 (J)	0.12 (J)	0.81 (U)	4.5	0.31 (J)	1.3	0.81 (U)	0.42 (J)	0.1 (J)	2.8	5
0316-95-0195	16 (U)	16 (U)	16 (U)	4.2 (J)	16 (U)	16 (U)	16 (U)	16 (U)	16 (U)	2.2 (J)	4.8 (J)
0316-95-0196	3.7 (U)	3.7 (U)	3.7 (U)	0.94 (J)	3.7 (U)	3.7 (U)	3.7 (U)	3.7 (U)	3.7 (U)	0.51 (J)	1 (J)
0316-95-0197	0.58 (U)	0.58 (U)	0.58 (U)	0.58 (U)	0.58 (U)	0.58 (U)	0.58 (U)	0.06 (J)	0.58 (U)	0.58 (U)	0.067 (J)
0316-95-0198	0.44 (U)	0.44 (U)	0.44 (U)	0.14 (J)	0.44 (U)	0.44 (U)	0.44 (U)	0.44 (U)	0.44 (U)	0.093 (J)	0.12 (J)

[a] N/A = Not applicable.
[b] NC = Not calculated.
[c] J = Estimated quantity. Result is above the detection limit but below the estimated quantitation limit.
[d] U = Undetected. The listed value is the detection limit.
[e] NA = Not analyzed.
[f] UJ = The analyte was not positively identified in the sample and the associated value is an estimate of the EQL/EDL.

TABLE 5.9.7-3

PRS 16-026(v) SOIL CONCENTRATIONS FOR DETECTED HIGH EXPLOSIVE ANALYTES

SAMPLE ID	DEPTH (ft)	TETRYL (mg/kg)	TATB (mg/kg)
SAL	N/A^a	650	NC^b
EQL	N/A	0.65	NC
0316-95-0188	0-0.5	0.122	NA
0316-95-0194	0-0.5	0.101	10.5
0316-95-0195	0-0.5	0.096 (U^c)	11.1
0316-95-0196	0-0.5	0.096 (U)	2.41

[a] N/A = Not applicable.
[b] NC = Not calculated.
[c] U = Undetected. The listed value is the detection limit.

5.9.8 Risk-Based Screening Assessment

PAHs were detected at levels above SALs, although all were at concentrations less than 10 ppm. Inorganics were present at levels less than SALs. The PAHs present above SAL include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene These PAHs are COPCs for this PRS.

Since arsenic was detected slightly above the Qbt4 UTL in a soil-tuff interface sample, which is a very conservation assessment, arsenic will not be retained as a COPC. Beryllium was detected slightly above UTL (2.0 vs. 1.82) in one sample and will not be retained as a COPC.

Maximum concentrations of carcinogenic and noncarcinogenic compounds present at levels greater than background UTLs but less than SALs were used for an MCE. The result of this MCE is shown in Table 5.9.8-1. The MCE values for the noncarcinogenic and carcinogenic compounds were 0.9 and 1.4, respectively. The MCE for noncarcinogens is less than the target value of 1, so none of these constituents will be retained as COPCs. The MCE for carcinogens is greater than 1, the target action level. This indicates that these compounds are present at large enough concentrations to warrant further evaluation at PRS 16-026(v). The carcinogenic COPCs that have a normalized value of more than 0.1 in the MCE at this PRS are chromium, benzo(k)fluoranthene, and chrysene. These compounds are, therefore, retained as COPCs for further evaluation.

TABLE 5.9.8-1

MCE CALCULATION FOR PRS 16-026(v)

ANALYTE	MAX CONCENTRATION mg/kg	SAL mg/kg	NORMALIZED VALUE
Noncarcinogenic Effects			
Barium	317	5300	0.060
Copper	412	2800	0.147
Lead	103	400	0.258
Mercury	9.2	23	0.400
Nickel	26.1	1500	0.017
Silver	7.8	380	0.021
Zinc	170	23 000	0.007
Trichlorofluoromethane	0.01	380	<0.001
Acenaphthene	1.3	2200	0.001
Anthracene	2.6	18000	<0.001
Fluoranthene	13	2600	0.005
Fluorene	1.6	2300	<0.001
Naphthalene	1.2	1000	0.001
Pyrene	9.7	19000	<0.001
Benzoic Acid	0.59	100000	<0.001
Dibenzofuran	0.83	260	0.003
Diethylphthalate	0.093	52000	<0.001
4-Methylphenol	0.42	330	0.001
Tetryl	0.122	650	<0.001
TOTAL			0.9
Carcinogenic Effects			
Chromium	160	210	0.762
Methylene Chloride	0.004	7.81	<0.001
Benzo(k)fluoranthene	2.7	6.1	0.443
Chrysene	6.9	61	0.113
Bis(2-ethylhexyl)phthalate	2.9	32	0.091
TOTAL			1.4

5.9.9 Human Health Risk Assessment

A quantitative human health risk assessment was not performed for this PRS. However, a qualitative evaluation of the COPCs identified in the screening assessment is presented.

The carcinogenic COPCs identified above SALs in the screening assessment include the PAHs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Also included as COPCs from the MCE are chromium, chrysene and benzo(k)fluoranthene (the concentrations of these chemicals did not exceed a SAL). The PAHs exceeded their SAL values in three samples at the outfall at a maximum concentration of 6.5 mg/kg. This maximum concentration [benzo(b)fluoranthene] exceeds the SAL by an order of magnitude. The sampling locations where PAHs were detected also receive storm-water runoff from asphalt paved areas such as the parking lot to the west of the PRS. The presence of PAHs in the analytical data from this site is not unusual because PAHs are found in asphalt and are products of incomplete combustion from motor vehicles. The low concentrations of PAHs at this PRS (less than 10 ppm) are likely to be associated with runoff from the nearby paved areas and roof drains rather than due to PRS-related contamination.

The most likely explanation for the observation of PAHs in these soil samples is that they represent nonspecific contamination associated with general industrial activities. The "Toxicological Profile for Polycyclic Aromatic Hydrocarbons (PAHs)" (ATSDR 1995, 55663) by the Agency of Toxic Substances and Disease Registry-shows that soil concentrations of PAHs in urban/industrial areas commonly range in the tens to hundreds of mg/Kg. The source of these signatures includes combustion products from organic materials and fossil fuels and runoff from asphalt and roofing tar.

Process knowledge and history for the facilities associated with 16-026(v) suggests that PAHs were not used in this area. Asphalt and roof tar are common sources of PAHs that are upgradient from the catchment for this outfall. Those materials and vehicle emissions are the likely sources for these contaminant signatures. Parking lot runoff and roof drain runoff directly and strongly impact this drainage. This constitutes a continuing source of contaminants and consequently is not within the scope of the Environmental Restoration Project. The PAHs will be dropped as COPCs for this PRS.

The maximum chromium value that contributed 0.762 (160 mg/Kg) to the MCE for carcinogens is from a sample collected 2.5-4 ft below the ground surface. All the other chromium values are less that 27 mg/Kg. There is no viable exposure pathway for the location of the maximum chromium values under the current landuse conditions. Industrial use of the site is anticipated for the foreseeable future. The chromium value is well-below the industrial PRG for chromium. Therefore, further investigation of chromium as a COPC is not proposed.

COPCs are bounded in the downgradient and vertical directions relative to SALs. Samples at depth and downgradient samples are all at levels less than SALs. Most constituents show general decreases in concentration both with increased depth and in the downgradient direction. Chromium is somewhat anomalous, as is typical in sump drainages, because it shows its highest value in a sample taken at a depth of 2.4 ft.

5.9.10 Preliminary Ecological Assessment

In cooperation with NMED and EPA Region 6, the Laboratory ER Project is developing an approach for ecological risk assessment. Further ecological risk assessment at this site will be deferred until this site can be assessed as part of the ecological exposure unit methodology currently being developed. When completed, the ecological risk assessment will be provided as an attachment.

5.9.11 Conclusions and Recommendation

Biased samples collected during the Phase I investigation showed no contamination present at levels likely to pose an unacceptable risk to human receptors under an industrial land use scenario. Metals were not present above SALs. PAHs were present above SALs but are associated with continuing releases from nearby parking lots and roof drains.

These data generally support the site-conceptual model, except for the anomalous chromium value observed in a deep sample. This elevated value may be due to natural high values of chromium in the subunit of the Bandelier tuff that underlies this PRS.

Contamination at this site is bounded. Both downgradient samples and sample at depth are present at levels below SALs. This PRS is proposed for a human-health NFA under NFA criterion 5.

5.10 16-028(a) South Drainage

The south drainage is the main drainage channel from the burning ground at TA-16. It is designated as PRS 16-028(a) in Addendum I to RFI Work Plan for Operable Unit 1082 (LANL 1994, 1160). One sample location contained HE at a level greater than SAL but less than PRG. The PRS is recommended for human health NFA.

5.10.1 History

The south drainage is discussed in detail in Subsection 5.8 of the RFI Work Plan for Operable Unit 1082 (LANL 1993 1094). It is also discussed in Section 6.4 under PRS 16-028(a) of Addendum I to the RFI Work Plan (LANL 1994, 1160).

The south drainage PRS was established in 1993. In 1994, PRS 16-028(a) was found to be synonymous with the south drainage PRS. The drainage was suspected to contain various types of HE contamination and, possibly, barium from the burning ground runoff. Potential contaminants at this site were identified as HE, HE impurities and degradation products, metals (particularly barium), and laboratory chemicals such as solvents that were burned at the burning ground.

5.10.2 Description

PRS 16-028(a) is referred to as the south drainage because it is located on the south end of the TA-16 Burning Ground (Figure 5.0-1) and provides the only drainage for half the burning ground. It also marks the southern edge of burning ground activities. The drainage channel is well defined and is cut into the steep, rocky side of the mesa. PRSs 16-010(c,d,e,f,g,h,j,k,l,m) are all upgradient of this PRS. Based on Phase I sampling during fiscal year 1995, several of these PRSs (16-010[h,k,l,m]) are contaminated at levels well above SALs for HE. They will be cleaned up in a future Voluntary Corrective Measure (VCM) or Voluntary Corrective Action (VCA). Most of the rest of the upgradient PRSs (16-010[c,d,e,f,j]) are active burning units that currently have interim status under RCRA. PRS 16-010(g), the carbon filter treatment unit, was proposed for NFA in the RFI Work Plan for OU 1082, and EPA suggested that the unit was appropriate for removal from the HSWA permit. Drainage from the asphalt roadway runs directly into PRS 16-028(a).

5.10.3 Previous Investigations

Three extraction procedure (EP) toxicity soil analyses for soluble barium in the south drainage, taken in February 1987, yielded 26 mg/L at 3 ft from the upgradient end of the PRS, 6.6 mg/L at 20 ft, and 2.7 mg/L at 40 ft, with a background value of 0.8 mg/L (Ellvinger 1990, 15-16-372). Five soil samples taken further downgradient in November 1987 yielded concentrations of EP toxicity metals, VOCs, and SVOCs below the detection limits of the analytical methods, except for one sample, which yielded an EP toxicity cadmium value of 0.19 mg/L.

A scoping study of metals in the drainages from the burning ground was performed during the summer of 1992 (Brown et al. 1992, 15-16-389). Three soil samples were collected from the south drainage. Barium concentrations ranged from 941 ppm to 1 420 ppm in the south drainage.

5.10.4 Field Investigation

The objective of the Phase I investigation of this site was to use biased sampling to determine if a release above action levels had occurred. If a release did occur, COPCs would be identified during the Phase I investigation.

The conceptual model for releases at this site is that the primary release mechanism to the PRS is by run-on of material from the upgradient PRSs at the TA-16 Burning Ground. It is assumed that such discharge will result in the highest constituent concentrations near the discharge point and in the downgradient sediment traps, particularly the sediment traps nearest the top of the drainage. Both heavy organic contaminants, such as high explosives and SVOCs, and inorganic contaminants are hypothesized to decrease in concentration both vertically into tuff and downgradient from the outfall. This conceptual model guided sampling and screening locations by emphasizing samples near the top of the drainage, surface samples, and soil-tuff interface samples. Field screening, particularly for HE (the principal constituents likely to be present at this site), was further used to bias sample locations based on this conceptual model. The intent was to submit samples with positive screening results for laboratory analysis.

The sampling at this site called for field screening of ten randomly selected sediment traps in the drainage. The field screening would be used to bias selection of five laboratory samples. Field screening was conducted with an XRF for barium, as well as the HE spot test and radiation screening.

Ten screening samples that were collected during 1995 were surface soil samples taken from the 0- to 0.5-ft interval. Subsurface samples were to be collected only if the soil-tuff interface was located at a depth greater than 0.5 ft. During sampling in FY 1995, the soil-tuff interface was identified at a depth of less than 0.5 ft, and no subsurface samples were collected.

As a deviation from the approved work plan, four subsurface samples were taken from tuff during a re-sampling field campaign in August 1997. These samples were designed to vertically bound contamination found during the 1995 sampling. The samples were located at the same places where the highest levels of COPCs were found during the 1995 sampling. The borehole at location ID16-1329 reached the soil-tuff interface at a depth of 2 ft. Samples were taken from this location at the soil-tuff interface and at a depth of 4-5 ft. The borehole at location ID 16-1330 reached the soil-tuff interface between 1.1 and 2.1 ft. The identification of the soil-tuff interface at a depth of less than 0.5 ft during the FY 1995 campaign was apparently an error. Samples were taken at the soil-tuff interface and at a depth of 4–5 ft.

The results of field screening for barium using XRF are shown in Table 5.10.4-1. All of the barium screening results are below SAL. Field screening with other equipment did not detect any contamination above background.

TABLE 5.10.4-1

FIELD SCREENING RESULTS

SAMPLE ID	LOCATION ID	SCREENING METHOD/RESULT
0316-95-1601	16-1329	XRF(Ba): 699 ppm
0316-95-1602	16-2125	XRF(Ba): not detected
0316-95-1603	16-1330	XRF(Ba): 1 129 ppm
0316-95-1604	16-2126	XRF(Ba): 545 ppm
0316-95-1605	16-1331	XRF(Ba): 635 ppm
0316-95-1606	16-2127	XRF(Ba): 578 ppm
0316-95-1607	16-1332	XRF(Ba): 674 ppm
0316-95-1608	16-1333	XRF(Ba): 655 ppm
0316-95-1609	16-2128	XRF(Ba): 627 ppm
0316-95-1610	16-2129	XRF(Ba): 577 ppm

Table 5.10.4-2 summarizes the samples collected at this PRS. Figure 5.10.4-1 shows screening and laboratory sample locations.

TABLE 5.10.4-2

SUMMARY OF REQUEST NUMBERS FOR LABORATORY SAMPLES TAKEN AT PRS 16-028(a)

SAMPLE ID	LOCATION ID	DEPTH (ft)	SAMPLE MATRIX	VOCs	SVOCs	HE	INORGs	U
0316-95-0363	16-1329	0–0.5	Soil	NA[a]	1391[b]	1391	1392	1393
0316-97-0601	16-1329	1.1–2.1	Tuff	3624R	3624R	3625R	3626R	3627R
0316-97-0602	16-1329	4–5	Tuff	3624R	3624R	3625R	3626R	3627R
0316-95-0364	16-1330	0–0.5	Soil	NA	1391	1391	1392	1393
0316-97-0603	16-1330	1.1–2.1	Tuff	3624R	3624R	3625R	3626R	3627R
0316-97-0604	16-1330	4–5	Tuff	3624R	3624R	3625R	3626R	3627R
0316-95-0365	16-1331	0–0.5	Soil	NA	1391	1391	1392	1393
0316-95-0366	16-1332	0–0.5	Soil	NA	1391	1391	1392	1393
0316-95-0367	16-1333	0–0.5	Soil	NA	1391	1391	1392	1393

a. NA = Not Analyzed
b. ER analytical request number

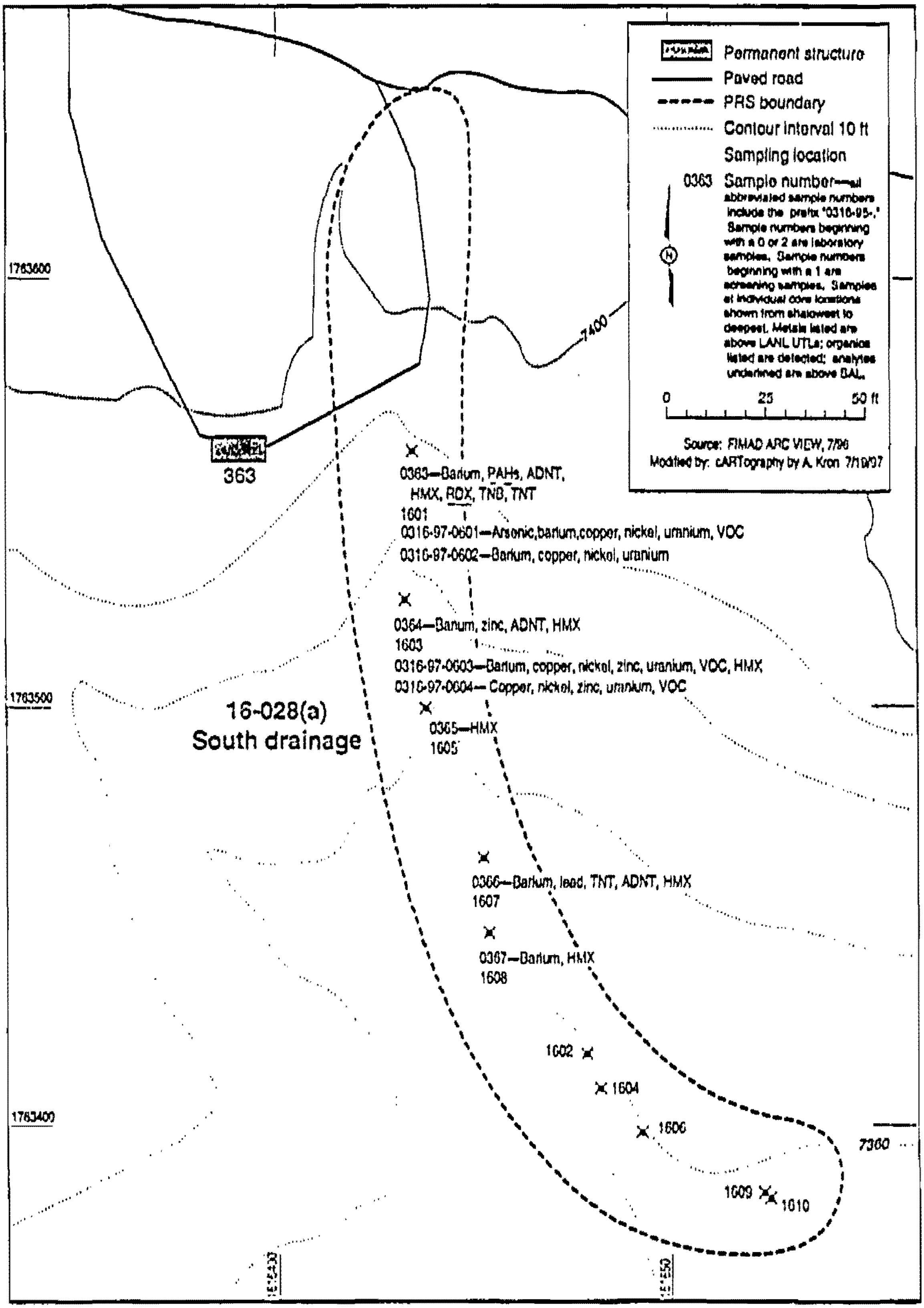


Fig. 5.10.4-1. Sample locations at PRS 16-028(a).

5.10.5 Evaluation of Inorganic Chemicals

Table 5.10.5-1 shows the metals present at levels above UTLs. Barium, a component of many explosives, was above its UTL but well below its SAL. Arsenic, copper, lead, nickel, silver, and zinc were also above UTLs. All values were well below SALs. Arsenic will be carried forward as a COPC from the evaluation of inorganic chemicals.

Sample 0316-97-0602 was U-qualified for barium due to the presence of barium in the blank. Copper had poor duplicate recovery in samples 0316-97-0601 through -0604 and was P-qualified. Focused validation of these data suggests that they should be J-qualified and considered estimated.

5.10.6 Evaluation of Radionuclides

Uranium was present in one sample at a level slightly greater than the UTL. The value is well below the SAL.

5.10.7 Evaluation of Organic Chemicals

PAHs were found at levels less than 0.3 mg/kg in one sample (Table 5.10.7-1). All the PAH data were qualified as being estimated concentrations. Benzo(a)pyrene was present at a level slightly greater than its SAL (0.09 ppm vs. 0.061 ppm). No other PAHs were above SALs. Tetrachloroethene was detected in three out of four subsurface samples, but at levels well below SALs (Table 5.10.7-2). SVOC data for only one (0316-97-602) of the four samples collected in 1997 was valid for decision purposes. Data for the other three samples were rejected. The one sample with valid SVOC data contained no constituents at levels greater than the detection limit.

TABLE 5.10.5-1

INORGANICS WITH CONCENTRATIONS GREATER THAN BACKGROUND UTLs FOR PRS 16-028(a)

SAMPLE ID	DEPTH (ft)	SOIL/ROCK UNIT	ARSENIC (mg/kg)	BARIUM (mg/kg)	COPPER (mg/kg)	LEAD (mg/kg)	NICKEL (mg/kg)	SILVER (mg/kg)	TOTAL URANIUM (mg/kg)	ZINC (mg/kg)
LANL UTL (all soil)	N/A[a]	N/A	7.82	315	15.5	23.3	15.2	NC[b]	5.45	50.8
LANL UTL (Qbt4)	N/A	N/A	2.18	56.6	6.43	11	8.73	<1	4.55	75.4
SAL	N/A	N/A	NC	5 300	2 600	400	1 500	315	29	23 000
0316-95-0363	0–0.5	Soil	1.09	321	3.68	7.9	3.27	0.494 (U[c])	1.68	35.1 (P[d],J)
0316-95-0364	0–0.5	Soil	0.755	588	4.97	5.5	2.35	0.509 (U)	1.15	170 (P,J)
0316-95-0366	0–0.5	Soil	1.43	501	3.93	76.6	3.75	0.492 (U)	2.53	37.8 (P,J)
0316-95-0367	0–0.5	Soil	1.13	368	2.81	6.3	2.83	0.503 (U)	1.69	30.1 (P,J)
0316-97-0601	1.1–2.1	Qbt4	2.4	1770	43.4 (P,J)	5.2	12.5	0.28 (U)	1.38	52.4
0316-97-0602	4–5	Qbt4	1.7	74.1	59.1 (P,J)	1.3	12.8	0.25 (U)	4.60	68.4
0316-97-0603	1.1–2.1	Qbt4	2.0	190	68.5 (P,J)	3.3	16.5	0.49 (U)	1.10	81.5
0316-97-0604	4.5	Qbt4	1.3	43.2	73.2 (P,J)	1.8	16.6	0.29	0.97	81.8

a. N/A = Not Applicable
b. NC = Not Calculated
c. J = Analyte was positively identified, but the result is estimated to be more uncertain than would normally be expected for that analysis.
d. P = Professional judgment should be applied, depending on proposed use of the data.

TABLE 5.10.7-1

PRS 16-028(a) SOIL CONCENTRATIONS FOR DETECTED SEMIVOLATILE ORGANIC ANALYTES

SAMPLE ID	DEPTH (ft)	ANTHRACENE (mg/kg)	BENZO(a)-ANTHRACENE (mg/kg)	BENZO(a)-PYRENE (mg/kg)	BENZO(b)-FLUORANTHENE (mg/kg)	BENZO(k)-FLUORANTHENE (mg/kg)	CHRYSENE (mg/kg)	FLUORANTHENE (mg/kg)	PHENANTHRENE (mg/kg)	PYRENE (mg/kg)
SAL	N/A[a]	18 000	0.61	0.061	0.61	6.1	61	2 600	NC[b]	19 000
EQL	N/A	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
0316-95-0363	0-0.5	0.042 (J)	0.095 (J)	0.09 (J)	0.11 (J)	0.056 (J)	0.11 (J)	0.26 (J)	0.2 (J)	0.22 (J)

a. N/A = Not Applicable
b. NC = Not Calculated
c. J = Estimated quantity—result is above the detection limit but below the estimated quantitation limit.

TABLE 5.10.7-2

PRS 16-028(a) SOIL CONCENTRATIONS FOR DETECTED VOLATILE ORGANIC ANALYTES

SAMPLE ID	DEPTH (ft)	TETRACHLOROETHENE (mg/kg)
SAL	N/A[a]	5.4
EQL	N/A	0.0059
0316-95-0363	0-0.5	NA[b]
0316-97-0601	1.1-2.1	0.230
0316-97-0603	1.1-2.1	1.0
0316-97-0604	4-5	0.024

a. N/A = Not Applicable
b. NA = Not Analyzed

HE was found in a number of samples. Table 5.10.7-3 presents the analytical results for samples containing HE. Only sample 0316-95-0363 contained HE (RDX only) at a level above SAL. All other samples showed that HE contamination dropped off significantly with distance from the burning ground, with only very low levels of HMX (< 1 ppm) detected at the farthest downgradient point. Samples taken at the soil-tuff interface and in tuff also had no or low levels of HE. Only a single subsurface sample, 0316-97-0603, contained any HE (4.87 mg/kg of HMX).

TABLE 5.10.7-3

PRS 16-028(a) SOIL CONCENTRATIONS FOR DETECTED HIGH EXPLOSIVE ANALYTES

SAMPLE ID	DEPTH (ft)	2-ADNT (mg/kg)	4-ADNT (mg/kg)	HMX (mg/kg)	RDX (mg/kg)	1,3,5-TNB (mg/kg)	TNT (mg/kg)
SAL	N/A[a]	NC[b]	NC	3 300	4	3.3	15
EQL	N/A	0.26	NC	2.2	1	0.25	0.25
0316-95-0363	0–0.5	0.093	0.097	8.22	5.33	2.33	0.139
0316-95-0364	0–0.5	0.081(U[c])	0.12	1.04	0.174(U)	0.092(U)	0.089(U)
0316-95-0365	0–0.5	0.081(U)	0.084(U)	0.34	0.174(U)	0.092(U)	0.089(U)
0316-95-0366	0–0.5	0.171	0.247	0.644	0.175(U)	0.093(U)	0.301
0316-95-0367	0–0.5	0.081(U)	0.084(U)	0.432	0.174(U)	0.092(U)	0.089(U)
0316-97-0603	1.1–2.1	0.25(U)	0.25(U)	4.87	1(U)	0.25(U)	0.25(U)

a. N/A = Not Applicable
b. NC = Not Calculated
c. U = Undetected—the listed value is the detection limit.

5.10.8 Risk-Based Screening Assessment

Seven inorganic, one radionuclide, and several organic chemicals were carried forward from the background comparison and organic constituent evaluation. As described in Section 3 of this report, analytes are divided into three classes for the screening assessment (noncarcinogens, carcinogens, and radionuclides), depending on which toxicological effect forms the basis of their SAL. This separation is required to evaluate possible additive effects within each class of chemical.

RDX and benzo(a)pyrene exceeded their SALs in one sample. These two constituents will be retained as COPCs for further evaluation. Sample results that exceeded SAL values are highlighted in black squares in the previous tables.

Arsenic is present at a level slightly higher than the UTL for Qbt4 (2.4 vs. 2.18). However, this sample was a soil-tuff interface sample. Application of a tuff UTL to this material is an extremely conservative assumption. The sample value of 2.4 is well below the UTL for arsenic (7.82) in soils. Because the sample is a mixture of tuff and soil, it is not surprising that arsenic is higher than the tuff UTL. Arsenic will be dropped as a COPC because it is extremely likely that the single sample with a value greater than the UTL represents a mixture of arsenic-poor tuff and arsenic-rich soil.

An MCE calculation was performed using the sum of those maximum constituent concentrations that exceeded background UTLs but were less than SALs. The MCE results for noncarcinogens and chemical carcinogens were 1.05 and 0.383, respectively. The MCE value for noncarcinogenic compounds is equal to or greater than unity; therefore, a potential human-health risk based on additive effects has been identified for this class of chemicals. The noncarcinogenic COPCs that have a normalized value of more than 0.1 in the MCE at this PRS are barium, lead, and 1,3,5-trinitrobenzene. These compounds are, therefore, retained as COPCs for further evaluation. The MCE value for carcinogenic compounds is less than the target value of 1, indicating that multiple constituents below SALs are not present at levels that pose a risk when combined. The MCE calculations are presented in Table 5.10.8-1.

TABLE 5.10.8-1

MCE CALCULATION FOR PRS 16-028(a)

ANALYTE	MAX CONCENTRATION	SAL	NORMALIZED VALUE
Noncarcinogenic Effects			
Barium	588	5 300	0.111
Copper	73.2	2 800	0.026
Lead	76.6	400	0.191
Nickel	16.6	1 500	0.011
Zinc	170	23 000	0.007
Anthracene	0.04	18 000	<0.001
Fluoranthene	0.3	2 600	<0.001
Pyrene	0.2	19 000	<0.001
HMX	8.22	3 300	0.002
1,3,5-Trinitrobenzene	2.3	3.3	0.697
		TOTAL	1.05
Carcinogenic Effects			
Benzo(a)anthracene	0.1	0.61	0.164
Benzo(b)fluoranthene	0.056	6.1	0.009
Benzo(k)fluoranthene	0.06	6	0.010
Tetrachloroethene	1.0	5.4	0.185
Chrysene	0.1	61	0.002
2,4,6-TNT	0.2	15	0.013
		TOTAL	0.383

Only a single radionuclide, uranium, was found above UTL, so no MCE for radionuclides was performed.

5.10.9 Human-Health Risk Assessment

RDX and benzo(a)pyrene were identified as COPCs in the screening assessment presented in Section 5.10.8. Due to the low concentrations of those compounds, a quantitative human-health risk assessment was not performed for this PRS. However, a qualitative evaluation of these COPCs is presented.

RDX and benzo(a)pyrene were detected above their respective SALs. Each of these constituents was detected in one out of five surface samples. The data for these contaminants do not exceed EPA Region 9 industrial PRGs. These contaminants are removed as COPCs because industrial land use will continue at this location for the foreseeable future. In addition, this drainage receives run-on from the upgradient road, suggesting that the PAH is derived from a continuing source.

The noncarcinogenic chemicals analyzed in the MCE had a normalized sum of 1.0. The COPCs that have a normalized contribution of more than 0.1 at this PRS are barium, lead, and trinitrobenzene. The maximum concentrations detected for these chemicals were compared with preliminary remediation goals (PRGs) for industrial soil (as published by EPA Region 9). This comparison indicates that concentrations of noncarcinogenic compounds in the soil around this outfall are an order of magnitude below concentrations that would potentially impact human health under an industrial exposure scenario (Table 5.10.9-1). Region 9 PRGs for industrial soil are conservatively based on 250 days per year of exposure, an assumption that is highly conservative for an outfall area behind a TA-16 building. In addition, the MCE calculation assumes additivity. The maximum values for barium, lead, and 1,3,5-trinitrobenzene are from three different sample locations, making simultaneous exposure highly unlikely. Therefore, based on this qualitative evaluation of the noncarcinogenic chemicals detected at this PRS, further human-health risk analyses for these chemicals is not justified.

TABLE 5.10.9-1

COMPARISON OF COPCs TO INDUSTRIAL SOIL PRGs

CHEMICAL	MAXIMUM CONCENTRATION (mg/kg)	INDUSTRIAL SOIL PRG (mg/kg)
Barium	588	100 000
Lead	77	1 000
1,3,5-trinitrobenzene	2	34
Benzo(a)pyrene	0.1	0.3
RDX	5	17

The three rejected SVOC samples do not significantly affect the decision at this site. The single valid SVOC sample collected in 1997 sufficiently bounds SVOC contamination in the vertical direction. The 1995 data bounded the contamination in the downgradient direction.

The data collected at this PRS have determined the extent of contamination relative to SALs. Both downgradient samples and samples collected at depth are well below SALs. The single sample that contained PAH at levels greater than SALs had a valid SVOC analysis directly beneath it. In addition, a trend toward decreasing constituent concentration is seen in both the vertical and downgradient directions.

5.10.10 Preliminary Ecological Assessment

In cooperation with NMED and EPA Region 6, the Laboratory ER Project is developing an approach for ecological risk assessment. Further ecological risk assessment at this site will be deferred until this site can be assessed as part of the ecological exposure unit methodology currently being developed. When completed, the ecological risk assessment will be provided as an attachment.

5.10.11 Conclusions and Recommendations

Five surface soil laboratory samples and four subsurface laboratory samples were collected in the drainage from the south side of the TA-16 Burning Ground. The south drainage is a well-defined channel, which makes it easy to locate the potential off-site pathway. Laboratory samples were selected from five field locations, conservatively biased to sediment traps that screen high for barium. Barium and HE were the potential contaminants most likely to be present at this site. A second field campaign sampled locations that initially showed the presence of contamination.

The results show that one sample at the top of the mesa had levels of HE above SAL. RDX and benzo(a)pyrene were present at levels above SALs. All of the results above SALs were below EPA Region 9 PRGs. The concentration of contaminants drops off quickly and the last downgradient sample contained only trace amounts of HMX. Samples at depth show all constituents at levels less than SALs. Contamination is bounded in the downgradient and vertical directions relative to SALs.

These data generally support the site-conceptual model: The highest concentrations of constituents are found nearest the source of contamination at the TA-16 Burning Ground.

This PRS is proposed for human-health NFA based on NFA Criterion 5.

5.11 PRS 16-030(g)

PRS 16-030(g) is the inactive outfall from the sump at TA-16-380, a former HE inspection building. The contaminants in the outfall include lead, PAHs, and a variety of HE. It is recommended for human-health NFA because the contaminant concentrations do not pose a risk to human health.

5.11.1 History

PRS 16-030(g) is discussed in detail in Subsection 5.2 of the RFI work plan (LANL 1993, 1094).

PRS 16-030(g) is the outfall from the sump at TA-16-380, a former HE inspection facility. The facility is currently used for storage of classified parts. TA-16-380 was built in 1952 and continues as an active facility. The building is no longer used for HE inspection. Because this outfall is from an HE inspection building, HE, HE degradation products and impurities, and metals were the major potential contaminants at this site. Small chips of HE and HE dust could have entered the outfall from the sump.

5.11.2 Description

The PRS is located south of TA-16-380 (Figure 5.0-1) on top of a mesa, in a well-defined drainage that slopes to the south. The drainage historically received effluent from the HE sumps, from a parking-lot drain, and from the steam-heating system. The sump and steam-heating system discharge have been plugged. The outfall now receives only parking lot runoff. Drainage from this site is to the south into Water Canyon. This outfall is NPDES permitted under permit EPA 05A052. The outfall is in the process of being removed from the Laboratory's NPDES permit.

5.11.3 Previous Investigations

Several studies of effluent from TA-16 sumps have been performed over the last 30 years. The studies are discussed in detail in the RFI Work Plan for OU 1082 (LANL 1993, 1094). Three studies involved the outfall associated with PRS 16-030(g). Studies by Baytos in the 1970s and early 1980s showed almost no HE in the outfall, except for 0.4% wt HE in one sample in 1985 (Baytos 1970, 15-16-278, through Baytos 1988, 15-16-266). A soil study in this drainage showed less than 10 ppm of barium, less than 1 ppm of HMX and RDX, and 11 ppm of TNT (Turner and Schwartz 1971, 15-16-284). During the 1970s, water samples from this outfall were analyzed as part of the NPDES permit application process. Results showed that effluent contained 4 to 20 ppm TNT (Rickenbaugh 1979, 15-16-440; LASL 1977, 15-16-380).

5.11.4 Field Investigation

The objective of Phase I sampling at this site was to determine via biased sampling if a release had occurred from the drain line outfall and if that release caused contamination above action levels. The sampling design was biased to detect contaminants by collecting samples at locations most likely to be contaminated, according to the site conceptual model. The sampling and analysis plan was also designed to: (1) delineate any contamination above action levels in both vertical and downgradient directions to support cleanup activities; and (2) provide sufficient data to support a preliminary risk assessment. If contamination did occur, Phase I investigation would also identify all COPCs.

The site conceptual model for releases at this outfall is that the primary release mechanism to the PRS is by discharge of constituents from the outfall pipe to the downgradient drainage area. It is assumed that such discharge will result in the highest constituent concentrations near the outfall and in the downgradient sediment traps, particularly the sediment traps nearest the outfall. Non-volatile constituents (e.g. SVOCs, HE, inorganics) are hypothesized to decrease in concentration vertically into tuff and downgradient from the outfall. Volatile organics are likely to be at higher concentrations in subsurface samples because they are likely to volatilize in near-surface samples due to temperature fluctuations. The soil-tuff interface consists of a transition in both material and hydrogeologic properties that can act as a collection and transport zone for contaminants. This conceptual model guided sampling and screening locations by emphasizing samples near the outfall, surface samples, and soil-tuff interface samples. Field screenig—particularly for the HE, which are the principal constituents likely to be present at this site—was further used to bias sample locations, based on this conceptual model. The intent was to submit samples with positive screening results for laboratory analysis.

The EPA-approved Phase I investigation of this site called for two boreholes to be drilled near the outfall. The first borehole was drilled at the outfall. The second borehole was drilled at the next downstream sediment trap. Borehole samples were collected from the surface interval, the interval bounding the soil-tuff interface, and the bottom of each borehole. The bottom of each borehole was at least 2.5 ft below the soil-tuff interface.

Beyond the boreholes, sample locations were screened for HE at 10-ft intervals downgradient. At the first negative HE screening location, a total of three surface laboratory samples were collected at 20-ft intervals. A minimum of two additional surface laboratory samples were collected further downgradient.

The depth of the borehole at the outfall itself was 12.5 ft. The soil-tuff interface was reached at 9 ft. While collecting sample 0316-95-0268, the soil-tuff interface sample at the outfall, the field team encountered auger refusal while hand augering at a depth of approximately 10 in. Tuff material was retrieved in sample 0316-95-0268; however, the field team later realized that the soil-tuff interface was significantly deeper at this site. The hole was resampled and a new soil-tuff interface sample, 0316-95-0505, was collected with a split spoon. The depth of the borehole located 16 ft downgradient from the outfall was 7 ft. The soil-tuff interface was located at a depth of 4 ft.

Twelve analytical samples were collected at this site. All samples were field screened for VOCs, radiation, and HE. All field screening results were negative.

The RFI work plan called for the outfall to be screened for a distance of 500 ft down the drainage. This could not be done because the drainage drops off sharply into Water Canyon at 450 ft. This deviation had no impact on the sampling results because sufficient samples were collected in the areas most likely to be impacted by constituents from this PRS. All laboratory samples were collected within 350 ft of the outfall.

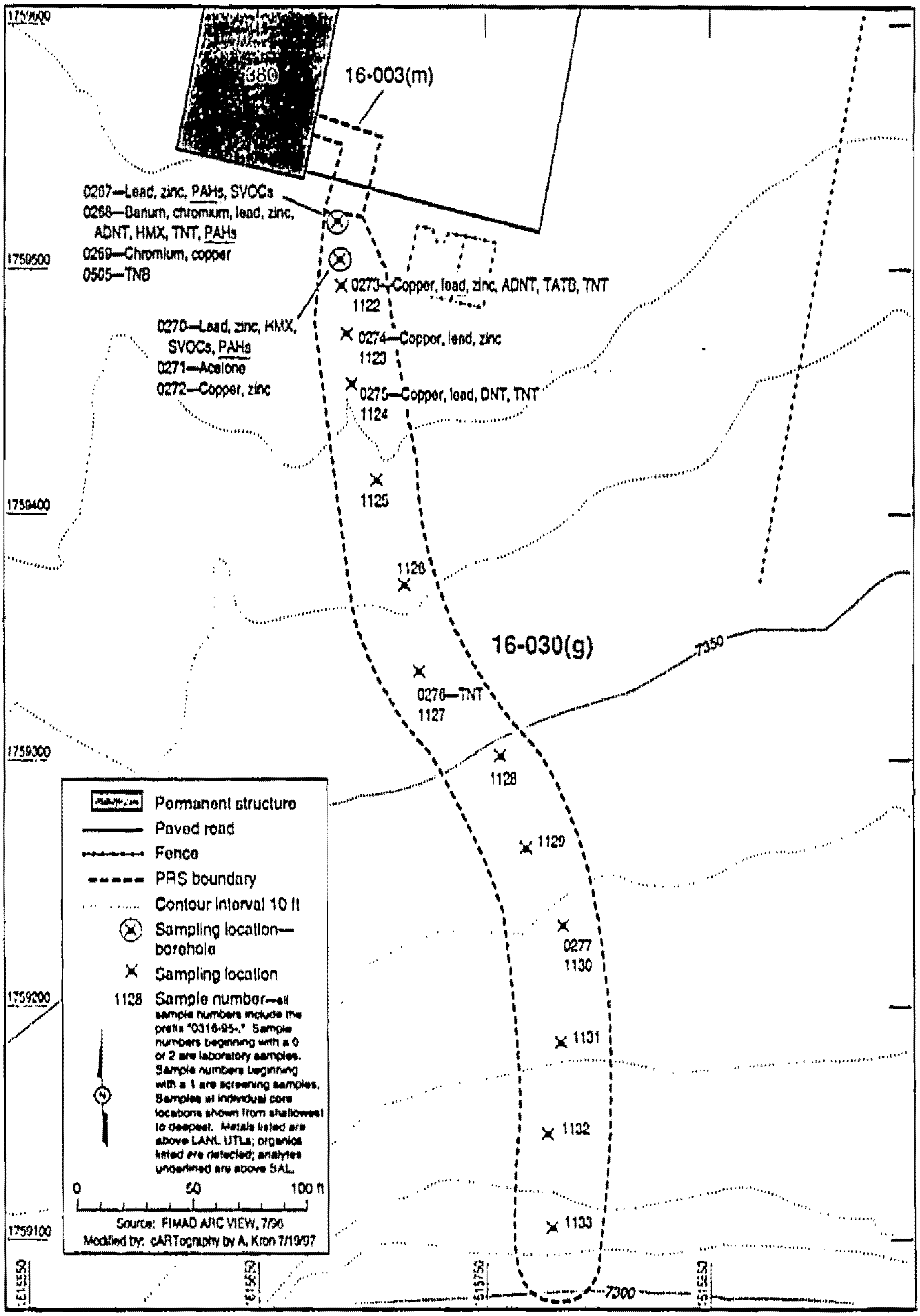
Table 5.11.4-1 summarizes the sampling at the site and Figure 5.11.4-1 shows sample locations.

TABLE 5.11.4-1

SUMMARY OF REQUEST NUMBERS FOR LABORATORY SAMPLES TAKEN AT PRS 16-030(g)

SAMPLE ID	LOCATION ID	DEPTH (ft)	SAMPLE MATRIX	VOCs	SVOCs	HE	INORGs
0316-95-0267	16-1606	0-0.5	Soil	NA[a]	923[b]	NA	924
0316-95-0268	16-1606	0.5-1.5	Soil	923	923	923	924
0316-95-0269	16-1606	11-12.5	Qbt4	972	972	972	978
0316-95-0270	16-1668	0-0.5	Soil	923	923	NA	924
0316-95-0271	16-1668	0.5-0.9	Soil	923	923	NA	924
0316-95-0272	16-1668	5-7	Qbt4	1242	1242	1242	1243
0316-95-0273	16-1607	0-0.5	Soil	NA	215*	215	206
0316-95-0274	16-1608	0-0.5	Soil	NA	215*	215	206
0316-95-0275	16-1609	0-0.5	Soil	NA	215*	215	206
0316-95-0276	16-1610	0-0.5	Soil	NA	215*	215	206
0316-95-0277	16-1611	0-0.5	Soil	NA	215*	215	206
0316-95-0505	16-1606	8.5-9.5	Soil	972	972	972	978

a. NA = Not Analyzed
b. ER analytical request number
* Samples were not analyzed for SVOCs due to laboratory error.



Source: FIMAD ARC VIEW, 7/96
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Fig. 5.11.4-1. Sample locations at PRS 16-030(g).

5.11.5 Evaluation of Inorganic Chemicals

Table 5.11.5-1 shows the metals present at levels above UTLs. Lead is present in one sample at 9% above its SAL. Lead is also elevated above background in several other samples. Barium and lead data were P-qualified in one sample because duplicate recovery was poor.

TABLE 5.11.5-1

INORGANICS WITH CONCENTRATIONS GREATER THAN BACKGROUND UTLs FOR PRS 16-030(g)

SAMPLE ID	DEPTH (ft)	SOIL/ROCK UNIT	BARIUM (mg/kg)	CHROMIUM (mg/kg)	COPPER (mg/kg)	LEAD (mg/kg)	ZINC (mg/kg)
LANL UTL (all soil)	N/A[a]	N/A	315	19.3	30.7	23.3	50.8
LANL UTL (Qbt4)	N/A	N/A	56.6	10.9	6.4	11	75.4
SAL	N/A	N/A	5 300	210	2 800	400	23 000
0316-95-0267	0-0.5	soil	67.4	8.8	14.1	27.1	102
0316-95-0268	0.5-1.5	soil	391	36.9	10.1	138	107
0316-95-0269	11-12.5	Qbt4	11 (J+[b],P[c])	38.5	10.3	2.5 (P)	39.6
0316-95-0270	0-0.5	soil	214	12.6	3.2	40	88.5
0316-95-0272	5-7	Qbt4	14.7	2.2	40.9	1.8 (J+)	56.4
0316-95-0273	0-0.5	soil	150	6.9	73	434	88.8
0316-95-0274	0-0.5	soil	93.4	7	34.9	37	65.6
0316-95-0275	0-0.5	soil	97.4	4.4	62.4	25.9	45.5

[a] N/A = Not applicable.
[b] J+ = Estimated value likely to be high.
[c] P = Professional judgment should be applied, depending on proposed use of the data.

5.11.6 Evaluation of Radionuclides

Radionuclides were not analyzed for at this PRS because process knowledge and facility history suggests that radionuclides were not associated with this PRS.

5.11.7 Evaluation of Organic Chemicals

The only VOC present at this PRS was acetone. It was found in sample 0316-95-0271 at a concentration of 0.009 mg/kg, although this value was qualified as estimated. This level of acetone is below the EQL of 0.02 mg/kg and well below the SAL of 2 000 mg/kg.

PAHs were found in a number of samples. PAHs were present in some samples at levels above SALs. The data are provided in Table 5.11.7-1. Note that samples 0316-95-0273 through -0277 were not analyzed for SVOCs due to an error at the analytical laboratory. The existing data shows that PAHs are present in the outfall, but other SVOCs are not present at levels of concern. Based on the SVOC data available, the PAH contamination decreases with depth.

TABLE 5.11.7-1

PRS 16-030(g) SOIL CONCENTRATIONS FOR DETECTED ORGANIC ANALYTES

SAMPLE ID	DEPTH (FT)	ACENAPHTHENE (MG/KG)	ANTHRACENE (mg/kg)	BENZO(A)-ANTHRACENE (mg/kg)	BENZO(A)-PYRENE (mg/kg)	BENZO(B)-FLUORANTHENE (mg/kg)	BENZO(G,H,I)-PERYLENE (mg/kg)	BENZO(K)-FLUORANTHENE (mg/kg)	CHRYSENE (mg/kg)
SAL	N/A[a]	2 200	18 000	0.61	0.061	0.61	NC[b]	6.1	61
EQL	N/A	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
0316-95-0267	0-0.5	0.84 (J[c])	1.8 (J)	3.3	3.2 (J)	4.8 (J)	1.4 (J)	2.5 (J)	4.9 (U[d])
0316-95-0268	0.5-1.5	0.44 (U)	0.11 (J)	0.44 (U)	0.074 (J)	0.09 (J)	0.44 (U)	0.44 (U)	0.1 (J)
0316-95-0270	0-0.5	0.095 (J)	0.43	1.9	2	2.8	0.93	1	27

DIBENZO-(A,H)-ANTHRACENE (mg/kg)	DI-BENZO-FURAN (mg/kg)	DI-N-BUTYL-PHTHALATE (mg/kg)	FLUORANTHENE (mg/kg)	FLUORENE (mg/kg)	INDENO(1,2,3-CD)-PYRENE (mg/kg)	NAPHTHALENE (mg/kg)	PHENANTHRENE (mg/kg)	PYRENE (mg/kg)
0.061	200	6 500	2 600	2 300	0.61	1 000	NC	19 000
0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
0.41 (J)	0.53 (J)	2.2 (U)	9	0.56 (J)	1.4 (J)	0.86 (J)	6.6	8.5
0.44 (U)	0.44 (U)	0.44 (U)	0.15 (J)	0.44 (U)	0.44 (U)	0.44 (U)	0.1 (J)	0.12 (J)
0.29 (J)	0.043 (J)	0.051 (J)	3.7	0.11 (J)	1.1	0.42 (U)	1.4	2.6

[a] N/A = Not applicable.
[b] NC = Not calculated.
[c] J = Estimated quantity. Result is above the detection limit but below the estimated quantitation limit.
[d] U = Undetected. The listed value is the detection limit.

HE was found in a number of samples. Table 5.11.7-2 presents the analytical results for samples containing HE. No sample contained HE at levels near SALs.

TABLE 5.11.7-2

PRS 16-030(g) SOIL CONCENTRATIONS FOR DETECTED HE ANALYTES

SAMPLE ID	DEPTH (ft)	2-ADNT (mg/kg)	4-ADNT (mg/kg)	2,4-DNT (mg/kg)	HMX (mg/kg)	TATB (mg/kg)	1,3,5-TNB (mg/kg)	TNT (mg/kg)
SAL	N/A[a]	NC[b]	NC	0.65	3 300	NC	3.3	15
EQL	N/A	0.26	NC	0.25	2.2	NC	0.25	0.25
0316-95-0268	0.5-1.5	0.109	0.218	0.058 (U[c])	0.356	NA[d]	0.086 (U)	0.309
0316-95-0270	0-0.5	0.078 (U)	0.092 (U)	0.058 (U)	1.72	NA	0.086 (U)	0.091 (U)
0316-95-0273	0-0.5	0.076 (U)	0.124	0.055 (U)	0.167 (U)	3.34 (J)	0.095 (U)	0.206
0316-95-0275	0-0.5	0.078 (U)	0.094 (U)	0.114	0.171 (U)	1.99 (U)	0.097 (U)	0.109
0316-95-0276	0-0.5	0.075 (U)	0.091 (U)	0.054 (U)	0.166 (U)	1.94 (U)	0.094 (U)	0.478
0316-95-0505	8.5-9.5	0.076 (U)	0.091 (U)	0.056 (U)	0.165 (U)	NA	0.184	0.089 (U)

[a] N/A = Not applicable.
[b] NC = Not calculated.
[c] U = Undetected. The listed value is the detection limit.
[d] NA = Not analyzed.

5.11.8 Risk-Based Screening Assessment

Five inorganic and twenty-four organic chemicals were carried forward from the background comparison and organic constituent evaluation. As described in Chapter 3 of this report, analytes are divided into three classes for the screening assessment (noncarcinogens, carcinogens, and radionuclides), depending on which toxicological effect forms the basis of their SAL. This separation is required to evaluate possible additive effects within each class of chemical.

Only in sample, 0316-95-0273, did lead exceed its SAL. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-c,d)pyrene exceeded SAL values in several soil samples. These compounds will be retained as COPCs for further evaluation. Sample results that exceeded SAL values are highlighted in black squares in the previous tables.

An MCE calculation was performed using the sum of the maximum concentrations of constituents that exceeded background UTLs but were less than SALs. The MCE results for noncarcinogens and chemical carcinogens were 0.2 and 0.8, respectively. These MCE values are less than unity; therefore, a potential human health risk based on additive effects from contaminants not exceeding SALs is not identified for these classes of chemicals, and no further COPCs have been identified. The MCE calculations are presented in Table 5.11.8-1.

TABLE 5.11.8-1

MCE CALCULATION FOR PRS 16-030(g)

Analyte	Max Conc. mg/kg	SAL mg/kg	Normalized Value
Noncarcinogenic Effects			
Barium	391	5300	0.074
Copper	62.4	2800	0.022
Zinc	107	23 000	0.005
Acetone	0.009	2 100	<0.001
Acenaphthene	0.84	2 200	<0.001
Anthracene	1.8	18 000	<0.001
Fluoranthene	9	2600	0.003
Fluorene	0.96	2 300	<0.001
Naphthalene	0.86	1000	0.001
Pyrene	8.5	19 000.	<0.001
Dibenzofuran	0.53	260	0.002
Di-n-butyl phthalate	2.2	6500	<0.001
HMX	1.72	3300	0.001
1,3,5-TNB	0.184	3.3	0.056
TOTAL			0.2
Carcinogenic Effects			
Chromium	38.5	210	0.183
Benzo(k)fluoranthene	2.5	6.1	0.410
Chrysene	2.7	61	0.044
2,4-DNT	0.114	0.65	0.175
TNT	0.478	15	0.032
TOTAL			0.8

5.11.9 Human Health Risk Assessment

Lead and five PAHs were identified as COPCs in the screening assessment presented in Section 5.11.8. Due to the low concentrations of these compounds, a quantitative human health risk assessment was not performed for this PRS. However, a qualitative evaluation of these COPCs is presented.

Lead was detected in one out of eight samples, at a concentration 9% above its SAL (434 versus 400 ppm). The EPA Region IX industrial PRG for lead is 1000 mg/Kg. This is a more appropriate decision point, given the industrial landuse for this PRG. Therefore, additional evaluation of lead for human health risk will not be pursued.

Five PAHs were identified in the screening assessment presented in Section 5.11.8. PAHs were detected above SALs at this PRS. The sampling locations where PAHs were detected receive storm-water runoff from asphalt paved areas that drain into a parking-lot drain that also discharges into this PRS. The presence of PAHs in the analytical data from this site is not unusual because PAHs are found in asphalt and are products of incomplete combustion from motor vehicles. The low concentrations of PAHs at this PRS (less than 5 ppm) are likely to be associated with runoff from the nearby paved areas rather than due to PRS-related contamination.

The most likely explanation for the observation of PAHs in these soil samples is that they represent nonspecific contamination associated with general industrial activities. The "Toxicological Profile for Polycyclic Aromatic Hydrocarbons (PAHs)" (ATSDR 1995, 55663) by the Agency of Toxic Substances and Disease Registry shows that soil concentrations of PAHs in urban/industrial areas commonly range in the tens to hundreds of mg/Kg. The source of these signatures includes combustion products from organic materials and fossil fuels and runoff from asphalt and roofing tar.

Process knowledge and history for the facilities associated with 16-030(g) suggests that PAHs were not used in this Area. Asphalt is a common sources of PAHs that is upgradient of this PRS.In particular, the drainage from the nearby parking lot runs directly into this outfall-discharge area. These materials and vehicle emissions are the likely sources for these contaminant signatures. This constitutes a continuing source of contaminants and consequently is not within the scope of the Environmental Restoration Project. The PAHs will be dropped as COPCs for this PRS.

5.11.10 Preliminary Ecological Assessment

In cooperation with NMED and EPA Region 6, the Laboratory ER Project is developing an approach for ecological risk assessment. Further ecological risk assessment at this site will be deferred until this site can be assessed as part of the ecological exposure unit methodology currently being developed. When completed, the ecological risk assessment will be provided as an Attachment.

5.11.11 Conclusions and Recommendation

The objective of the Phase I RFI at PRS 16-030(g) was to determine if a release had occurred from the sump drain line, outfall, and drainage at this site at a level that represents a risk to human health and the environment. RFI sampling was conducted at locations biased to represent the area(s) of greatest contamination. The COPCs that were identified have been:

(1) shown not represent a risk in an industrial scenario (i.e. lead), or (2) attributed to on-going releases from the nearby parking lot, which drains directly to this outfall (the PAHs).

These data generally support the site-conceptual model, except for slightly elevated copper and chromium values observed in one of the two deepest samples. Those elevated values may be due to natural high values of these constituents in the subunit of the Bandelier tuff that underlies this PRS.

Contamination has been bounded relative to SALs except for the PAHs. Both samples at depth and downgradient samples contain constituents at levels well below SALs for all constituents analyzed. PAH contamination has not been bounded, because the downgradient samples were not analyzed for SVOCs. However, the SVOC contamination is attributable to an ongoing release. The data suggests that widespread contamination at concentrations of human health concern has not occurred. PRS 16-030(g) is recommended for human-health NFA.

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APPENDIX A. ANALYTICAL SUITES

Results of analyses can be found in the Facility for Information Management and Display (FIMAD). Hard copies of supporting information will be provided upon request.

Chemicals that are reported by analytical laboratories as not detected have not been included in the tables of this RFI report. Nonetheless, undetected analytes are often part of the decision-making process and it is important to note that these chemicals were analyzed. This appendix lists the target analytes in each analytical suite included in the tables of Section 5.

Inorganic Suite

- Aluminum
- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium
- Calcium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Magnesium
- Manganese
- Mercury
- Nickel
- Potassium
- Selenium
- Silver
- Sodium
- Thallium
- Vanadium
- Zinc

Volatile Organic Compound (VOC) Suite

- Acetone
- Benzene
- Bromobenzene
- Bromochloromethane
- Bromodichloromethane
- Bromoform
- Bromomethane
- 2-Butanone
- n-Butylbenzene
- sec-Butylbenzene
- tert-Butylbenzene
- Carbon disulfide
- Carbon tetrachloride
- Chlorobenzene
- Chloroethane
- Chloroform
- Chloromethane
- 2-Chlorotoluene
- 4-Chlorotoluene
- 1,2-Dibromo-3-chloropropane
- 1,2-Dibromoethane
- Dibromomethane
- Dibromochloromethane
- 1,2-Dichlorobenzene
- 1,3-Dichlorobenzene
- 1,4-Dichlorobenzene
- Dichlorodifluoromethane
- 1,1-Dichloroethane
- 1,2-Dichloroethane
- 1,1-Dichloroethene
- cis-1,2-Dichloroethene
- trans-1,2-Dichloroethene
- 1,2-Dichloropropane
- 1,3-Dichloropropane
- 2,2-Dichloropropane
- 1,1-Dichloropropene
- cis-1,3-Dichloropropene
- trans-1,3-Dichloropropene
- Ethylbenzene
- Hexachlorobutadiene
- 2-Hexanone
- Iodomethane
- Isopropylbenzene
- p-Isopropyltoluene
- Methyl iodide
- 4-Methyl-2-pentanone
- Methylene chloride
- Naphthalene
- n-Propylbenzene
- Styrene
- 1,1,1,2-Tetrachloroethane
- 1,1,2,2,-Tetrachloroethane
- Tetrachloroethene
- Toluene
- Trichlorotrifluoroethane
- 1,2,4-Trichlorobenzene
- 1,1,1-Trichloroethane
- 1,1,2-Trichloroethane
- Trichloroethene
- Trichlorofluoromethane
- 1,2,3-Trichloropropane
- 1,2,4-Trimethylbenzene
- 1,3,5-Trimethylbenzene
- Vinyl chloride
- o,m-Xylene
- p-Xylene

Semivolatile Organic Compound (SVOC) Suite

Acenaphthene
Acenaphthylene
Aniline
Anthracene
Azobenzene
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(g,h,i)perylene
Benzo(a)pyrene
Benzoic acid
Benzyl alcohol
Bis(2-chloroethoxy)methane
Bis(2-chloroethyl)ether
Bis(2-chloroisopropyl)ether
Bis(2-ethylhexyl)phthalate
4-Bromophenylphenyl ether
Butylbenzylphthalate
Carbazole
4-Chloroaniline
4-Chloro-3-methylphenol
2-Chloronaphthalene
2-Chlorophenol
4-Chlorophenylphenyl ether
Chrysene
Dibenzo(a,h)anthracene
Dibenzofuran
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
3,3'-Dichlorobenzidine
2,4-Dichlorophenol
Diethylphthalate
Dimethylphthalate
Di-n-butylphthalate
Di-n-octylphthalate
2,4-Dimethylphenol
2,4-Dinitrophenol
4,6-Dinitro-2-methylphenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Indeno(1,2,3-cd)pyrene
Isophorone
2-Methylnaphthalene
2-Methylphenol
4-Methylphenol
Naphthalene
2-Nitroaniline
3-Nitroaniline
4-Nitroaniline
Nitrobenzene
2-Nitrophenol
4-Nitrophenol
N-Nitrosodimethylamine
N-Nitrosodiphenylamine
N-Nitroso-di-n-propylamine
Pentachlorophenol
Phenanthrene
Phenol
Pyrene
Pyridine
1,2,4-Trichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol

Uranium Suite

Total Uranium

Radionuclide Suite—Gamma Spectroscopy

Americium-241
Cerium-144
Cesium-137
Cobalt-57
Cobalt-60
Europium-152
Iodine-129
Neptunium-237
Potassium-40
Ruthenium-106
Sodium-22

High Explosives Suite

- 2-Amino-4,6-DNT
- 4-Amino-2,6-DNT
- 1,3-Dinitrobenzene (1,3-DNB)
- 2,4-Dinitrotoluene (2,4-DNT)
- 2,6-Dinitrotoluene (2,6-DNT)
- HMX
- Nitrobenzene (NB)
- o-Nitrotoluene (2-NT)
- m-Nitrotoluene (3-NT)
- p-Nitrotoluene (4-NT)
- RDX
- Tetryl
- 1,3,5-Trinitrobenzene (1,3,5-TNB)
- 2,4,6-Trinitrotoluene (2,4,6-TNT)

Extended High Explosives Suite

- Nitroglycerin
- Triaminiotrinitrobenzene (TATB)
- Nitroguanadine
- Pentaerythritol tetranitrate(PETN)

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APPENDIX B. DATA VALIDATION

The following tables summarize the results of quality assurance/quality control data validation for all analytical results used to support recommendations in this RFI report. Tables are presented in order of request number for each sample delivery group sent for laboratory analysis. The tables are grouped by analytical suite. Request numbers for each PRS are cited in Section 5.x.4, in Table 5.x.4-1, entitled Summary of Request Numbers for Samples Taken at PRS xx-xxx.

Tables in this appendix cover radiochemical analysis (Table B-1), HE analysis (Table B-2), inorganic analysis (Table B-3), SVOC analysis (Table B-4), total uranium analysis (Table B-5) and VOC analysis (Table B-6).

TABLE B-1

DATA QUALITY EVALUATION FOR RADIOCHEMISTRY ANALYSES AT TA-16

SUITE	REQUEST NUMBER	COMMENTS
Radionuclides	330	All data are useable without qualification.
Radionuclides	1108	All data are useable without qualification.
Radionuclides	1194	All data are useable without qualification.
Radionuclides	1244	All data are useable without qualification.
Radionuclides	1253	All data are useable without qualification.
Radionuclides	3627	All data are useable without qualification.

TABLE B-2

DATA QUALITY EVALUATION FOR HIGH EXPLOSIVES ANALYSES AT TA-16

SUITE	REQUEST NUMBER	COMMENTS
HEXP[a]	116	All data are useable without qualification.
HEXP[a]	121	All data are useable without qualification.
HEXP[a]	140	TATB in samples 0316-95-0194,-0195,-0196 and nitroguanadine in sample 0316-95-0206 were not detected in second column analysis and should be considered estimated. All data are useable with qualification.
HEXP[a]	215	Holding times were missed by one day. This has no effect on the usability of the data. PETN in sample 0316-95-0222 and TATB in sample 0316-95-0273 were not detected in second column analysis and should be considered estimated. All data are acceptable with qualification.
HEXP[a]	222	Tetryl was found in the method blank but not confirmed by second column analysis. Samples analyzed for nitroglycerin, PETN, TATB, and nitroguanadine did not have a surrogate. The values associated with those compounds should be considered estimated. All data are acceptable with qualification.
HEXP	328	All data are useable without qualification.
HEXP	525	No lab control standard was present. All data were P-qualified[b]. All data are considered useable for the purposes of this report.
HEXP	546	No lab control standard was present. All data were P-qualified. All data are considered useable for the purposes of this report.
HEXP	621	Lab control standard was not present. Data considered useable.
HEXP	731	All data are useable without qualification.
HEXP	874	Lab control standard was not present. Data considered useable.
HEXP	903	No lab control standard was present. All data were P-qualified. All data are considered useable for the purposes of this report.
HEXP	923	No lab control standard was present. All data were PM-qualified[c]. All data are considered useable for the purposes of this report.
HEXP	972	Samples 0316-95-0115 missed holding times by 3 days. This sample is not included in this report. Samples 0316-95-0110 through -0114 and sample 0316-95-2014 missed holding times by 1 day. A one-day deviation from the standard holding time has no effect on the data usability. All data are useable for the purposes of this report.
HEXP	980	No lab control standard was present. All data were PM-qualified. All data are considered useable for the purposes of this report.
HEXP	1052	Lab control samples not present. Lab provided a lab control standard for analysis. Results showed high recovery of 2,4-DNT. This did not affect the usability of the samples included in this report.

TABLE B-2

DATA QUALITY EVALUATION FOR HIGH EXPLOSIVES ANALYSES AT TA-16 (continued)

SUITE	REQUEST NUMBER	COMMENTS
HEXP	1102	No lab control standard was present. All data were PM-qualified. All data are considered useable for the purposes of this report.
HEXP	1154	Sample 0316-95-0461 missed holding times by two days. This sample is not included in this report. Lab control samples not present. All data are accepted as useable for the purposes of this report.
HEXP	1183	No lab control standard was present. All data were PM-qualified. All data are considered useable for the purposes of this report.

a. These request numbers called for an expanded suite of HE analysis. The expanded HE suite includes HEPETN, HENG, HETATD, as well as HEXP.

b. P = Professional judgment should be applied prior to using the data

c. PM = Professional judgment should be applied prior to using the data—manual review of the raw data is recommended

TABLE B-3

DATA QUALITY EVALUATION FOR INORGANIC ANALYSES AT TA-16

SUITE	REQUEST NUMBER	COMMENTS
Inorganics	120	All data are useable.
Inorganics	122	All data are useable.
Inorganics	141	All data are useable.
Inorganics	206	All data are useable.
Inorganics	223	All data are useable.
Inorganics	252	All data are useable.
Inorganics	329	All data are useable.
Inorganics	526	Duplicate recovery for beryllium, chromium, iron, lead, and manganese was outside the acceptable 20% range and these values were J-qualified.[a] The matrix spike for zinc was out of control and zinc values were J-qualified. The matrix spike for selenium was out of control and selenium values were UJ-qualified.[b] All data are acceptable with qualification.
Inorganics	547	Duplicate recovery for chromium was outside the acceptable 20% range. Matrix spikes for barium and zinc were outside the acceptable range. Zinc, chromium, and barium values were J-qualified. All data are useable with qualification.

TABLE B-3

DATA QUALITY EVALUATION FOR INORGANIC ANALYSES AT TA-16 (continued)

SUITE	REQUEST NUMBER	COMMENTS
Inorganics	622	Duplicate recovery for chromium, copper, zinc, nickel, iron, and lead were outside the acceptable 20% limit and these data were P-qualified.[c] These data should be considered estimated. Zinc also had a low spike recovery and was qualified as J-.[d] Spike recovery was above the acceptable limit of 125% for arsenic and the data were qualified as J+.[e] Spike recovery for selenium was below the acceptable limit of 75% and the data were UJ-qualified. All data are useable with qualification.
Inorganics	730	Spike recovery was out of control for antimony, arsenic, and selenium. Data were qualified as UJ. Aluminum was out of control in the duplicate and data were P-qualified. Aluminum should be considered as estimated. All data are acceptable with qualification.
Inorganics	875	Duplicate recovery for calcium and chromium was outside the acceptable 20% range. Calcium and chromium were P-qualified and should be considered estimated. This did not affect the quality of the data for the purposes of this report. All data are considered useable.
Inorganics	924	Duplicate recovery for chromium was outside the acceptable 20% range and was P-qualified. Spike recoveries were below the acceptable level of 75% for manganese (74%), lead (58%), copper (64%), and chromium (69%). The data are qualified as J-. All data are considered useable as qualified.
Inorganics	978	Spike recovery for barium was outside the acceptable value of 125% and all barium data were qualified as estimated with a high bias (J+). Spike recovery for selenium was below the acceptable value of 75%. All selenium data were qualified as UJ. Matrix spike criteria for lead were not met in sample 0316-95-0110, although this sample is not included in this report. Duplicate recovery for barium, lead, and manganese was outside the acceptable 20% range. This did not affect the quality of the data for the purposes of this report. All data are useable with qualification.

a. J = Analyte was positively identified, numerical value is estimated to be more uncertain than would normally be expected for that analysis
b. UJ = Analyte was not detected, numerical value is an estimate of the EQL
c. P = Professional judgment should be applied prior to using the data
d. J- = Analyte was positively identified, result is likely biased low
e. J+ = Analyte was positively identified, result is likely biased high
f. U = Analyte was not detected

TABLE B-4

DATA QUALITY EVALUATION FOR SEMIVOLATILE ORGANIC COMPOUND ANALYSES AT TA-16

SUITE	REQUEST NUMBER	COMMENTS
SVOCs	116	Phthalate contamination of method blank due to lab contamination. Phthalate data are U-qualified.[a] All data are acceptable with qualification.
SVOCs	121	Phthalate contamination of method blank due to lab contamination, and phthalate data are U-qualified. Surrogate recovery of terphenyl-d14 was high. One internal standard was out of control. This caused the following analytes to be qualified as estimated: di-n-octyl phthalate, benzo(b)-fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)-pyrene, dibenzo(a,h)anthracene, benzo(g,h,i)pyrene. All data are acceptable with qualification.
SVOCs	140	All data are useable without qualification.
SVOCs	215	Samples were never analyzed for SVOCs due to laboratory error.
SVOCs	222	The response of two internal standards for sample 0316-95-0255 was low upon analysis and reanalysis. As a result, phenanthrene and fluoranthene were J-qualified.[b] All data are acceptable with qualification.
SVOCs	249	Phthalate contamination of method blank due to lab contamination, and phthalate data are U-qualified. Sample 0316-95-2000 contained bis(2-ethylhexyl) phthalate at a level more than five times the level found in the blank and the compound should be reported as detected. All data are acceptable with qualification.
SVOCs	328	Phthalate contamination of method blank due to lab contamination caused some phthalate data to be U-qualified. Samples 0316-95-0014 and -2001 contained bis-(2-ethylhexyl) phthalate at levels greater than ten times the level in the blank, and the compound should be reported as detected. The method blanks also contained five unknown tentatively identified compounds. Sample 0316-95-2001 was diluted and reanalyzed due to the presence of compounds at levels outside the calibration range. The diluted sample analytical results should be used for phenol, N-nitroso-di-n-propylamine, 2,4-dinitrotoluene, 4-chlorophenyl phenyl ether, and pentachlorophenol. All data are acceptable with qualification .
SVOCs	525	Phthalate contamination of method blank due to lab contamination causes phthalate to be U-qualified. All data are considered useable.
SVOCs	546	Phthalate contamination of method blank due to lab contamination causes phthalate to be U-qualified. One internal standard for sample 0316-95-0132 did not meet quality control criteria. All data are considered useable.

TABLE B-4

DATA QUALITY EVALUATION FOR SEMIVOLATILE ORGANIC COMPOUND ANALYSES AT TA-16
(continued)

SUITE	REQUEST NUMBER	COMMENTS
SVOCs	621	Phthalate contamination of method blank due to lab contamination causes phthalate to be U-qualified. All internal standards did not meet quality control criteria. Samples were reanalyzed. Only reanalyzed results are considered useable.
SVOCs	729	All data are useable without qualification.

a. U = Analyte was not detected
b. J = Analyte was positively identified, numerical value is estimated to be more uncertain than would normally be expected for that analysis
c PM = Professional judgment should be applied prior to using the data—manual review of the raw data is recommended
d. UJ = Analyte was not detected, numerical value is an estimate of the EQ
e. J- = Analyte was positively identified, result is likely biased low
f. RPM = Without further review of the raw data, sample results are unusable

TABLE B-5

DATA QUALITY EVALUATION FOR TOTAL URANIUM ANALYSES AT TA-16

SUITE	REQUEST NUMBER	COMMENTS
Uranium	142	All data are useable without qualification.
Uranium	925	All data are useable without qualification.
Uranium	982	All data are useable without qualification.
Uranium	1108	All data are useable without qualification.
Uranium	1244	All data are useable without qualification.
Uranium	1393	All data are useable without qualification.
Uranium	3627	All data are useable without qualification.

TABLE B-6

DATA QUALITY EVALUATION FOR VOLATILE ORGANIC COMPOUNDS ANALYSES AT TA-16

SUITE	REQUEST NUMBER	COMMENTS
VOCs	249	One method blank contained methylene chloride, trichloroethene, and trichlorofluoromethane. Another method blank contained methylene chloride and acetone at levels less than EQLs. Results for these analytes were qualified as U[a] or J.[b] All data are useable as qualified.
VOCs	289	One method blank contained methylene chloride, trichloroethene, and trichlorofluoromethane. Another method blank contained methylene chloride and acetone at levels less than EQLs. Results for these analytes were qualified as U or J. All data are useable as qualified.

TABLE B-6

DATA QUALITY EVALUATION FOR VOLATILE ORGANIC COMPOUNDS ANALYSES AT TA-16 (continued)

SUITE	REQUEST NUMBER	COMMENTS
VOCs	328	The method blank contained acetone, methylene chloride, and trichlorofluoromethane. One internal standard exhibited a low response and some compounds were UJ-qualified.[c] Data are useable as qualified.
VOCs	525	Acetone, methylene chloride, and trichlorofluoromethane were present in the blanks and U-qualified. All data are useable with qualification.
VOCs	546	Acetone, methylene chloride, and trichlorofluoromethane were present in the blanks and U-qualified. All data are useable with qualification.
VOCs	621	Trichlorofluoromethane and methylene chloride present in levels less than five times the EQL were U-qualified. All data are useable with qualification.
VOCs	729	One internal standard was out of control. Data were UJ-qualified. All data are useable with qualification
VOCs	874	Methylene chloride and acetone were found in the blanks. Values below ten times EQL are U-qualified. All data are useable with qualification.
VOCs	903	Methylene chloride and acetone were found in the blanks. Values below ten times the EQL are U-qualified. All data are useable with qualification.
VOCs	923	Methylene chloride and trichlorofluoromethane were found in the blanks and U-qualified. In samples 0316-95-0063 and -0063RE, one surrogate had a low recovery and one internal standard had a low response. Detected compounds are qualified as J-.[d] Undetected compounds are UJ-qualified. All data are acceptable with qualification.
VOCs	972	Methylene chloride, trichlorofluoromethane, and acetone were found in the blanks and U-qualified. All data are useable for the purposes of this report.
VOCs	980	Methylene chloride and acetone were found in the blanks and U-qualified. All data are acceptable with qualification.
VOCs	1052	Methylene chloride was found in the blanks and U-qualified. All data are acceptable with qualification.
VOCs	1102	Methylene chloride, trichlorofluoromethane, and acetone were found in the blanks and U-qualified. All data are acceptable with qualification.
VOCs	1192	All data are acceptable without qualification.
VOCs	1242	Methylene chloride, trichloroflluromethane, and acetone were found in the blanks and U-qualified. All data are acceptable with qualification.
VOCs	1251	Methylene chloride, acetone, and trichlorofluoromethane were present in method blanks due to laboratory contamination and U-qualified. All data are acceptable with qualification.

a. U = Analyte was not detected

b. J = Analyte was positively identified, numerical value is estimated to be more uncertain than would normally be expected for that analysis

c. UJ = Analyte was not detected, numerical value is an estimate of the EQL

d. J- = Analyte was positively identified, result is likely biased low

e. PM = Professional judgement should be applied prior to using the data—manual review of the raw data is recommended

f. J+ = Analyte was positively identified, result is likely biased high

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APPENDIX C. FIELD SCREENING METHODS

The field screening methods used for biasing laboratory-sample selection during the fiscal year (FY) 1995 TA-16 field campaign include volatile organic methods (photoionization detector [PID]), metals methods (X-ray fluorescence [XRF] and laser-induced breakdown spectrometry [LIBS]), radionuclide methods (sodium iodide [NaI] detector), and the high explosives (HE) spot test for explosives. Each of these techniques indicates the presence of constituents of potential concern in soil samples. These methods are qualitative (indicative of the presence or absence of a constituent) to semi-quantitative (indicative of the relative amount of a constituent) indicators of the presence of constituents. The principal utility of such methods is to increase the chances that samples are taken in locations of higher contamination. These methods are not used for determining whether a potential release site (PRS) is clean; that decision is based entirely on the results of laboratory analysis.

Each of these methods is described briefly below. Additional information about these techniques is provided in the cited references and standard operating procedures (SOPs).

Photoionization Detector (PID)

A PL-101 PID with a 11.7 eV lamp was used during the FY 1995 TA-16 field campaign. This is a general survey instrument capable of real-time detection of many complex organic compounds in air. The PID is used both for health and safety purposes to ensure that the breathing zone in a PRS is free of high levels of organic constituent. It also used to identify soil samples that contain volatile organic compounds. The PID provides semi-quantitative results that can be used to select the most volatile organic–rich samples from a PRS. Because the principal constituents of concern at TA-16 are HE and barium, the PID was not typically the principal biasing method used at TA-16 PRSs.

Operation of the PID follows LANL-ER-SOP-HSM-1C "Direct-Reading Monitoring Method Using GCs, PIDs, and FIDs." The PID is calibrated daily. Records of this calibration are in the field notes, which are archived at the Records Processing Facility.

A review of the locations at TA-16 that were sampled during FY 1995 based on PID hits (e.g., PRS 16-021[a]) suggests that the method is subject to false positives. Locations that provided PID hits of 20–50 ppm showed only low levels (20 ppb or less) of volatile organic compounds. The PID is known to react with naturally occurring VOCs (e.g. pinenes, terpenes) that are a component of forest litter. It is likely that these false positive are due to the presence of those compounds.

XRF

A Spectrace 9000 XRF instrument was used during the FY 1995 TA-16 field campaign. XRF is a technique for analyzing total metals in solids. The instrument consists of a source for sample excitation, a detector or proportional counter, a sample chamber, and an energy analyzer. XRF only scans the upper layer of material, which means that sample preparation can have a large impact on reproducibility of repeated sample measurements. The XRF typically provides semi-quantitative data on metal concentrations in soils. The instrument is subject to matrix effects; however, it can provide quantitative data if matrix-matched standards are available. The principal inorganic analyte used for biasing samples at TA-16 is barium. The detection limit for barium in soils is 60 mg/kg, a level that is well below the SAL of 5300 mg/kg.

Operation of the Spectrace 9000 XRF instrument currently follows LANL-ER-SOP-10.08 "Operation of the Spectrace 9000 Field-Portable X-Ray Fluorescence Instrument." However, this SOP was not promulgated during FY 1995; use of this instrument during the FY 1995 TA-16 field campaign followed the manufacturer's instructions. The XRF was checked daily for (1) instrument response on an iron blank, and (2) analytical background on teflon. Precision was evaluated by reanalyzing a sample at a rate of approximately 1 in 10. All calibration and operation records are available in the field notes, which are archived at the Records Processing Facility. The XRF method has been approved for inclusion in EPA SW-846 methods as method 6200.

A review of the locations at TA-16 that were sampled during FY 1995 based on XRF hits for barium suggests that the method is effective for biasing. A comprehensive statistical study of the relationship between barium determined by field-based XRF and barium determined by laboratory methods has not been completed at this time. However, as an example, laboratory sample locations at PRS 16-010(a) were selected based on barium field screening. Comparative data between XRF and laboratory methods are provided in Table C -1.

TABLE C-1

COMPARISON OF XRF AND LABORATORY DATA FOR BARIUM

SCREENING SAMPLE ID	LABORATORY SAMPLE ID	LOCATION ID	XRF:Ba (mg/kg)	LABORATORY:Ba (mg/kg)
0316-95-1504	0316-95-0383	16-1343	4620	6680
0316-95-1505	0316-95-0386	16-1344	4260	9580
0316-95-1507	0316-95-0389	16-1345	3650	5220
0316-951519	0316-95-0392	16-2167	240	1090

This simple comparison suggests that XRF barium data is biased low relative to laboratory barium analyses, probably due to matrix effects, and that XRF barium data can successfully be used for sample biasing. The technique can correctly identify the two higher barium samples relative to the lower barium samples.

LIBS

A Spectra-Physics DCR-11 laser-induced breakdown spectroscopy (LIBS) instrument was used for sample biasing at one PRS in this report (PRS 16-010[a]) during the FY 1995 TA-16 field campaign. This instrument was tested to determine whether LIBS or XRF had greater utility for biasing samples based on their barium abundance.

In LIBS, a laser spark is focused on a soil sample to excite atomic emission lines that are characteristic of the trace metals in the sample. One identifies emitting species by spectrally and temporally resolving the plasma light. The LIBS instrument typically provides semi-quantitative data on metal concentrations in soils. The instrument is subject to matrix effects; however, it can provide quantitative data if matrix-matched standards are available. The principal inorganic analyte used for biasing samples at TA-16 is barium. The LIBS detection limit for barium in soils is 42 mg/kg (Eppler et al. 1996, 15-16-643), a level well below the SAL of 5300 mg/kg. A detailed description of the application of LIBS to Ba-contaminated soils is provided by Eppler (Eppler et al. 1996, 15-16-643).

There is no ER SOP for operation of the LIBS instrument because it is still an experimental analytical technique. The PRS 16-010(a) test was completed by the LANL scientist who developed this analytical method. The field test at PRS 16-010(a) was completed by standardizing barium response of the LIBS instrument against soils of known barium composition. Comparative data showing LIBS and laboratory methods are provided in Table C-2.

TABLE C-2

COMPARISON OF LIBS AND LABORATORY DATA FOR BARIUM

SCREENING SAMPLE ID	LABORATORY SAMPLE ID	LOCATION ID	LIBS:Ba (mg/kg)	LABORATORY:Ba (mg/kg)
0316-95-1504	0316-95-0383	16-1343	2880	6680
0316-95-1505	0316-95-0386	16-1344	2040	9580
0316-95-1507	0316-95-0389	16-1345	2070	5220
0316-951519	0316-95-0392	16-2167	1340	1090

This comparison suggests that LIBS barium data is biased low relative to laboratory barium analyses, probably due to matrix effects, and that LIBS barium data can successfully be used for sample biasing. The technique can correctly identify the higher barium samples relative to the lower barium samples.

Both LIBS and XRF can be used successfully to bias laboratory samples based on barium abundance. However, XRF appears to be a superior biasing technique than LIBS. XRF is a proven technique that is scheduled for inclusion as an SW-846 method. XRF uses an off-the-shelf instrument that can be operated in the field by a sampling technician; LIBS still requires operation by a highly trained scientist. XRF can provide semi-quantitative data on a wide range of heavy metals in a short period of time; LIBS is best for investigating a single element at a time. There are specific applications for which LIBS is superior to XRF, such as determination of beryllium or chromium in soil; however, for field biasing based on barium, XRF is the technique preferred by Field Unit 3.

Sodium Iodide Detector for Gamma Emitters

A Ludium 2x2 sodium iodide (NaI) detector was used during the FY 1995 TA-16 field campaign. This is a general survey instrument capable of real-time detection of gamma emitters in soil or surfaces. The NaI detector is used for both health and safety purposes to ensure that materials in a PRS are free of high levels of radioactive constituents and to identify soil samples that contain radionuclides at levels greater than background. The NaI instrument provides semi-quantitative results that can be use to select radionuclide-rich samples from a PRS. Because the principal constituents of concern at TA-16 are HE and barium, the NaI was not typically the principal biasing method at TA-16 PRSs.

Operation of the NaI instrument follows LANL-ER-SOP-06.23 "Measurement of Gamma-Ray Fields Using a Sodium Iodide Detector." The NaI detector is response-checked daily. Records of this check are in the field notes, which are archived at the Records Processing Facility.

HE Spot Test

The HE spot test kit with Modified Griess reagents was extensively used for sample biasing during the FY 1995 TA-16 field campaign. All PRSs in which the HE spot test revealed contamination (e.g., Burning Ground PRSs, the TA-16-260 outfall) are not included in this report. An HE spot test kit positive result typically indicates that a PRS is not suitable for NFA unless the spot test result was a false positive. PRSs included in this report typically had negative HE spot test results or false positive HE spot test results.

The HE spot test kit was developed at LANL to identify the presence of explosives as contaminants on equipment and environmental media. Four reagents in a carrying case can be used to detect any of the common explosives used at Los Alamos (HMX, RDX, TNT, PETN, and TATB). The HE spot test kit provides a rapid (less than 1 minute) qualitative indicator of the presence or absence of HE in soils. The nominal detection limit for this kit is 100 ppm of HE (Baytos 1991, 15-16-339). The HE spot test kit is used by Field Unit 3 for

- safety purposes to determine whether a soil is likely to present an explosive hazard to workers,
- determining whether a soil must be classed as an explosive for shipping purposes, and
- biasing laboratory samples to locations that have received significant HE discharge.

The HE spot test is a gross biasing method that is used to ensure that locations with high concentrations of HE are sampled or cleaned up. It is not used for final cleanup decisions at a site.

Use of the HE Spot-Test kit is dictated by LANL-ER-SOP-10.06 "High Explosives Spot Test."

A comparison of HE spot test results against laboratory data collected during the FY 1995 TA-16 field campaign reveals the following:

- the HE spot test successfully identified samples with greater than 100 ppm HE at highly contaminated potential release sites such as those at the TA-16 Burning Ground and the TA-16-260 outfall,
- there were few (one or two) false negative results (locations where greater than 100 ppm HE was found based on laboratory analysis, but the HE spot test gave a negative result), and
- false positive results (locations where less than 100 ppm HE was found based on laboratory analysis, but the HE spot test provided a positive result) were common.

False negative results were noted at the TA-16-260 outfall and may be due to sample heterogeneity. False positive results were noted at several PRS, such as PRS 16-010(a), which is included in this report. False positive results may be due to the presence of nitrite in the soil or to low levels of humic material in soils that may suggest a color change in the spot test reagents (Spontarelli personal communication, 1996).