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ENTERED

Date: March 30, 1999
Refer to: EM/ER:99-068

RECEIVED 1999

Dr. Robert S. Dinwiddie
NMED-HRMB
P.O. Box 26110
Santa Fe, NM 87502

HSWA LANL 5/1111/22

SUBJECT: SAMPLING AND ANALYIS PLAN FOR POTENTIAL RELEASE SITES 22-012 AND 22-015(A, B, D, E) (FORMER OU 1111)

Dear Dr. Dinwiddie

Enclosed is the Sampling and Analysis Plan (SAP) for Potential Release Sites (PRSs) 22-012 and 22-015(a, b, d, e). This SAP is being submitted in response to the Rejection of the Resource Conservation and Recovery Act Facility Investigation Report for PRSs 22-012 and 22-015(a, b, d, e) dated June 24, 1998 and the Submittal of Rejection dated July 6, 1998. It is also a requirement of the fiscal year 1999 Work Schedule due to your office March 31, 1999.

If you have any questions, please call Dave McInroy at (505) 667-0819 or Joe Mose at (505) 667-5808.

Sincerely,

Julie A. Canepa, Program Manager
LANL/ER Project

Sincerely,

Theodore J. Taylor, Program Manager
DOE/LAAO

JC/TT/VR/dm

Enclosure: SAP for PRS 22-012 and 22-015(a, b, d, e)

2155

TC

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March 31, 1999

Sampling and Analysis Plan for Potential Release Sites

22-012
22-015(a,b,d,e)

Environmental Restoration Project
A Department of Energy Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY
Los Alamos, NM 87545

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Produced by the Remedial Actions Focus Area

Author: Albert Dye

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1.0 INTRODUCTION

This report presents a sampling and analysis plan (SAP) for five potential release sites (PRS) at technical area 22 (TA-22). TA-22, which is located in former Operable Unit (OU) 1111 (Figures 1.0-1 and 1.0-2), is part of the Los Alamos National Laboratory's Environmental Restoration (ER) Project. Los Alamos National Laboratory (the Laboratory) is a multi-disciplinary research facility owned by the Department of Energy and managed by the University of California. The Laboratory is located in north-central New Mexico, approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe. The Laboratory site covers 43 square mi. of the Pajarito Plateau, which consists of a series of fingerlike mesas separated by deep canyons containing ephemeral and intermittent streams that run from west to east. Mesa tops range in elevation from approximately 6200 ft to 7800 ft. The eastern portion of the plateau stands 300–900 ft above the Rio Grande.

TA-22 is located on the south side of Two-Mile Mesa, which is in the northwestern portion of the Laboratory. During the Manhattan Project, this area was designated Trap Door Site. In the late 1940s or early 1950s, the Laboratory changed the designation to TA-22. TA-22 is still an active site and continues to be used in support of explosives and detonator development. The five PRSs (Figure 1.0-3 and Table 1.0-1) described in this report are

- PRSs 22-012, 22-015(d), and 22-015(e), inactive explosives sump and associated wash pad and seepage pit which are grouped because they were all part of the same disposal unit and are in the same geographical area (discussed in Section 2.0),
- PRS 22-015(a), inactive seepage pits (discussed in Section 3.0), and
- PRS 22-015(b), an inactive explosives sump (discussed in Section 4).

Table 1.0-1
PRSs Covered by This SAP

PRS	PRS Type	HSWA*	PRS Description	Section No.
22-012	Solid Waste Management Unit (SWMU)	Yes	High Explosives (HE) Wash Pad	2.0
22-015(d)	SWMU	Yes	HE Seepage Pit	2.0
22-015(e)	SWMU	Yes	HE Sump	2.0
22-015(a)	SWMU	Yes	Seepage Pits	3.0
22-015(b)	SWMU	Yes	Sump and Outfall	4.0

* If the site is listed in Module VIII of the Laboratory's Hazardous Waste Facility Permit, then "yes" applies. Otherwise, "no" applies.

These PRSs were recommended for no further action (NFA) in a September 1997 RFI report, "RFI Report for Potential Release Sites 22-012, 22-015(a,b,d,e)," (LANL 1997, 56749) submitted to the New Mexico Environment Department (NMED). The NMED reviewed the RFI report and submitted a rejection notice dated June 24, 1998, indicating additional sampling should be conducted to determine nature and extent of contamination. This plan is in response to the comments/questions raised by the rejection notice. The NMED's reasons for rejecting the RFI report are included as an attachment to this plan.

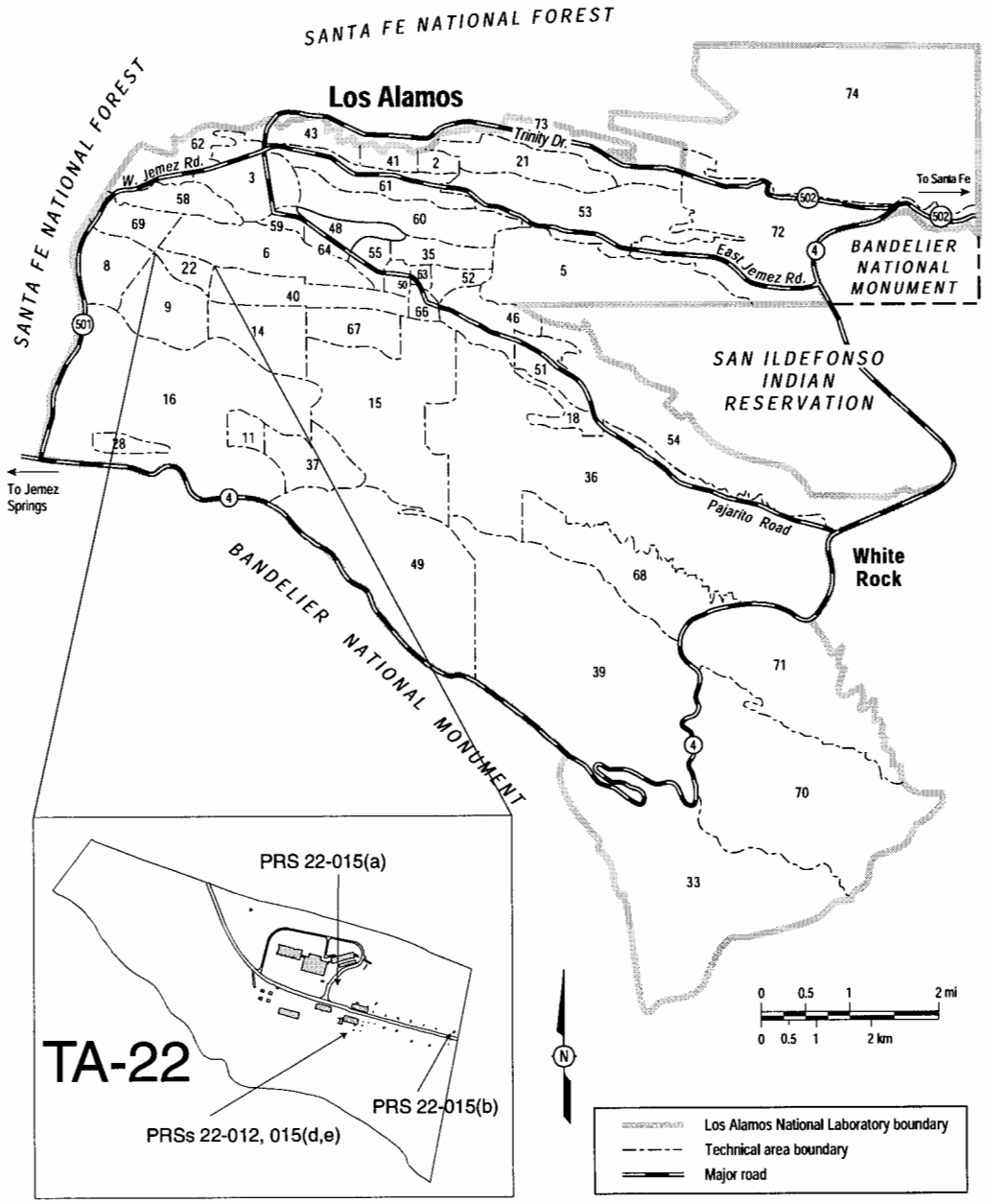

Figure 1.0-1. **Location of TA-22 with respect to Laboratory technical areas and surrounding land holdings.**

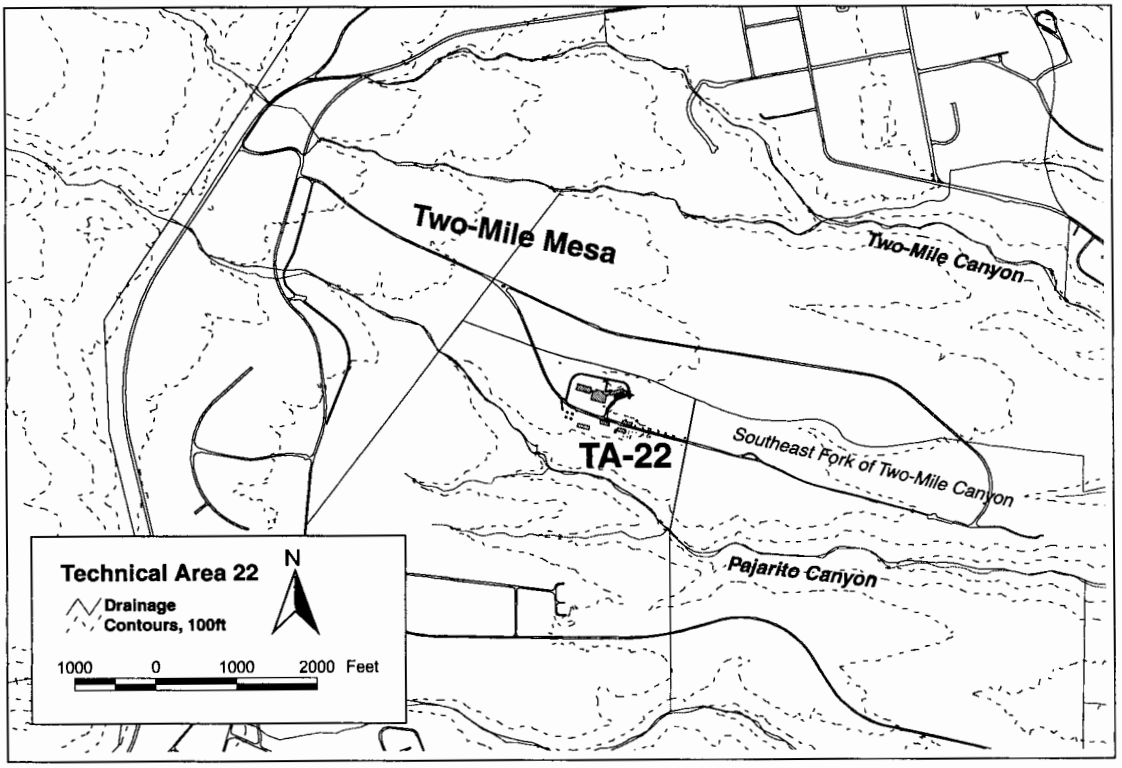

Figure 1.0-2. PRSs at TA-22.

This sampling and analysis plan is organized as follows:

- Section 1 discusses the objectives and scope of the proposed investigation.
- Section 2 presents information on the PRSs 22-012 and 22-015(d,e) explosives wash pad, sump, drainline and seepage pit. Proposed sampling activities for these PRSs are discussed beginning in Subsection 2.2.3.
- Section 3 presents information on the 22-015(a) etching and plating operations seepage pits and TA-22 marsh area. Proposed sampling activities are discussed beginning in Subsection 3.2.3
- Section 4 presents information on the 22-015(b) explosives sump and outfall. Proposed sampling activities are discussed beginning in Subsection 4.2.3.
- Section 5 discusses data collection design and procedures.
- Section 6 discusses program management issues associated with the proposed sampling activities.
- The attachment lists NMED's reasons for rejection of the previous TA-22 RFI report.

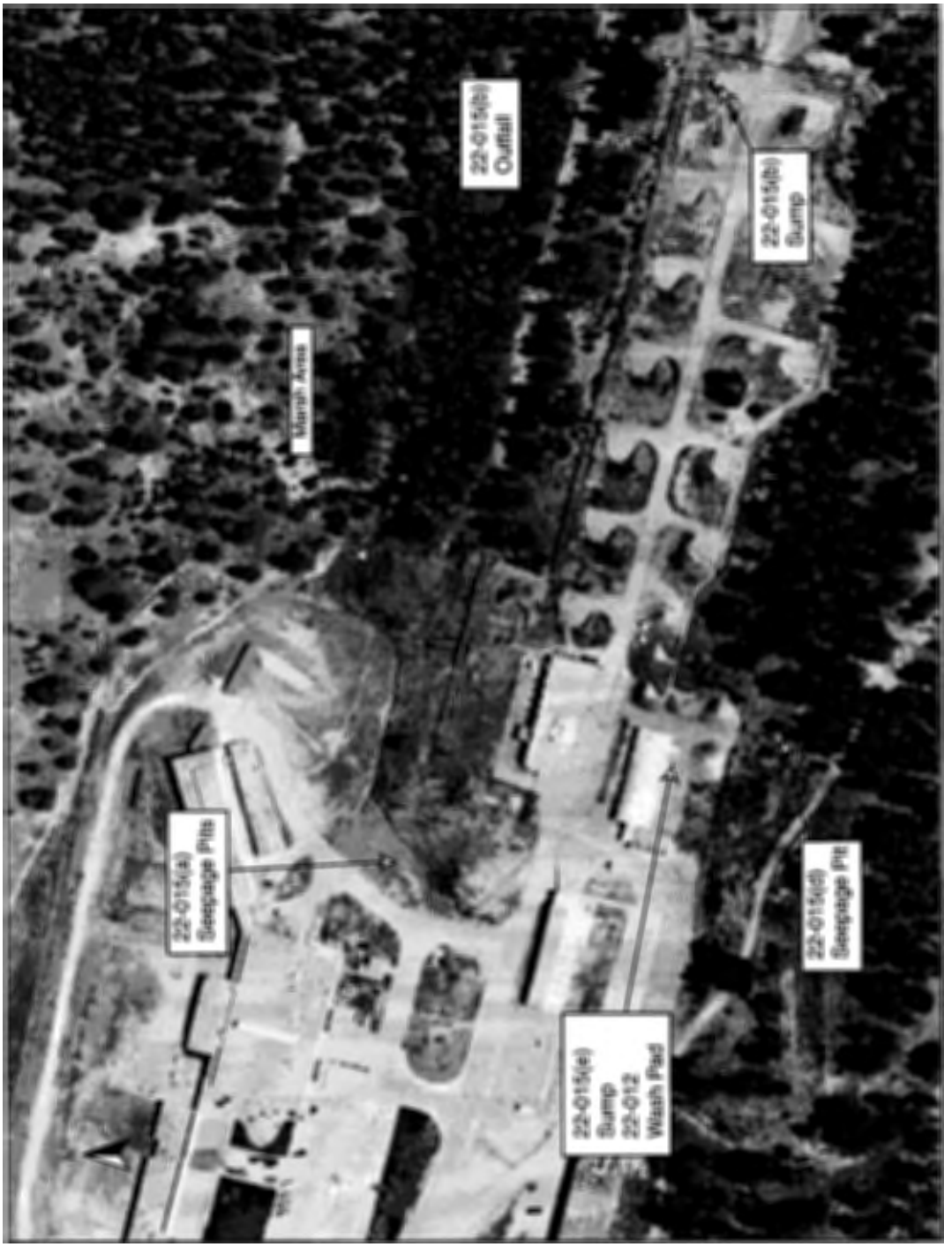

Figure 1.0-3. Aerial View of TA-22.

1.1 Objectives and Scope

The objective of the proposed investigation is to provide supplemental information about the nature and extent of selected chemicals. This investigation will determine

- if volatile organic compounds (VOCs) and HE compounds are present in the subsurface soils near the sump and wash pad (22-015(e), 22-012)
- if and how far pentaerythritol tetranitrate (PETN) has moved laterally from the 22-015(d) seepage pit, and
- the nature and extent of contamination under the 22-015(d) drainline, and
- if and how far copper has moved through the subsurface from the 22-015(a) seepage pits and drainline, and
- the nature and extent of contamination at the 22-015(b) drainline and outfall area.

Completion of the investigation will provide information to address deficiencies in the determination of the nature and extent of contamination for PRSs 22-012, 22-015(a,b,d,e) as listed in the Attachment to this plan. The scope of this plan will not address characterization of the TA-22 marsh area (Attachment Item 8e). Presently, the ER Project is in the process of aggregating PRSs. Therefore, characterization of possible contamination at the TA-22 wetland or marsh area will be deferred to a future sampling and analysis plan for the Two Mile Canyon watershed aggregate.

The results of the investigations on PRSs 22-014(a) Explosives sump, 22-014(b) Active explosives and chemical waste line, and 40-005 Active sump and outfall (Attachment Item 11) are included in a RCRA Facility Investigation report titled "RFI Report for Potential Release Sites at TAs -6, -8, -22, and -40" and submitted to the NMED in September of 1997.

1.2 Approach and Implementation

Biased sampling will be conducted based on knowledge gained from the previous three sampling events. Subsurface soil samples will be collected through the use of a hollow stem auger drill rig. Samples from 22-012 and 22-015 (d,e) will be analyzed for HE and for VOCs. Samples from 22-015(a) will be analyzed for copper and VOCs, and samples from 22-015(b) will be analyzed for HE and VOCs. Analysis of the samples for these analytes should determine the nature and extent of contamination for these PRSs.

1.3 Background Issues

1.3.1 Regulatory Requirements

The investigation, including sampling and analysis, of SWMUs is conducted under the requirements of Module VIII of the Laboratory's Hazardous Waste Facility Permit, which was issued on May 23, 1990, (EPA 1990, 1585) and modified on May 19, 1994.

1.3.2 Other Issues

No other regulatory issues are applicable for the PRSs presented in this SAP.

1.4 Data Quality Objectives Process

Previous investigations have determined that HE compounds, VOCs, and copper are present in the soil and tuff around sump, seepage pit, and outfall area disposal units; however, the complete nature and/or extent of the contamination is not known for these units. Limited or no previous characterization was conducted for the soil and tuff around drainlines connecting the disposal units. The New Mexico Environment Department rejected a previously submitted RFI Report (LANL 1997, 56749) for failing to determine the nature and extent of contamination.

The problem to be addressed by this sampling and analysis plan is that the determination of nature and/ or extent of contamination for these units is not complete. The previous investigations provided approximate boundaries of the extent of contamination. The objective of this sampling and analysis plan is to collect data to complete the nature and extent of HE, VOC and/or copper contamination and to address the concerns raised in the NMED rejection notice. It is expected that the boundaries of contamination at these PRSs are within 10 feet horizontally of the sumps, drainlines, seepage pits, outfall area units and not greater than 5-15 feet below the bottom of the units. The boundaries will be extended, if needed, based on the results of the field sampling efforts. A marsh area discussed in Section 3.0, is at a greater distance than 10 feet away from the PRS 22-015(a) seepage pits. The marsh area will be addressed in a larger scale separate RFI investigation to be completed by the ER Canyons Focus Area. Once nature and extent have been adequately defined, these data, along with the previously collected data will be used to evaluate human health and ecological risks presented by the contamination and to decide whether or not further action is needed for these PRSs.

2.0 POTENTIAL RELEASE SITES (PRSs) 22-012, WASH PAD, 22-015(d), SEEPAGE PIT, AND 22-015(e), SUMP

2.1 Characterization and Setting

2.1.1 Site Description

PRSs 22-012, 22-015(d), and 22-015(e) are located on the southern edge of Two-Mile Mesa, in the east-central area of TA-22. They are south of both the main TA-22 paved access road and Building TA-22-1, an HE laboratory. The TA-22 explosives sump aggregate, shown in Figure 2.1-1, consists of an inactive explosives sump (22-015[e]) and an associated wash pad (22-012), an inactive drainline and inactive seepage pit (22-015[d]). All of these disposal structures served Building TA-22-1.

PRSs 22-012, a concrete wash pad, and 22-015(e), an explosives sump, are located on the south side of Building TA-22-1. The concrete sump is approximately 6 ft by 4.5 ft, with a depth of 4 ft. The sump was decommissioned by cleaning and filling it with concrete. Adjacent to the sump is a curbed, 8-ft by 8-ft concrete wash pad which collected and conveyed washwater to the sump. The sump and wash pad are in a corner outside of Building TA-22-1. The surface soil around the sump and wash pad is covered by asphalt paving (Figure 2.1-2). The pavement extends for at least 20 feet away from Building TA-22-1.

A 6-in. vitrified clay pipe drainline from the sump extends in a southeasterly direction under the asphalt parking lot, under the TA-22 security fence, down an incline, and then terminates at the seepage pit. The length of the drainline from the sump to the seepage pit is approximately 180 ft, with a vertical drop of 20 ft. The drainline is exposed to the ground surface at the incline area south of the security fence (Figure 2.1-3). The exposed, individual vitrified clay pipe sections are 30 in. long and it is assumed that the pipe joints of the unexposed sections of the drainline occur at 30 in. intervals.

The seepage pit is located in a relatively level, open area between stands of Ponderosa Pine (Figure 2.1-4). The seepage pit, which is approximately 3 ft in diameter, was bored through soil and into tuff and filled with gravel. Previous sampling has shown the pit to be 10.5 ft deep.

There is no observable erosion at these PRSs. Stormwater run-on to the sump and wash pad can occur from the rooftop of adjacent Building TA-22-1. The Surface Water Site Assessment (SWSA), Standard Operating Procedure (SOP) 2.01, score for PRSs 22-012 and 22-015(e) is 17.5. An SWSA score of less than 40 indicates a low erosion potential. Scores of 40 to 60 indicate a medium potential and 60 to a maximum of 100 indicate a high erosion potential. The potential for stormwater run-on to the PRS 22-015(d) seepage pit is minimal. The SWSA, SOP 2.01, score for PRS 22-015(d) is 39.8.

The total surface area of this PRS aggregate is approximately 150 ft^2. Previous sampling indicates that contamination is present in the immediate surface area around the sump and within the seepage pit. These PRSs are situated in a mesa-top setting. The surface soil identified for the site is Carjo Loam (Nyhan et al. 1978, 5702). The nearest water course is within Pajarito Canyon, 450 ft south of the 22-015(d) seepage pit.

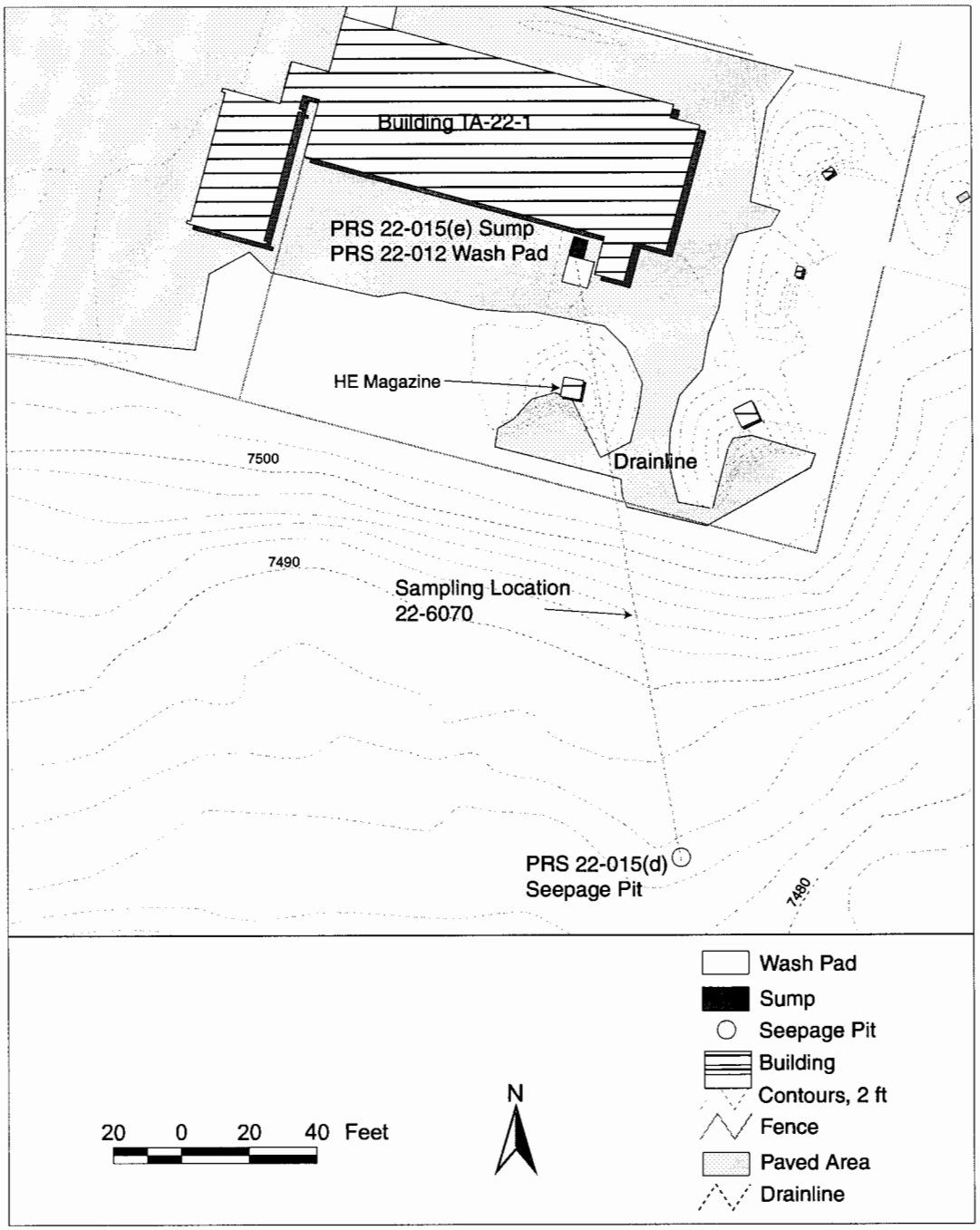

Figure 2.1-1. TA-22-1 Explosives Sump aggregate.

Figure 2.1-2. Photograph of the PRS 22-012 Wash Pad and 22-015(e) Sump during 1994 Sampling event

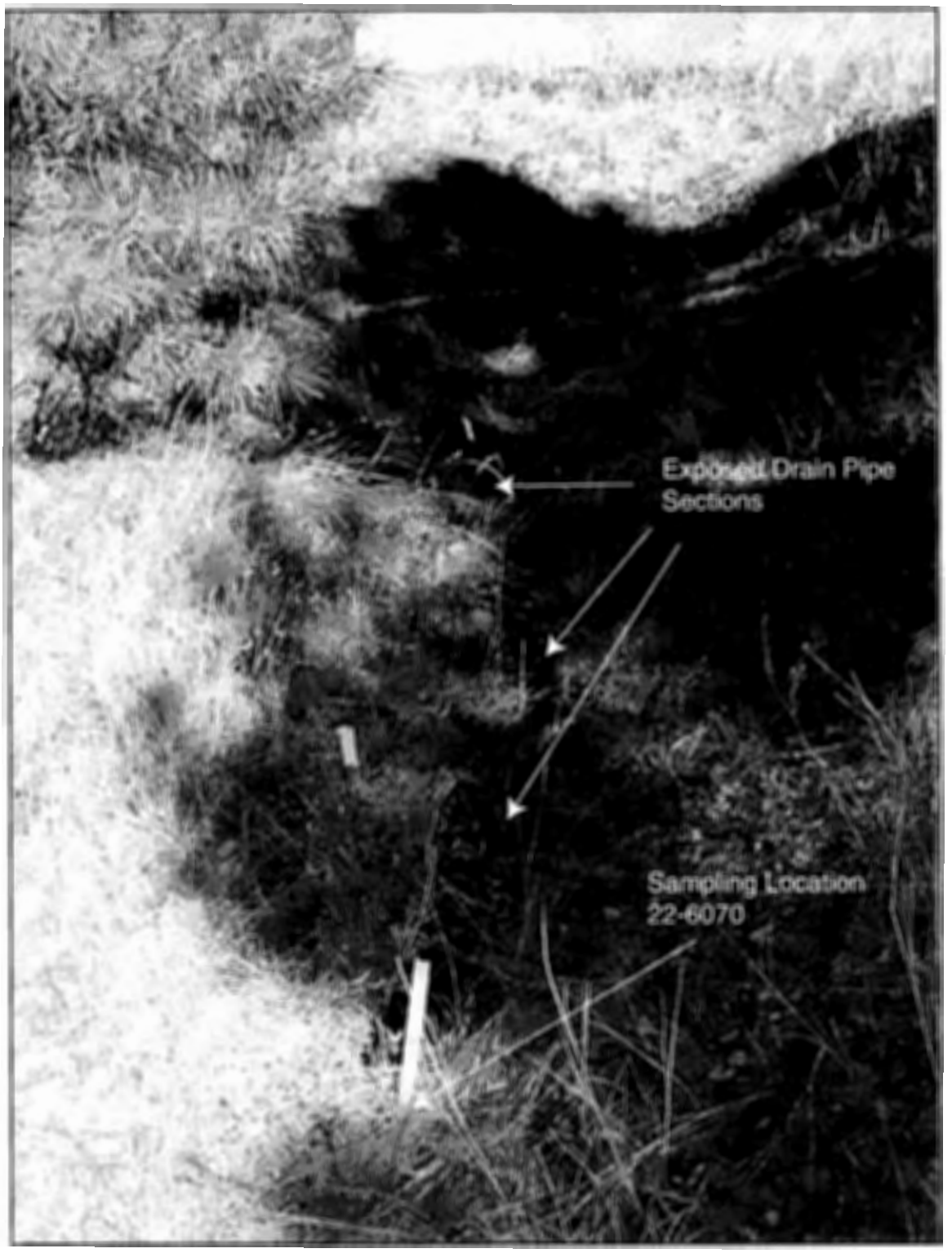

Figure 2.1-3. Exposed sections of PRS 22-015(d) drainline (View to the north).

Figure 2.1-4. Photograph of the PRS 22-015(d) Seepage Pit Site (View to the south).

2.1.2 Operational History

In 1948, an acetone-based PETN recrystallization process was put into operation at TA-22-1. Acetone and water-process effluents potentially contaminated with PETN were released to a seepage pit (PRS 22-015[d]). In 1949, this recrystallization process was moved to TA-22-25. At that time, an explosives sump (PRS 22-015[e]) was constructed between the HE drain from Building TA-22-1 and the seepage pit. The purpose of this sump was to allow the settling and recovery of suspended PETN from contaminated wastewater associated with continued HE wet grinding and pressing operations at TA-22-1. The estimated amount of HE released is approximately 0.02 lbs (Meyers 1993, 15072). A concrete wash pad for cleaning explosives-contaminated equipment, PRS 22-012, was also constructed next to the sump and drained into the sump. These processes remained in operation until 1984 when TA-22-1 was abandoned, the sump was filled with concrete, and discharges to PRS 22-015(d) were discontinued.

2.1.3 Waste Characteristics

This section addresses the potential contaminants that may be present at this PRS based on the information contained in subsections 2.1.1 and 2.1.2. This information is potentially relevant to waste only to the extent that solid waste, as that term is defined under RCRA, is subsequently generated at this PRS. This discussion of potential contaminants in no way implies that the materials present at this PRS are solid waste or hazardous waste as those terms are defined under the New Mexico Statutes Annotated (NMSA), the New Mexico Administrative Code (NMAC), RCRA, HSWA, SWDA, or other statutes or regulations.

The potential contaminants from the HE grinding, pressing, and recrystallization operations include HE (primarily PETN and also HMX, RDX and TNT) and acetone and possibly other solvents. No baritol has been used at TA-22. Mock HE (a non-HE material with physical properties similar to HE) has been pressed at TA-22, but the material used was sugar (Dye 1999a, 62907). Therefore, barium and other metals are not potential contaminants for these PRSs

2.2 Investigatory Approach

2.2.1 Existing Data

2.2.1.1 Nonsampling

No previous nonsampling investigations were conducted at these PRSs.

2.2.1.2 Sampling

Initial sampling events occurred on June 22 and July 11, 1994. These samples were analyzed for HE and VOCs. However, the HE samples exceeded the allowable holding times prior to analysis by a few months, PETN at that time was not was included as an analyte in the HE Suite, and some VOC samples were lost at the analytical laboratory.

PRS 22-012—Surface samples (0–0.5 ft) were collected from 12 locations (22-3036 to 22-3047) around and near the perimeter of the inactive wash pad (Figure 2.2-1). Three of these samples (22-3036, 22-

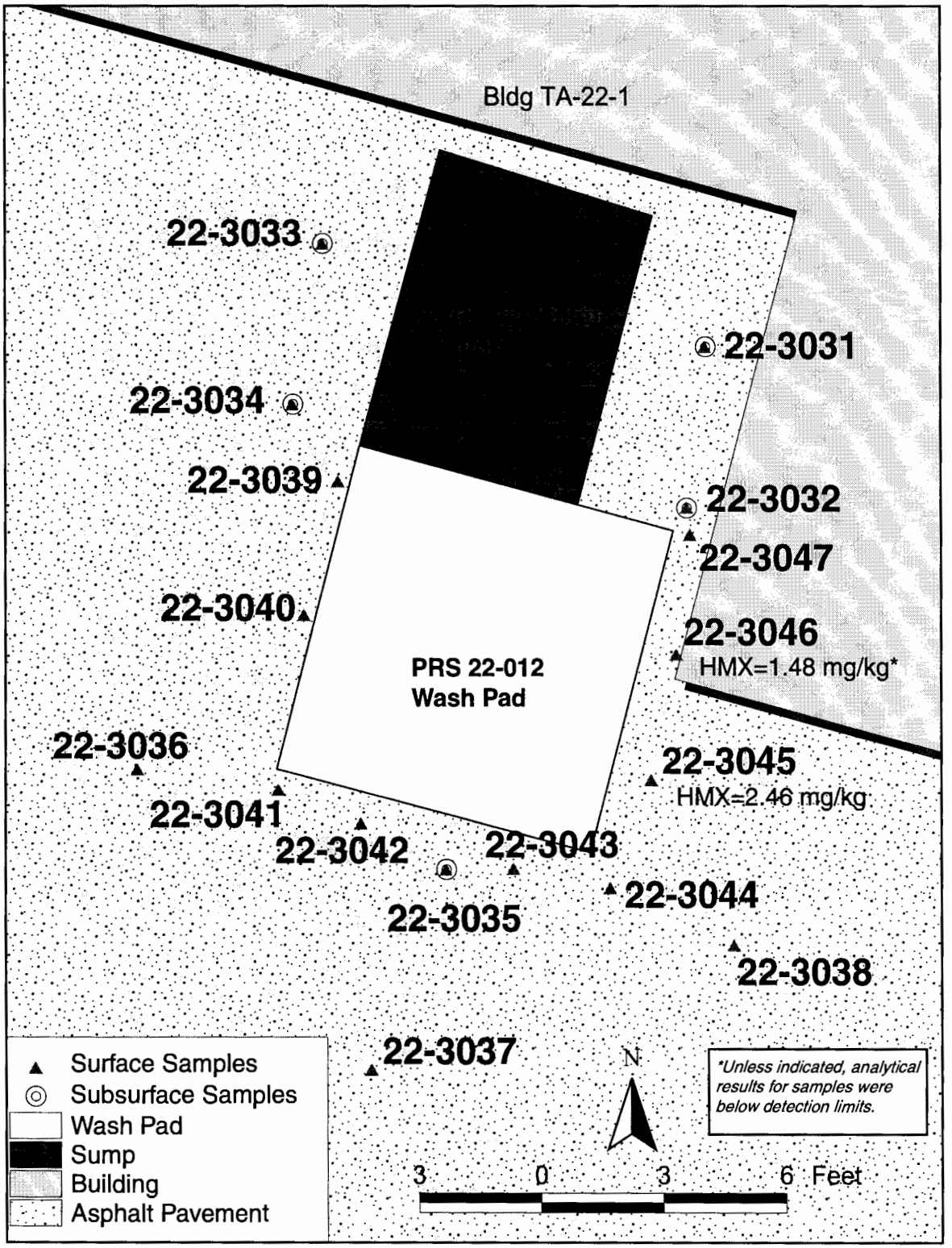

Figure 2.2-1. Sampling Locations at the PRS 22-012 Wash Pad and 22-015(e) Sump

3037, and 22-3038) consisted of asphalt material (collected at the surface) and were analyzed for HE compounds. Two of these surface soil samples (22-3042 and 22-3043) were collected following the removal of the overlying asphalt pad. All samples were analyzed for HE compounds (excluding PETN). No VOC or semivolatile organic compound (SVOC) analyses were requested for these samples. VOC analysis was not requested because VOCs were not expected to be associated with equipment-washing activities, and any low-level or surface VOC contamination would have volatilized or degraded in the intervening 10 years between cessation of operations and the time of the investigation. No SVOC analysis was requested because SVOCs were not expected to be associated with the equipment-washing activities, and constituents in the asphalt would have compromised the ability to quantify site-related SVOC contamination.

PRS 22-015(e)—Surface and subsurface soil samples were collected from four hand-augered boreholes (one near each corner of the sump). These boreholes, numbered 22-3031 through 22-3034, are shown on Figure 2.2-1. Each boring was sampled at three depth intervals: 0–0.5ft, 3 ft, and 6.5 ft, except for the southwest corner boring, which was not sampled at the 6.5-ft depth due to auger refusal below 3 ft. The sump was not sampled because it had been filled with concrete. The area of the sump outlet pipe was also sampled at depths of 0–0.5 ft and 3.5 ft, from location 22-3035. These samples were collected for HE (excluding PETN) and VOC analysis; all VOC samples from this first sampling effort were lost by the analytical laboratory.

PRS 22-015(d)—Three boreholes were drilled outside the perimeter of the pit, Figure 2.2-2. Samples were taken from the borings at 0–0.5 ft, 10 ft, 20 ft, and 25 ft. These samples were sent for HE (excluding PETN) and VOC analysis; all 1994 VOC analysis holding times were exceeded by the analytical laboratory.

A second sampling event took place between April 21 and April 24, 1997. The intent of the first sampling event was to characterize media surrounding the pit and potential transport outside the seepage pit. The intent of the second sampling event was to collect and analyze sediments from within the seepage pit and to perform limited characterization of the drainline by collecting a single sample close to a pipeline joint or break. This additional data was intended to address previous HE holding-time issues and to eliminate the PETN data gap through the characterization of source term material in the seepage pit. A single borehole was drilled through the seepage pit. Analytical samples were collected at 9–10 ft, 10.5–11.5 ft (bottom of seepage pit), 15–16 ft (3 ft below the bottom of the seepage pit), and 19–20 ft. One sample was collected from the area of a pipe joint in an exposed section of the drainline. This sample (location 22-6070) consisted of soil taken from beneath the open end of the pipe as well as sediment deposited inside the pipe. These samples were analyzed for HE compounds, including PETN and VOCs.

Detected organic chemicals for this PRS aggregate are presented in Table 2.2-1. No VOCs or SVOCs were reported as detected in any samples collected during the 1994 or 1997 samplings. All HE analyses exceeded holding times for the 1994 sampling, and PETN was not identified for analysis in the HE suite. High Melting Explosive (HMX) was detected in surface soils associated with the sump and wash pad at 2.46 and 1.48 mg/kg in samples AAA8777 (location 22-3045) and AAA8778 (location 22-3046), respectively. However, only a trace concentration of HMX was detected during the second sampling event at the seepage pit.

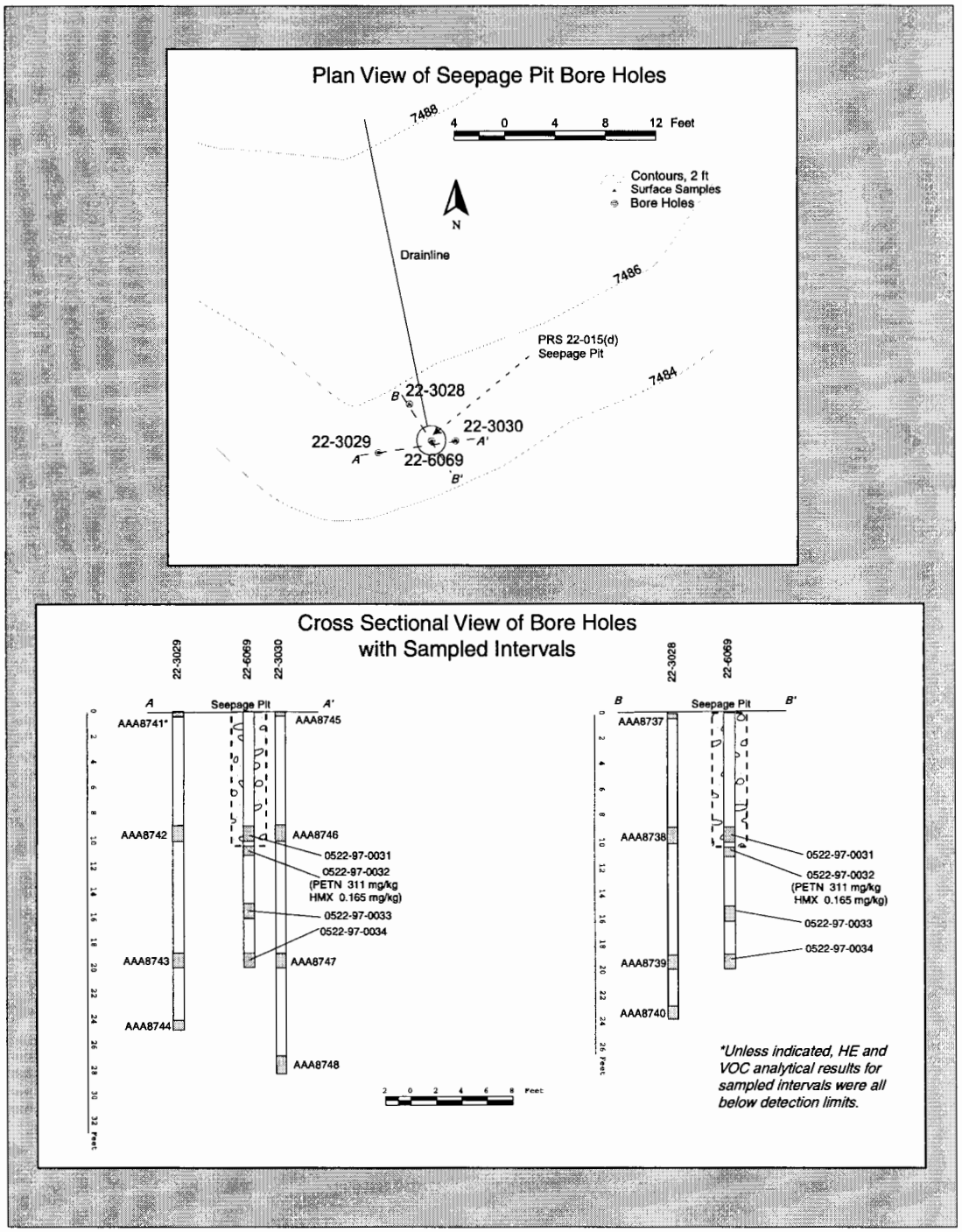

Figure 2.2-2. Plan and Cross section views of the PRS 22-015(d) Seepage Pit

Table 2.2-1
Detected Organic Chemicals for PRS Aggregate

Location ID	Sample ID	Depth (ft)	HMX (mg/kg)	PETN (mg/kg)
NA[a]	SAL[b]	NA	2700	1600
NA	EQL	NA	2.2	0.5
22-3045	AAA8777	0–0.5	**2.46**[c]	NA
22-3046	AAA8778	0–0.5	1.48	NA
22-6069	0522-97-0032	10.5–11.5	0.165	**311**

a. NA = not applicable
b. SAL = screening action level
c. **Bold** values indicate concentrations above estimated quantitation limits (EQLs).

2.2.2 Conceptual Model

The conceptual model for these PRSs includes the assumption that levels of contamination are likely to be low because of the limited amount of hazardous materials used during operation. Soil sampling conducted in 1994 and 1997 provides information that relatively low levels of contaminants are present at these PRSs. The model is based on the following release scenario:

- Wastewater from the PETN recrystallization process discharged directly from Building TA-22-1 to the PRS 22-015(d) seepage pit for about one year (1948-1949).

- Beginning in 1949, wastewater flowed through the sump, where most bulk and suspended contaminants settled.

- Supernatant from the sump, with lower contamination and reduced waste loading, was then intentionally released through an underground drainline to the seepage pit, where it percolated into the surrounding soil matrix.

- Aqueous effluent from equipment washing at PRS 22-012 (a wash pad) drained directly to the sump; any spillage or overspray was a source of potential surface soil contamination.

- The soil adjacent to the sump and wash pad were paved with asphalt as early as 1950 (Dye 1999b, 62894) reducing the potential for soil contamination adjacent to the sump and wash pad.

There are no reports of structural failure of the sump or wash pad which would have resulted in the release of waste water through cracks or breaches in the concrete. Stormwater drainage in the area of the sump consists of sheet flow across the asphalt parking area to the surrounding, relatively level landscape. There are no obvious drainage channels to conduct runoff from the asphalt-paved area to

surface stream channels. Any remaining contaminants from the recrystallization or equipment-washing processes were retained under the asphalt pavement and/or retained in the seepage pit media or at the soil/tuff interface within the pit.

The sump, wash pad, seepage pit, and surrounding soils are the primary sources of possible contaminants. The previous sampling results indicate that the seepage pit fill material is the most affected media. Site investigations were designed to assess the presence of environmental releases from overflows, spills, and normal operations related to the system during its history.

The possible primary sources of contaminants are the sump, drainline, and the wash pad (if overflows occurred); seepage pit; and surrounding soils. The seepage pit is the most likely part of the system to contain contaminants because it received flow from the operations at Building TA-22-1 since its installation, whereas solids were removed periodically from the sumps, and the drainlines were subject to flushing by continued flow. The seepage pit was designed to allow liquids to percolate into soils or tuff; dissolved contaminants or fine particulates may be carried with the liquids.

Prior to the installation of the sump, PETN bearing waste water was discharged directly to the seepage pit. The installation and use of the sump improved the removal efficiency of HE, by allowing solids to settle out in the sump prior to discharge to the seepage pit. The presence of PETN and only a trace of HMX in the seepage pit suggests that the deposition of PETN in the pit occurred during the PETN recrystallization activities at Building TA-22-1 (1948-1949) and prior to the installation of the PRS 22-015(e) sump in 1949. Solvents are expected to have been lost through biodegradation, volatilization from surface areas or diffusion into the surrounding geologic media. Explosives, being less volatile and water-soluble and being more resistent to biodegradation, can be expected to remain in place. Possible overflow from the seepage pit would have ponded around the pit.

The watershed system of these PRSs drains into Pajarito Canyon. Transport mechanisms include overland flow and associated sediment transport, infiltration, percolation, and wind erosion. Receptors include plants, animals, and humans. The plants and animals are potential ecological receptors. Exposure routes to receptors include direct skin contact with contaminated soils or sediments, ingestion, and inhalation when a contaminated area is disturbed. Herbivores living on-site may be exposed through eating plants that have grown in contaminated soils. On the basis of the information currently available, sources of contaminants appear to be small. Therefore, potential public health and environmental effects are expected to be extremely limited.

2.2.2.1 Nature and Extent of Contamination

The nature of the contamination, as determined by the previous sampling, in PRS 22-012 and 22-015(e) is HE contamination in soil and possibly asphalt. One HE compound, HMX, was detected at two locations, within three feet of each other between the curb of the wash pad (22-3046) and the walls of Building TA-22-1. These samples were mixtures of asphalt and the underlying soil. The extent of contamination, based on current knowledge, is confined to the surface area between the wash pad and Building TA-22-1. Surface samples collected at other locations around the wash pad had no detectable HE compounds. In addition, subsurface samples from locations around the sump and south of the wash pad had no detectable HE. This area between the wash pad and the building is somewhat sheltered from

weather. HMX, deposited by spillage or over-spray on to bare soil during the first two years of operation, may have been resistant to removal by storm water runoff. Asphalt paving of the soils may have trapped the HMX on the surface of the soil. VOCs and the HE compound PETN were not analyzed during previous sampling event due to sample loss by the analytical laboratory and by an oversight by the sampling team in not including PETN in the requested analyses. The nature and extent of PETN and VOC contamination will be determined by the proposed sampling.

Based on the available knowledge, the nature of the contamination at PRS 22-015(d) drainline and seepage pit is HE contamination at the bottom of the seepage pit bottom and tuff interface. The HE compound, PETN, was detected at a concentration of 311 mg/kg. A second HE compound from the sampling interval was reported at a very low concentration 0.165 mg/kg. The vertical extent of PETN appears to be confined to the bottom of the pit because samples from below the pit had no detectable VOCs or HE compounds. The horizontal extent will be determined by the proposed sampling. Previous samples collected at or near the drainline had no detectable contaminants. These include subsurface samples collected at sampling location 22-3035, south of the wash pad near the presumed location of the drainline. A sample was also collected at 22-6070 where the drainline is exposed on the ground surface. There may be other areas along the drainline where contaminants were released through joints/ breaches in the drainline. The proposed sampling will determine the nature and extent of contamination at the drainline.

2.2.2.2 Fate and Transport

The fate and distribution of chemicals in the environment are determined by variables that can interact in numerous ways: physical chemical properties of the individual chemical and the physical transport systems such as rain water or snow melt runoff. Chemical properties of organic chemicals, such as water solubility, octanol water coefficient (Kow), organic carbon adsorption coefficient (Koc) and vapor pressure, help determine the fate and transport and bioaccumulation and bioconcentration potential of such chemicals. Water solubility is perhaps the most important chemical characteristic used to assess chemical mobility, stability, or breakdown, accumulation, bioaccumulation and sorption. The Kow represents a mathematical equation expressing the ratio of a chemical's distribution between octanol and water phases. The Koc provides an indication of the adsorption potential of contaminants onto soil organic matter. Volatilization of a chemical provides an indication of whether a chemical will volatilize into the air. The higher the water solubility of a chemical, the more likely it is to be mobile and less likely it is to be accumulative, bioaccumlative, volatile and persistent. A highly soluble chemical (greater than 1000 ppm or mg/L) is prone to biodegradation and metabolism that may detoxify the parent chemical. The lower the water solubility of a chemical (less than 10 ppm or mg/L) the more likely it is that it will be immobilized by way of adsorption, and because it is less mobile, it is more accumulative or bioaccumulative, persistent in the environment, and slightly prone to biodegradation and may be metabolized in plants and animals. A chemical with a low vapor pressure (less than 0.000001 torr) is less likely to volatilize into the air, while one with a high vapor pressure (greater than 0.01 torr) is more likely to volatilize. A chemical with a low Kow (less than 500) is indicative of high water solubility, mobility, little or no bioaccumulation or accumulation, and biodegradability by microbes, plants and animals (Ney 1995, 58210).

The previous RFI sampling reported the presence of three organic chemicals (acetone, HMX and PETN). Acetone is completely miscible in water and has a high vapor pressure, 199 - 232 torr (Mackay

et al., 1992, 62895). This indicates that acetone could leach, be transported with run-off, diffuse and biodegrade. PETN and HMX are not very soluble in water, 2-32 mg/L and 2.6-5 mg/L and have Koc values of 129 and 68 and (LANL 1994, p D-14, 52910). These values indicate these two HE compounds are resistent to biodegradation and tend to be persistent in the environment. The HMX detected near the wash pad and sump is isolated from wind and water transport mechanisms by the overlying asphalt pavement. There appears to be very little vertical migration of PETN out of the seepage pit since it was deposited over the last 50 years. The PETN detected at the bottom of the seepage pit will eventually be leached away from the pit into the subsurface by rainwater and snowmelt infiltrating from the surface. This is expected to occur, however, at a such slow rate that it should have a negligible impact to the underlying ground water quality.

2.2.2.3 Data Gaps

PRSs 22-012 and 22-015(e)—PETN was not analyzed for in the subsurface soil samples collected around the sump. VOCs samples were lost by the analytical laboratory and were not analyzed.

Drainline soil sampling was conducted at the one location (22-6070) where the drainline is visible at ground level. No contaminants (including PETN) were detected at this site. However, the length of the drainline is approximately 180 ft, and there may be other subsurface locations where seepage occurred.

PRS 22-015(d)—In 1997, PETN was found at only one intermediate-depth interval (10.5 ft at the pit/tuff interface) in borehole 22-6069 (Figure 2.2-2). This borehole, drilled through the center of the seepage pit, determined the vertical extent of contamination. PETN was not analyzed for in the earlier (1994) sampling at the boreholes drilled outside of the perimeter of the seepage pit, so the lateral extent of contamination for PETN is unknown.

2.2.3 Sampling Activities

Sampling activities will include soil and tuff characterization as discussed in subsection 2.2.3.2. Samples to be collected are shown in Table 2.2-2. Figure 2.2-3 shows the location where the samples will be collected.

Table 2.2-2

Samples to be Collected for PRSs 22-012 and 22-015(d,e)

Sample Type	Number of Samples	Analytical Suite	Analytical Method	Matrix	Planned Depth(ft)
Sump Area: Soil/Tuff Interface and Tuff	4	HE	SW-846 Method 8330	Soil	4–5, 6–7
Sump Area: Soil/Tuff Interface and Tuff	4	VOCs	SW-846 Method 8260	Soil	4–5, 6–7
Seepage Pit Area Soil and Tuff	2	HE	SW-846 Method 8330	Soil	10–11, 14–15
Seepage Pit Area: Soil and Tuff	2	VOCs	SW-846 Method 8260	Soil	10–11, 14–15
Drainline soil	12	HE	SW-846 Method 8330	Soil	3–4, 6–7
Drainline soil	12	VOCs	SW-846 Method 8260	Soil	3–4, 6–7

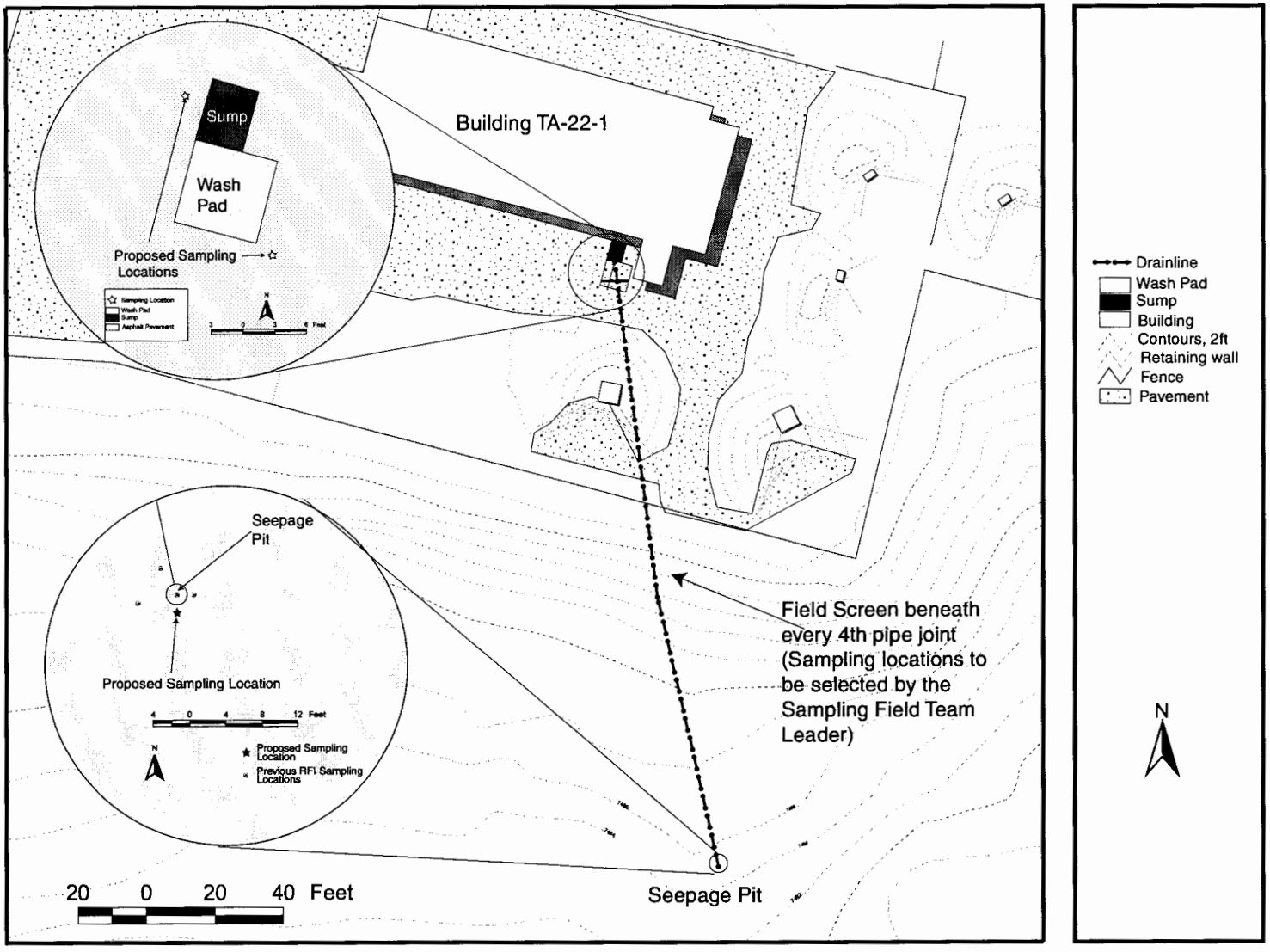

Figure 2.2-3. Proposed Sampling Locations.

2.2.3.1 Contaminant Source

No contaminant source sampling is planned.

2.2.3.2 Media Characterization

PRSs 22-012 and 22-015(e)—Two boreholes will be drilled: one on the west side of the sump and one at the southeast corner of the wash pad. Samples will be collected from the soil/tuff interface, at approximately 4 ft, and from the tuff, at a depth of 6 ft.

The use of hand-augering methods during the previous sampling event allowed the collection of subsurface soil in the narrow area between the sump/wash pad and the wall of Building TA-22-1. In order to penetrate the tuff, a hollow-stem auger drill rig will need to be used to collect the samples. Safety considerations for the drill rig will require an adequate setback distance from the walls of the building. Therefore sampling will have to be conducted at the southeast corner of the wash pad and on the west side of the sump. The samples will be analyzed for HE (including PETN) and VOCs.

PRS 22-015(d)—One borehole will be drilled with a hollow-stem auger drill rig approximately 4 ft south of the seepage pit. Samples will be collected for HE and VOC analysis at the soil/tuff interface, approximately 10–11 ft, and from the tuff, at a depth of 15 ft.

Releases of wastewater may have occurred through the pipe joints or through breaks or breaches in the line. In order to allow characterization of soil under the drainline, drain pipe from the sump to the seepage pit will be excavated and removed for disposal. The individual vitrified-clay drain pipe sections are 30 in. long. From under the drainline, beginning at the sump outlet and then from every fourth pipe joint (every 10 ft), soil will be field-screened for HE using an immunoassay method (D-Tech) and the HE spot test kit and for organic vapors. Soil samples will be also be field-screened from any areas below the drainline that appear to be stained or where there are obvious breaches in the line. Six sites with the highest field-screening results will be selected for sampling. If less than six sites have positive field-screening results, sampling locations beneath pipe joints will be randomly selected so that at least six sites along the drainline will be sampled. Soil samples will be collected from the selected sites immediately below the drainline. The field team will attempt to determine the vertical extent of potential HE and VOC contamination through the use field-screening methods (D-Tech immunoassay and HE spot test kit field methods, photoionization detectors). Soil sampling will be conducted at approximately 1 ft below the suspected depth of deepest contamination. Samples will be analyzed at a fixed analytical laboratory for HE (including PETN) and for VOCs. It is anticipated that 12 soil samples from 6 locations will be collected.

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3.0 PRS 22-015(a), SEEPAGE PIT

3.1 Characterization and Setting

3.1.1 Site Description

PRS 22-015(a) is situated on Two-Mile Mesa in the central-east area of TA-22. It is located at the east side of the main operations area of TA-22. PRS 22-015(a) is comprised of two inactive seepage pits, located east of Building TA-22-91 in an open, grass-covered area (Figure 3.1-1). The pits served Rooms B102, 107, 121, 123, 145, and 160 of Building TA-22-91, which housed printed circuit-board etching operations (LANL 1993, 26068). The pits have been bored through the soil and volcanic tuff and filled with .5 in. to 2.5 in. screened gravel. The southernmost pit (Pit A) is 4 ft in diameter and 26 ft deep; the northernmost pit (Pit B) is 4 ft in diameter and 20 ft deep. PRS 22-015(a) is a SWMU listed in Module VIII of the Laboratory's Hazardous Waste Facility Permit. Current and future land use is industrial. Access to TA-22 and this PRS is controlled by a security fence.

PRS 22-015(a) is located near the head of the Southeast Fork of Two-Mile Canyon, an intermittent drainage channel that runs eastward from TA-22 through TA-40 and then intersects the main Two-Mile Canyon at a distance of approximately 9500 ft. In the Southeast Fork of the Two-Mile Canyon drainage channel, a marshy area with cattails begins at approximately 240 ft east of the seepage pits (Figure 3.1-2). Surface soil identified for the site is Carjo Loam.

The Surface Water Site Assessment, SOP 2.01, score for PRS 22-015(a) is 34.6. There was no visible debris noted during the assessment. The site has a 75–100% vegetative cover (Figure 3.1-3).

3.1.2 Operational History

From 1985 to 1987, waste from the etching operations in Building TA-22-91 was discharged through a 6-in.-diameter PVC drainline to the seepage pits. Before discharge, waste material was pretreated to remove most contaminants. However, small quantities of dissolved contaminants and fine particulates may have been carried with the effluent released to the pits. The seepage pits were intended to enable liquids to percolate into the surrounding soils and tuff, while retaining most potential contaminants in the seepage pit sediments and immediately surrounding soil matrix. The system failed because the effluent production rate exceeded the infiltration rate of liquid into the tuff. This resulted in seepage pit overflow, and in 1987, the pits were disconnected from the drainlines and abandoned in place.

3.1.3 Waste Characteristics

This section addresses the potential contaminants that may be present at this PRS based on the information contained in Section 3.1.1, Site Description, and Section 3.1.2, Operational History. This information is potentially relevant to waste only to the extent that solid waste, as that term is defined under RCRA, is subsequently generated at this PRS. This discussion of potential contaminants in no way implies that the materials present at this PRS are solid waste or hazardous waste as those terms are defined under the New Mexico Statutes Annotated (NMSA), the New Mexico Administrative Code (NMAC), RCRA, HSWA, SWDA, or other statutes or regulations.

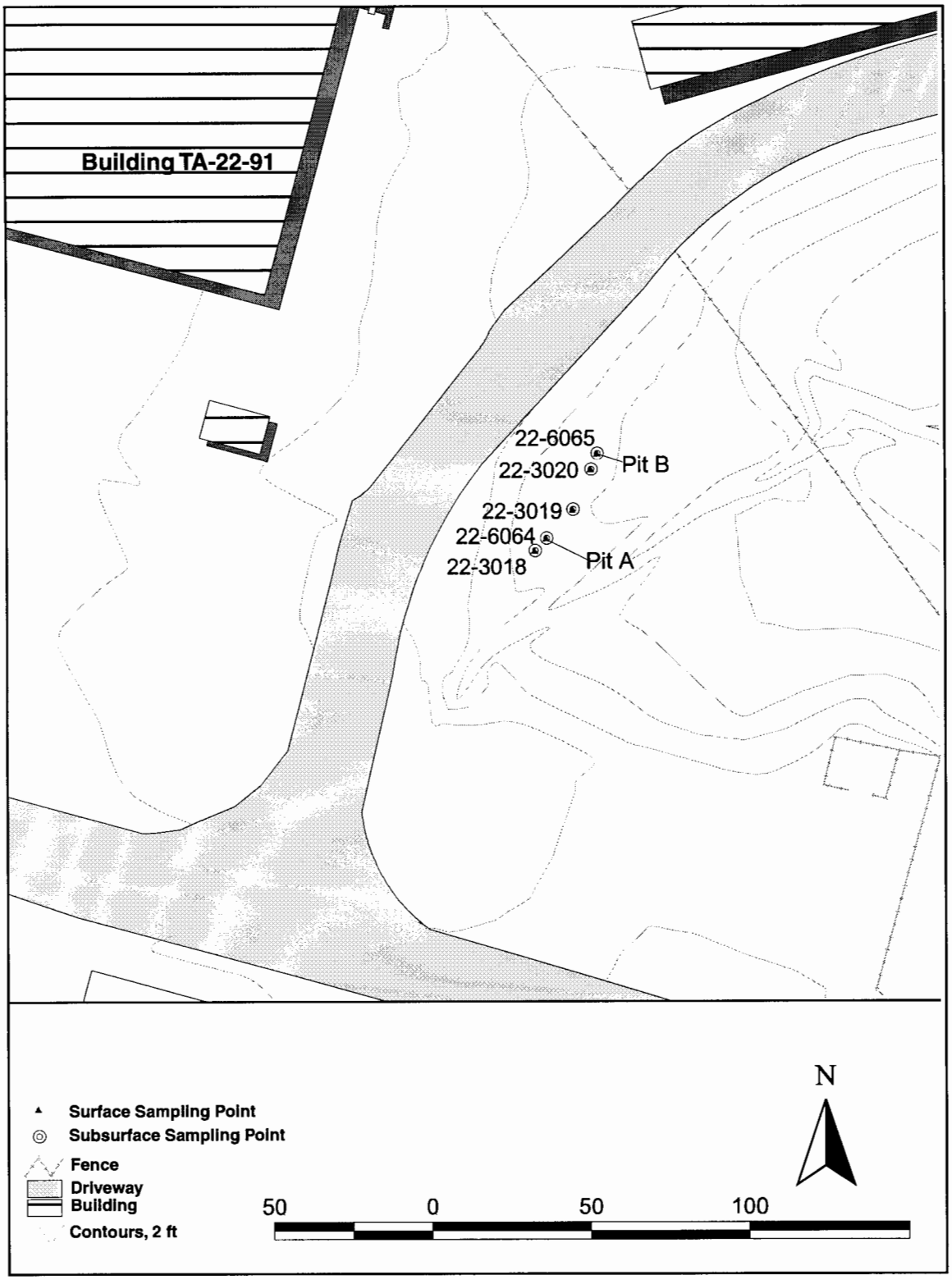

Figure 3.1-1. PRS 22-015(a) Seepage Pits.

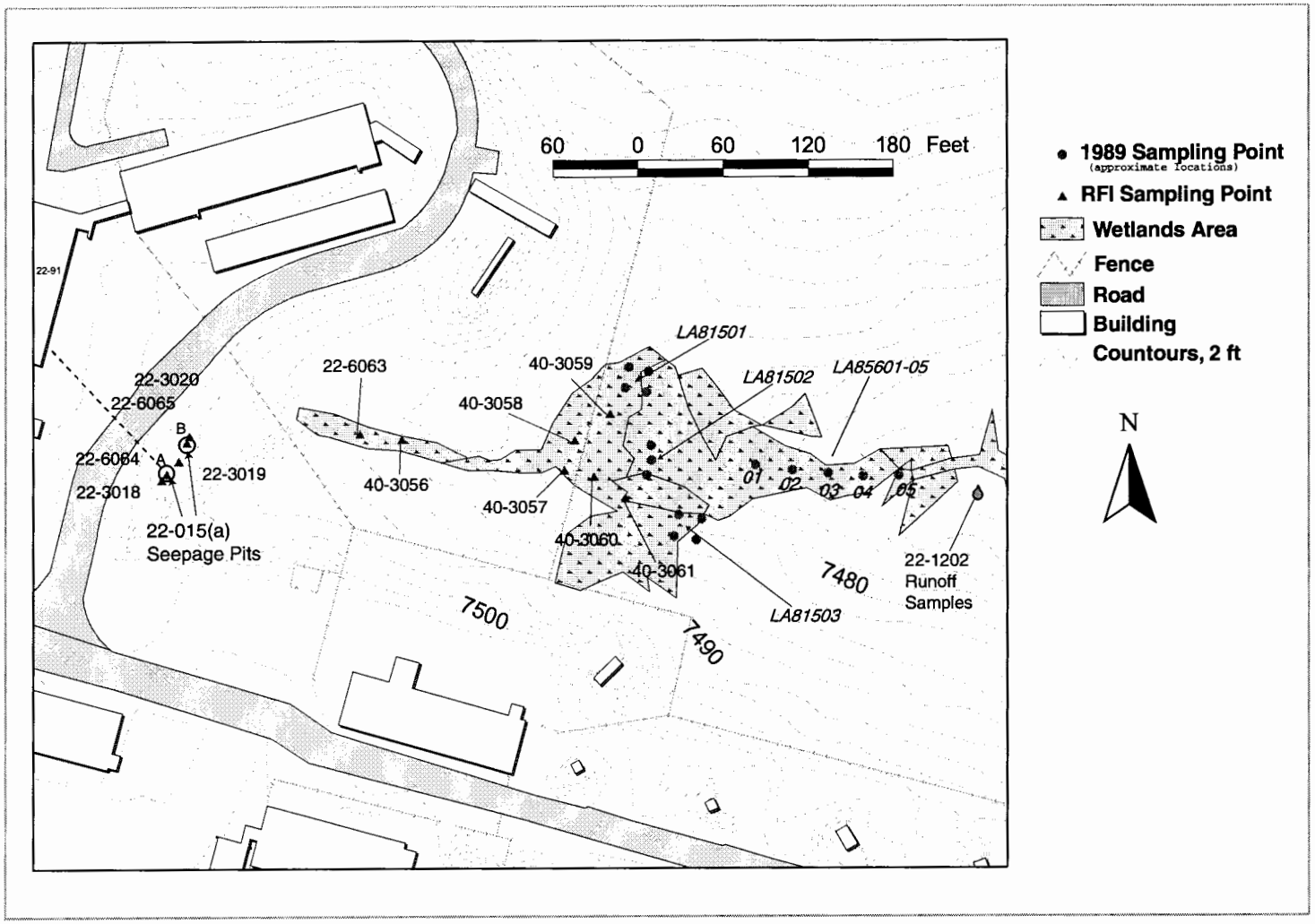

Figure 3.1-2. Sampling locations at PRS 22-015(a) and Marsh Area.

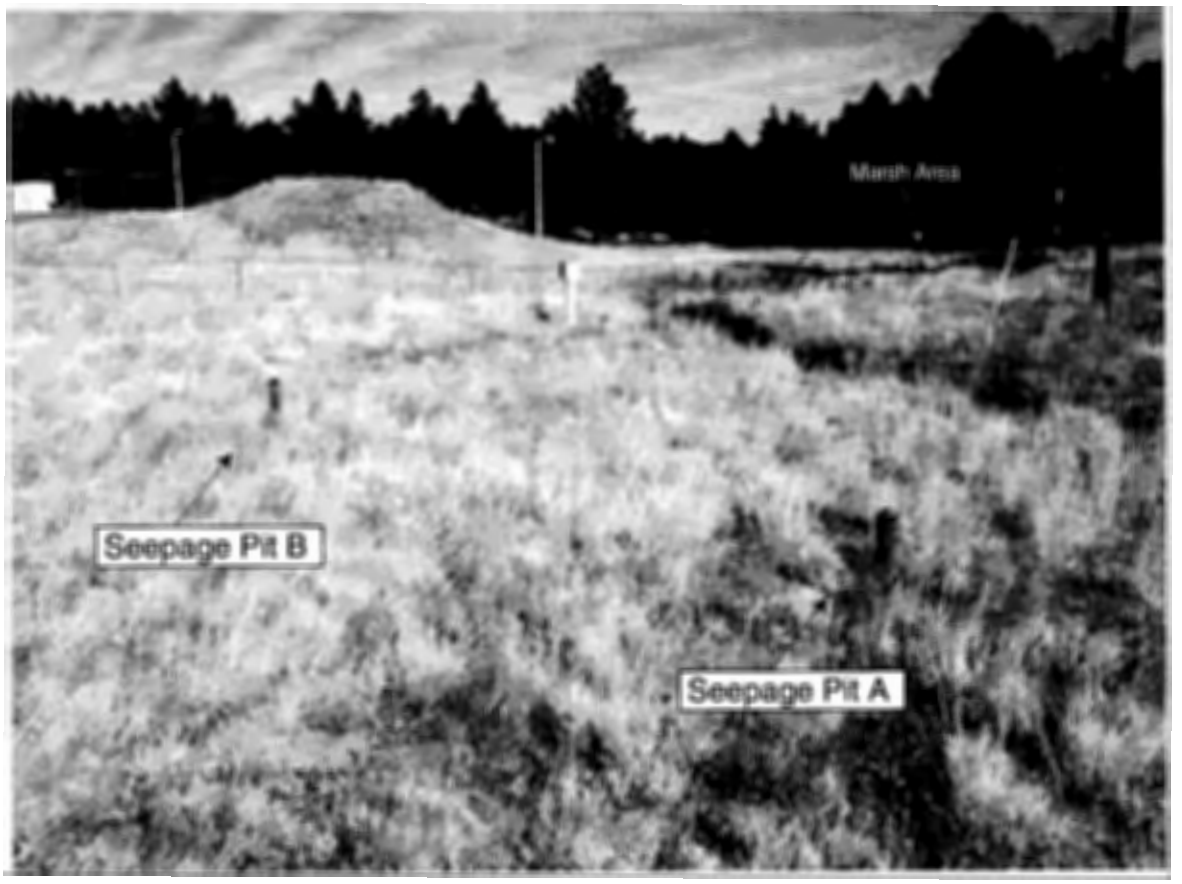

Figure 3.1-3. Photograph of the PRS 22-015(a) Seepage Pits (View to the east).

The potential contaminants from the plating and etching operations discharged to the seepage pits include metals (primarily iron and copper), cyanide, trichloroethylene, acids, and bases. No waste water from HE operations were discharged to this disposal system, so HE is not a potential contaminant for this PRS.

3.2 Investigatory Approach

3.2.1 Existing Data

3.2.1.1 Nonsampling

No previous nonsampling investigations were conducted at this PRSs.

3.2.1.2 Sampling

Two investigations were performed to characterize PRS 22-015(a): one in 1994 and a second focused investigation in 1997. The objectives of the investigations were:

- to determine whether contamination was present in media in the seepage pits and surrounding area, and
- if contamination was present, to determine if it posed an unacceptable human health risk, based on the results of a human health screening assessment.

Before samples were collected during both sampling events, all locations were field-screened for radioactivity, organic vapors, and HE. All field-screening results were negative or at background levels.

The first field-sampling event was conducted between June 22 and July 11, 1994. Three boreholes (Figure 3.2-1) were drilled: two (22-3018 and 22-3020) were located no more than 6 ft away and downgradient from Pits A and B, respectively; and a third (22-3019) was located downgradient and between the two seepage pits. Three samples were collected from each borehole: one at the soil surface (0–6 in.), one at the depth of the bottom of the pit (23–26.5 ft), and one at a midpit interval (14–16 ft).

The samples were submitted for laboratory analysis for metals (including cyanide), VOCs, SVOCs, and HE. Holding times for the HE analyses were exceeded, and PETN analysis was not requested due to an oversight by the sampling team.

Between April 21 and April 24, 1997, an additional field-sampling activity was conducted to characterize the source material within the seepage pits. One borehole was drilled through each seepage pit into the underlying tuff. Each boring was to be sampled at four intervals: Pit A (location 22-6064) at 12–14 ft, 19–20 ft, 24–26 ft, and 3 ft below the bottom of the pit; and Pit B (location 22-6065) at 8–10 ft, 13–15 ft, 18–20 ft, and 3 ft below the bottom of the pit. Core material from the first two planned intervals of each boring could not be recovered because of the course fill material and lack of consolidated sediments. The borings were sampled at the two lower intervals. The lack of samples from the upper two intervals should not impact PRS decisions because the intent was to sample sediments trapped by the gravels as the effluent passed through, and these samples could not be recovered because of the absence of consolidating sediment. All samples were submitted for laboratory analysis of metals, VOCs, cyanide, and HE, including PETN.

Inorganic chemicals with concentrations at or above background at PRS 22-015(a) are presented in Table 3.2-1. Analyses of samples taken during the investigation indicate that copper is present in eight samples and at concentrations that exceed media-specific background screening values. Figure 3.2-1 shows a cross-sectional view of the copper concentrations found in the boreholes.

Detected organic chemicals at PRS 22-015(a) are presented in Table 3.2-2. Samples from the first sampling event were not analyzed for the HE compound PETN, but samples from the second sampling event were. All VOC target analytes, except for acetone, were undetected in all samples associated with the RFI. Acetone is generally recognized as a potential laboratory contaminant but, in this case, the data validation and verification process did not indicate that the reported low concentrations of acetone in PRS 22-015(a) samples were associated with laboratory contamination.

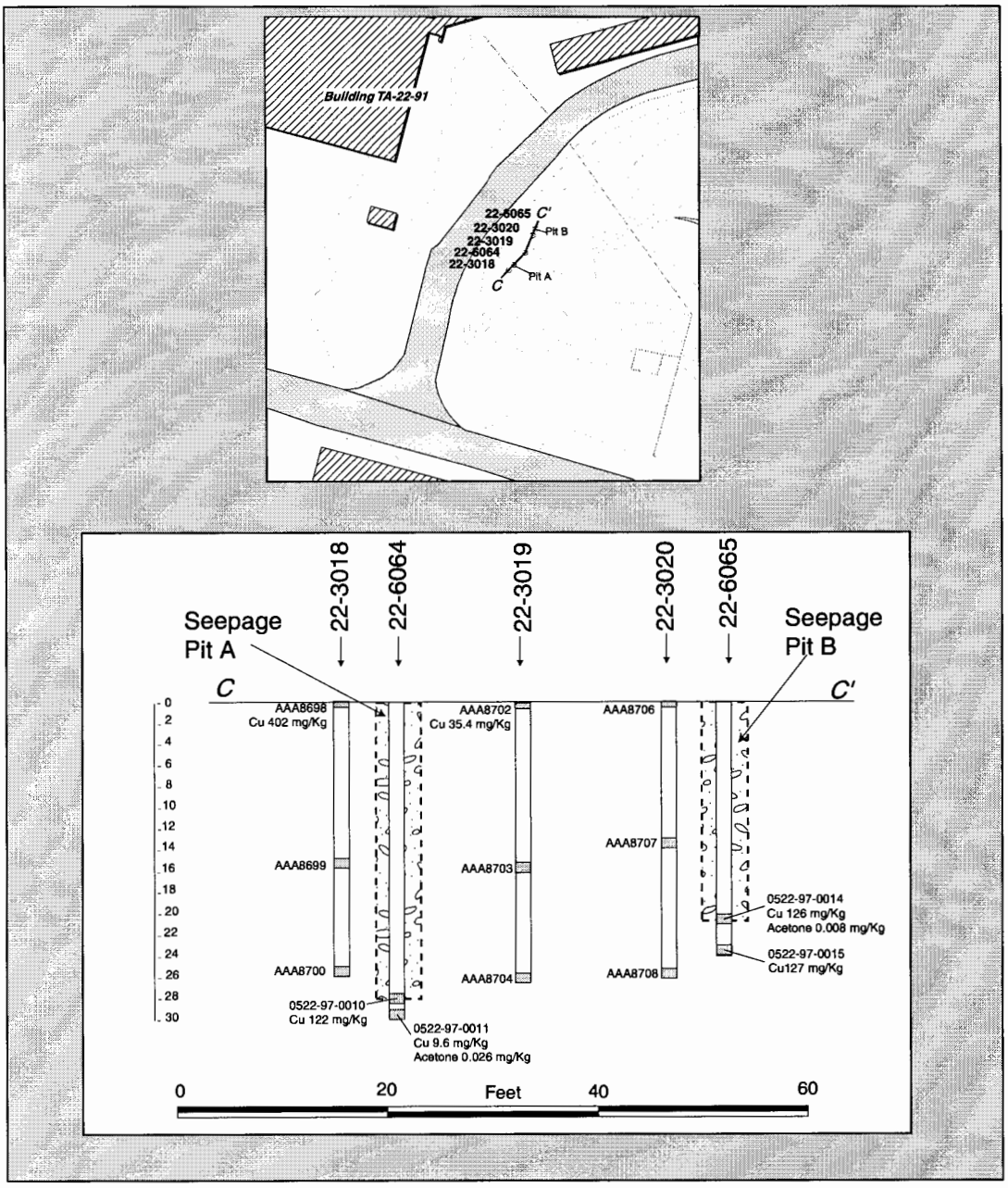

Figure 3.2-1. Plan and Cross section views of 22-015(a) seepage pits.

Table 3.2-1

Inorganic Chemicals with Concentrations Above Background Values for PRS 22-015(a)

Location ID	Sample ID[a]	Depth (ft)	Media	Copper (mg/kg)
SAL	NA[b]	NA	NA	2800
Soil BV[c]	NA	NA	NA	14.7
Qbt4 BV	NA	NA	NA	4.66
22-6064	0522-97-0010	27.7–28.5	Fill/tuff	**119.2**[d]
22-6064	0522-97-0010[e]	27.7–28.5	Fill/tuff	**122**
22-6064	0522-97-0011	29–30	Qbt4	**9.6**
22-6065	0522-97-0014	20.5–21.5	Fill/tuff	**126**
22-6065	0522-97-0015	23–24	Qbt4	**127**
22-3018	AAA8698	0–0.5	Soil	**362**
22-3018	AAA8698[e]	0–0.5	Soil	**402**
22-3020	AAA8706	0–0.5	Soil	**35.4**

a. Samples from 1997 begin with Sample ID "0522", samples from 1994 begin with Sample ID "AAA"
b. NA = not applicable
c. Background Value (BV) of Laboratory-wide soil background data
d. **Bold** values are above the background values
e. Laboratory duplicate

Table 3.2-2

Detected Organic Chemicals for PRS 22-015(a)

Location ID	Sample ID	Depth (ft)	Acetone (mg/kg)
SAL	NA[a]	NA	1400
EQL	NA	NA	0.02
22-6064	0522-97-0011	29–30	**0.026**[b]
22-6065	0522-97-0014	20.5–21.5	0.008(J)[c]

a. NA = not applicable
b. **Bold** values indicates results above EQL.
c. J = estimated value

The OU 1111 RFI Work Plan (LANL 1993, pp. 5-30 to 5-33, ER ID 26068) cites a report on sampling conducted in the TA-22 marsh area. In 1989, three composited surface soil samples (0–1 ft) and five composited subsurface soil samples (1–5 ft) were collected from the marsh. Maximum copper concentrations ranged from 66.2 mg/kg in the surface soil to 84.2 mg/kg in the subsurface soil (Table 3.2-3). Chromium was detected at a maximum concentration of 69.9 mg/kg in one subsurface sample. The subsurface samples were also analyzed for VOCs (Table 3.2-4).

Table 3.2-3

1989 TA-22 Marsh Metals Results

Sample Number	Medium	Depth (ft)	Metals (mg/kg)												
			Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Copper	Lead	Nickel	Selenium	Silver	Thallium	Zinc
LA85601	Subsurface soil	1–5	ND[a]	ND	124	1.3	ND	69.9	50.1	ND	27	ND	ND	ND	27.5
LA85602	Subsurface soil	1–5	ND	ND	151	1.2	4.8	19.9	84.2	ND	ND	ND	ND	ND	34.4
LA85603	Subsurface soil	1–5	ND	ND	132	1.1	3.8	ND	78.7	ND	ND	ND	ND	ND	25.6
LA85604	Subsurface soil	1–5	ND	ND	115	0.99	2.8	ND	45.7	ND	ND	ND	ND	ND	25.6
LA85605	Subsurface soil	1–5	ND	ND	114	ND	ND	43	47.2	ND	20.4	ND	ND	ND	23.8
LA81501	Soil	0–1	ND	ND	151	ND	ND	11.5	66.2	ND	ND	ND	ND	ND	35.5
LA81502	Soil	0–1	ND	ND	141	ND	ND	9	43.2	ND	ND	ND	ND	ND	30.3
LA81503	Soil	0–1	ND	ND	176	ND	3.3	13	ND	ND	ND	ND	ND	ND	39.8

a. ND= not detected (detection limits not available)

Table 3.2-4
1989 TA-22 Marsh VOCs Results

Sample Number	Medium	Depth (ft)	VOCs (mg/kg)			
			Acetone	1,1,1-Trichloroethane	Toluene	Ethyl benzene
LA85601	Subsurface soil	1–5	0.054	ND[a]	0.004	0.019
LA85602	Subsurface soil	1–5	ND	ND	ND	ND
LA85603	Subsurface soil	1–5	0.032	0.003	0.008	ND
LA85604	Subsurface soil	1–5	ND	ND	ND	ND
LA85605	Subsurface soil	1–5	ND	0.002	ND	ND
LA81501	Soil	0–1	NA[b]	NA	NA	NA
LA81502	Soil	0–1	NA	NA	NA	NA
LA81503	Soil	0–1	NA	NA	NA	NA

a. ND = not detected
b. NA = not applicable

Additional surface sampling of these surface sediments in the downstream marsh area was conducted as part of a separate RFI investigation, RFI Report for Potential Release Sites at TA-6, -8, -22, -40 (LANL 1997, pp. 175-183, ER ID 56664). Of the six surface samples collected, only one metal (copper) was observed above background values in a single sample at 23.8 mg/kg. Lastly, two surface water runoff samples were collected from the Southeast Fork of Two-Mile Canyon: one on August 2, 1994, and one on July 25, 1995, at location 22-1202 (Figure 3.1-2). These unfiltered water samples had a maximum copper concentration of 0.0367 mg/L.

3.2.2 Conceptual Model

The conceptual model for this unit is based on the following scenario:

- The seepage pits were designed to receive effluent and allow the waste to percolate into the surrounding tuff matrix.
- The system failed because the effluent production rate exceeded the infiltration rate of liquid into the tuff.
- This resulted in an overflow of effluent from the pits to the soil surrounding the pit.

The seepage pits and surrounding soils are the sources of possible contaminants. Site investigations were designed to assess the presence of environmental releases from normal operations or spills during the operational history. The nature and extent of contamination is discussed in subsection 3.2.2.1, and fate and transport is discussed in subsection 3.2.2.2

Previous sampling results indicate that the surface soil immediately adjacent to the seepage pits was affected the most by the overflow of the plating and etching operations waste water, with a lesser amount of contaminants being retained in the pits themselves. Particulate material in the waste water apparently accumulated on the bottom and walls of the seepage pits and significantly reduced the infiltration of the waste water into the surrounding subsurface soil and tuff. This resulted in the overflow of waste water from the top of the pits to the surrounding soil.

Because the seepage pits were designed to allow solids to settle out, the constituents most likely to have been carried to the surrounding soils are those that are soluble in water, those that are lighter than water, or fine particulates that could have been entrained in the water flow. Thus, soluble metal salts and solvents that are lighter than water or soluble in water are the constituents most likely to have been carried into the adjacent soil. Fine particulates may have been carried to the outflow areas. Solvents are expected to have evaporated from surface areas. Cyanides oxidize under atmospheric conditions and now are absent even if they had been deposited at one time. Discharge from the seepage pits will run downhill along the path of least resistance and will pond in depressions. Contaminants may be present anywhere along the drainage but would be most concentrated in sediment accumulations or in ponding areas.

The system drains into the Southeast Fork of Two-Mile Canyon. Transport mechanisms include overland flow and associated sediment transport, infiltration, percolation, wind erosion, and uptake by plants. Receptors include plants, animals, and humans. The plants and animals are potential ecological receptors. Exposure routes to receptors include direct skin contact with contaminated soils or sediments, ingestion, and inhalation when a contaminated area is disturbed. Herbivores living on-site may be exposed by eating plants that grow in contaminated soils or drinking water from the marshy area. On the basis of the the previous investigations, sources of contaminants are expected to be small or nonexistent. Therefore, potential public health and environmental affects are expected to be extremely limited.

3.2.2.1 Nature and Extent of Contamination

The extent of contamination appears to be confined to the immediate area around and within the seepage pits. The nature of contamination is copper contamination in and around the seepage pits.

Low levels of acetone were also found within the seepage pits. The nature and extent of contamination at the drainline is unknown. As discussed in Section 3.2.1.2, copper, chromium, and other metals were reported in samples collected from the TA-22 marsh area as part of the non-RFI, 1989 sampling event. Also, as previously discussed in Section 3.2.1.2, RFI sampling was conducted in 1994 at the marsh area as part of a separate RFI investigation. That sampling event reported copper in one sample above LANL background values. All other metals were at concentrations below background values. In addition to PRS 22-015(a), this marsh area receives, or potentially receives, runoff from other PRSs, including the 22-014(a) sump, the 22-014(b) sump and outfall, the 22-010 septic tank, and various TA-6 PRSs (Figure 3.2-2). PRSs 22-010 and 22-014(a,b) were recommended for NFA in a previous RFI report submitted to the NMED (LANL 1997, 56664). The TA-6 PRSs were recommended for NFA in a separate RFI report (LANL 1998, 62227). Therefore the nature, extent and source(s) of contamination at the marsh area is unknown and is outside of the scope of this sampling and analysis plan. The marsh area will be characterized in a future sampling and analysis plan for the Two-Mile Canyon watershed aggregate.

3.2.2.2 Fate and Transport

Small quantities of waste water may have flowed downstream from the seepage pits to the drainage channel and marsh area of the Southeast Fork of Two-Mile Canyon. At pH values and oxygen pressures that usually prevail in most soils, the predominate form of copper is a divalent cation. Mobility and displacement of copper in soils is low. It is strongly bound by organic compounds and clays. Even adsorption on pure quartz has been described. As a result of this bonding, downward movement of copper in silty or clayey soils is almost nil (Bolt and Bruggenwert 1978, 62797). The previous sampling found the greatest concentration of copper within surface soil adjacent to the pits, with decreasing concentrations downgradient from the pits.

3.2.2.3 Data Gaps

Copper was found at concentrations above background levels at the two deepest sampled intervals of the borehole (22-6065) drilled into Pit B; thus, the vertical extent of copper is unknown. In addition, acetone was detected at a low concentration in the deepest sampled interval of Seepage Pit A, and the vertical extent of acetone is unknown. The drainline running from building TA-22-91 to the seepage pits was not sampled. Prior sampling campaigns did not attempt to sample the drainline due to the presence of underground utilities between the pits and the buildings. Therefore, it is not known if waste water was released to the soil through possible breaches in the line upgradient from the seepage pits.

The 1989 TA-22 marsh area sampling reported metals concentrations in surface and subsurface samples above LANL background values. The vertical and horizontal extent of contaminants within the marsh area is unknown. At the time of the writing of this plan, the ER Project is in the process of aggregating PRSs. Therefore, characterization of the marsh area will be included in a future sampling and analysis plan for Two-Mile Canyon watershed aggregate.

3.2.3 Sampling Activities

Sampling activities will include soil and tuff media characterization as discussed in subsection 3.2.3.2. Samples to be collected are shown in Table 3.2-5. Figure 3.2-3 shows the locations from which the samples are planned be collected.

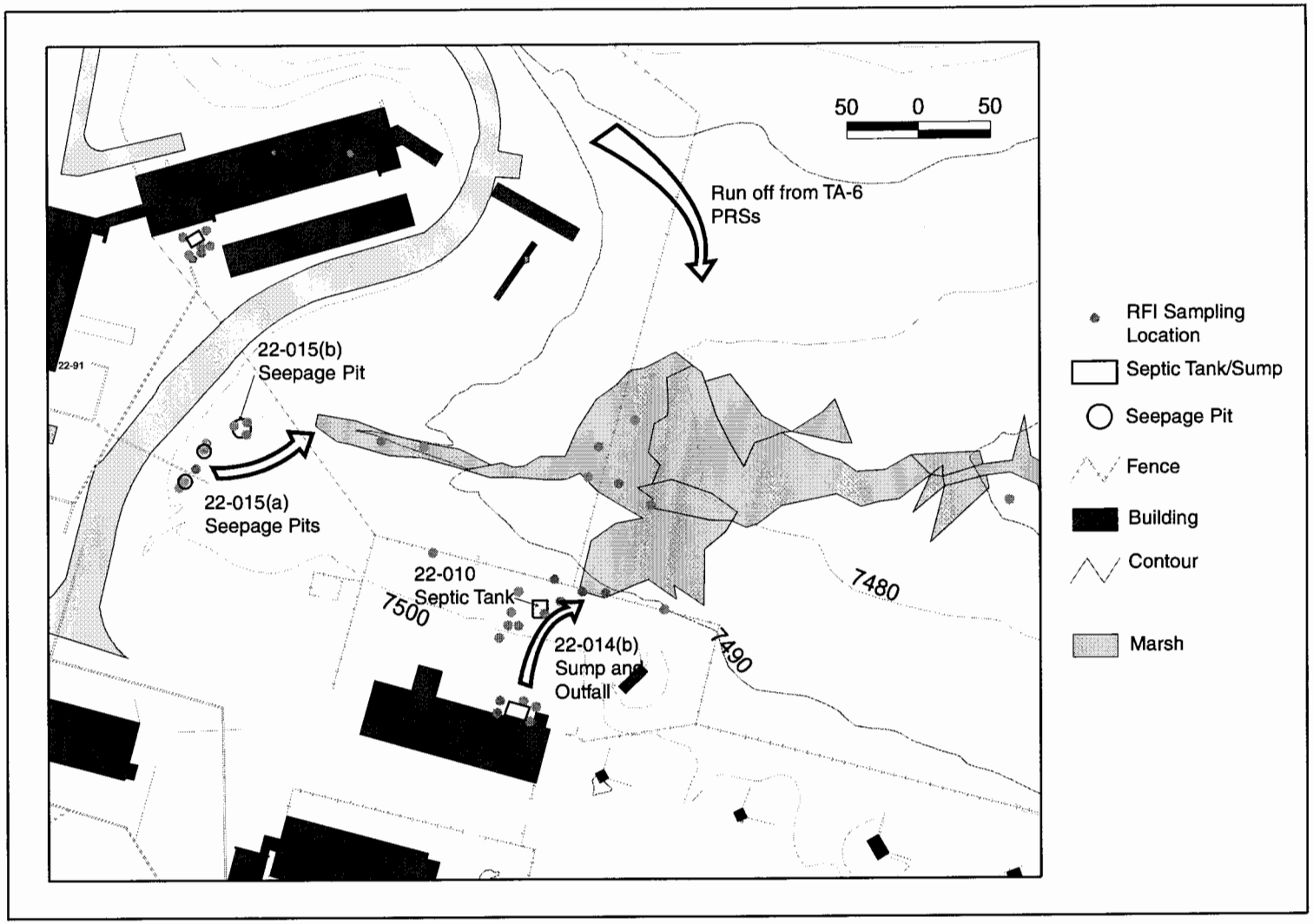

Figure 3.2-2. Marsh area PRSs.

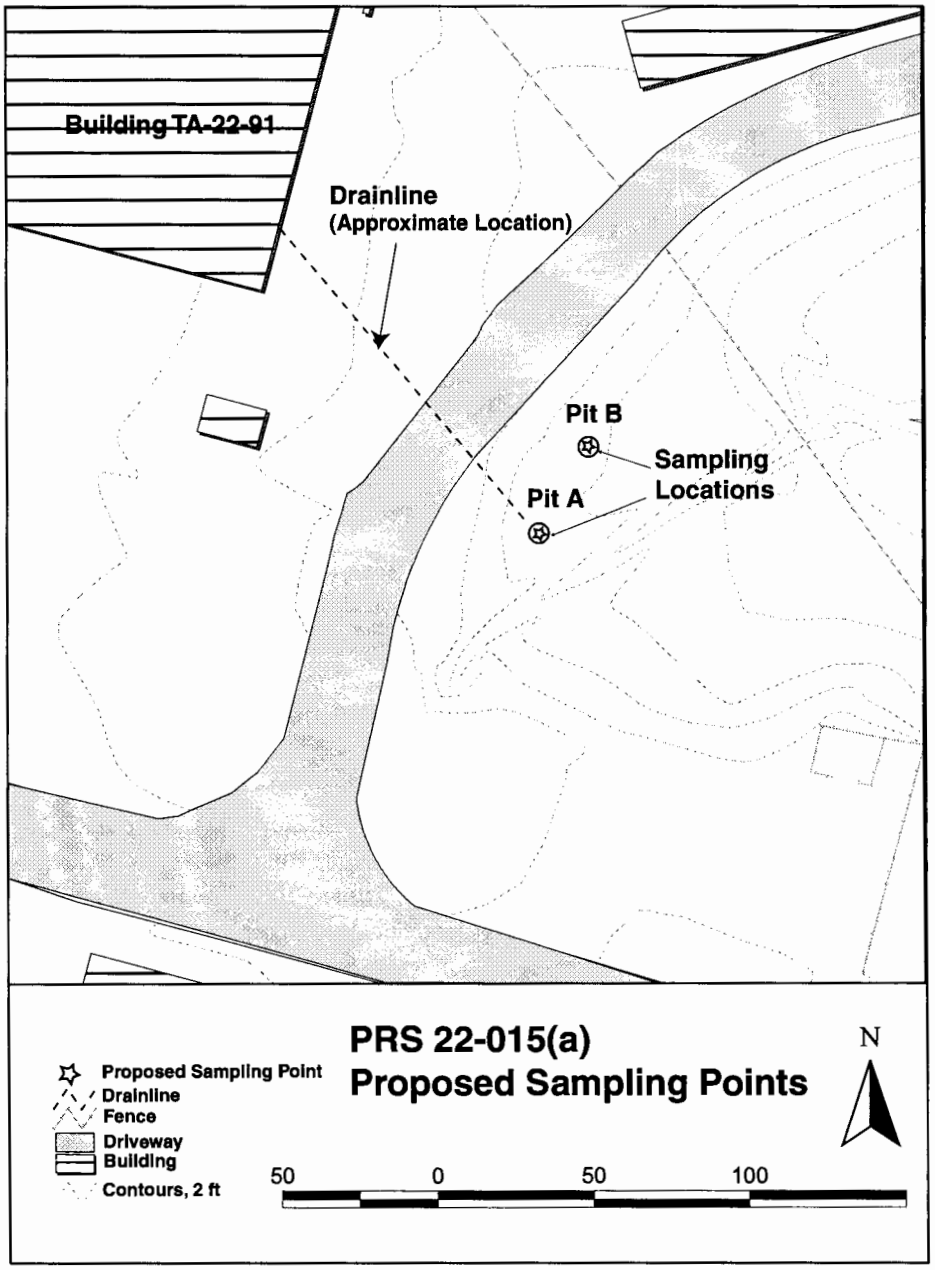

Figure 3.2-3. Proposed Sampling Locations for PRS 22-015(a).

Table 3.2-5
Samples to be Collected for PRS 22-015(a)

Sample Type	Number of Samples	Analytical Suite	Analytical Method	Matrix	Planned Depth(ft)
Seepage pit A	2	copper	SW-846 Method 6010	Soil	35–36, 40-41
Seepage pit A	2	VOCs	SW-846 Method 8260	Soil	35–36, 40-41
Seepage pit B	2	copper	SW-846 Method 6010	Soil	30–31, 35–36
Seepage pit B	2	VOCs	SW-846 Method 8260	Soil	30–31, 35–36
Drainline soil	4	copper	SW-846 Method 6010	Soil	3–4, 6–7
Drainline soil	4	VOCs	SW-846 Method 8260	Soil	3–4, 6–7

3.2.3.1 Contaminant Source

No contaminant source sampling is planned.

3.2.3.2 Media Characterization

The vertical extent of contamination at the seepage pits will be determined by the drilling of boreholes at Seepage Pits A and B. The anticipated depth of drilling at Pit A is 40 ft, and samples will be collected at the 35 and 40-ft depth intervals for copper and VOCs. The anticipated depth of drilling at Pit B is 35 ft, and samples will be collected at the 30 and 35-ft depth intervals for copper and acetone. These planned sampling depths may be increased based on field-screening results. X-ray fluorescence (XRF) field and organic vapor photoionization detector (PID) screening will be used to provide additional information to the sampling team about vertical extent of copper and VOC contamination; depending on the screening results, the depth of sample collection may be increased. The minimum detection limits of most XRF units, however, are above the LANL soil and tuff background values for copper. Nevertheless, XRF field screening can provide real-time copper data on the collected core samples. If the XRF field results for copper on samples from the planned sampling depths are above the XRF detection limit (approximately 60 mg/Kg), drilling will be continued in 5-ft increments. Sampling will be conducted at the depth interval in each borehole where copper-screening results are below the XRF detection limits. Likewise, any VOCs detected by the PID will result in an increase in the drilling and sampling depth. A qualified geologist will log the boreholes. The NMED raised an issue on the possible presence of a welded platy fracture zone at the seepage pits (see the Attachment to this plan). The geologist will evaluate the collected cores and document the presence of such fracture zones or other geologic features. All collected samples will be analyzed for copper and VOCs at a fixed, analytical laboratory.

The drainline for this PRS, unlike the other PRSs discussed in this plan, is constructed of polyvinyl chloride (PVC). If the drainline has never been broken or damaged, then there should not have been any releases of waste water except, as by design, to the seepage pits. An attempt will be made to assess the condition of the drainline with a pipeline camera. The interior of the drainline will be videotaped by the pipeline

camera. The lineal distance travelled by the camera along the drainline is measured and recorded on the video tape. The locations of any breaks or holes in the drainline detected by the camera will be marked on the ground surface. A maximum of three locations with drainline breaks will be selected for further investigation by drilling. Samples will be collected from immediately below the drainline and from a planned depth of 5 ft below the drainline.

As with the seepage pit sampling, XRF screening for copper and PID screening for organic vapors will be conducted on the deeper intervals to determine the vertical extent of contamination. Detection of copper above the XRF detection limits or organic vapors will require the sampling team to drill deeper in 5-ft depth increments until the field-screening results are below detection limits. Samples will be collected at this depth interval, as well as from the interval immediately below the drainline, and submitted to a fixed laboratory for copper and VOC analysis.

If the pipeline camera cannot be used to assess the condition of the drainline, then the drainline will be excavated, beginning at the seepage pits and continuing back to Building TA-22-91. The drainline condition will be assessed as it is excavated. The location of any breaks or holes in the drainline (not caused by the excavating equipment) will be marked for possible sample collection. In addition, any locations with reddish-brown staining (characteristic of plating wastes) will be marked for possible soil sampling. The sampling team will select three of these marked locations for sample collection at depth intervals immediately below and at a planned depth of 5 ft below the drainline. Again, the 5-ft depth may be increased based on XRF and/or PID screening data. If no breaks or holes in the excavated drainline are found, and if no staining of soil is observed, then the sampling team will field screen with an XRF unit and a PID at every 10 ft along the drainline, and they will select three locations for sampling based on the highest XRF copper and/or PID measurements.

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4.0 PRS 22-015(b), SUMP

4.1 Characterization and Setting

4.1.1 Site Description

PRS 22-015(b) is an inactive explosives sump and outfall area located on Two-Mile Mesa at the far east end of TA-22 and north of the main TA-22 access road (Figure 1.0-3). The sump is constructed of concrete and aluminum with dimensions of 4.5 ft wide by 6 ft long by 3.5 ft deep. It is adjacent to the northeast corner of Building TA-22-25. Building TA-22-25 is a small structure (159 ft^2) previously used for the recrystallization of PETN. Asphalt pavement extends from the sump perimeter approximately 7 ft to the north and to the east and 30 ft south to the TA-22 access road. An outfall line from the sump extends under the asphalt pavement, under a security fence, to an open area approximately 50 ft to the north (Figures 4.1-1 and 4.1-2). There is no seepage pit associated with this sump and outfall line. PRS 22-015(b) is a SWMU listed in Module VIII of the Laboratory's Hazardous Waste Facility Permit.

PRS 22-015(b) is located south of the Southeast Fork of Two-Mile Canyon, an intermittent drainage channel that runs eastward from TA-22 through TA-40 and then intersects with the main Two-Mile Canyon at a distance of approximately 8500 ft. This PRS is situated on a mesa-top setting. Surface soil identified for the site is Carjo Loam (Nyhan et al., 1978, 5702).

This PRS has a Surface Water Site Assessment, SOP 2.01, score of 8.8, a vegetative cover of 25–75%, and no debris in a watercourse. An SWSA score of less than 40 indicates a low erosion potential. Scores of 40 to 60 indicate a medium potential and 60 to a maximum of 100 indicate a high erosion potential.

4.1.2 Operational History

PRS 22-015(b) includes an inactive explosives sump, approximately 50 ft of drainline, and an associated outfall area (Figure 4.1-1). The sump, located on the east side of Building TA-22-25, received mixtures of PETN and acetone from a PETN recrystallization process. It was used from 1949 to the 1960s when it was abandoned in place. The drainline to the outfall area is still in place. According to the work plan, the maximum amount of HE that may have been processed through the drainlines is approximately 1 lb. (Meyers 1993, ER ID 15072) The volume of acetone and ethanol that may have passed through the lines is unknown.

4.1.3 Waste Characteristics

This section addresses the potential contaminants that may be present at this PRS based on the information contained in subsection 4.1.1, site description, and subsection 4.1.2, operational history. This information is potentially relevant to waste only to the extent that solid waste, as that term is defined under RCRA, is subsequently generated at this PRS. This discussion of potential contaminants in no way implies that the materials present at this PRS are solid waste or hazardous waste as those terms are defined under the NMSA, the NMAC, RCRA, HSWA, SWDA, or other statutes or regulations.

The potential contaminants from the PETN recrystallization processes discharged to the sump and outfall area include PETN, acetone, and ethanol.

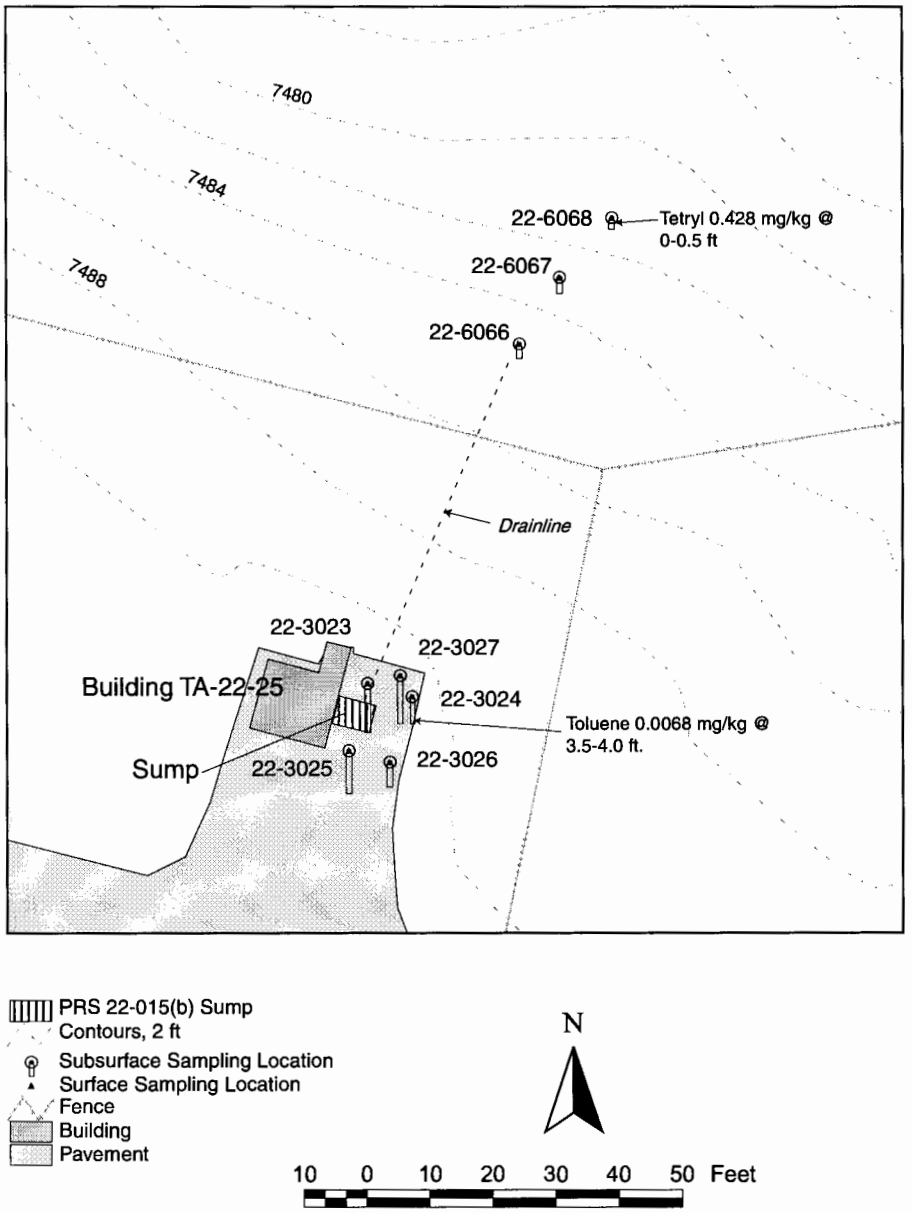

Figure 4.1-1. PRS 22-015(b) Sump, Drainline, Outfall Area, and previous RFI sampling locations.

Figure 4.1-2. Photographs of PRS 22-015(b). Upper photo: Building TA-22-25 and Sump. Lower photo: Outfall area. (View of both photos to the south).

4.2 Investigatory Approach

4.2.1 Existing Data

4.2.1.1 Nonsampling

No previous nonsampling investigations were conducted at this PRS.

4.2.1.2 Sampling

Two sampling investigations were performed at PRS 22-015(b). The first field sampling was conducted between June 22 and July 11, 1994. Soils surrounding the sump and the point of connection between the sump and drainline were characterized. One borehole was hand-augered at each corner of the sump, and an additional borehole was drilled at the connection of the sump and drain line to assess the potential for leakage. Samples were collected from each boring at the surface (0–0.5 ft), at the level of the bottom of the sump (3.5 ft), and at 3 ft below the bottom of the sump (6.5 ft). These samples were submitted for laboratory analysis of VOCs and HE. All VOC samples were lost by the analytical laboratory, PETN (the HE compound associated with the operation) had inadvertently been overlooked as an analyte in the requested suite of HE for analysis, and the effluent outfall area was not addressed. The results of these analyses indicate no HE above EQL in any sample. All VOC samples were lost and not analyzed.

A second sampling event, conducted between April 21 and April 24, 1997, was performed to fully characterize the sump and outfall area and to eliminate data gaps created by the lost VOC and missing PETN analyses. Two boreholes were drilled at the northeast corner (22-3024) and outfall pipe area (22-3027) of the sump. These borings were to be sampled at the surface, bottom of the sump, and 3 ft below the bottom of the sump, as in the previous investigation. However, a deviation to this plan was required when concrete was encountered at a depth of 4 ft at the northeast corner of the sump; therefore, the deepest sample from that boring was recovered from the 3.5- to 4.0-ft interval. The outfall area was field screened, first for VOCs and then for HE, to determine the best locations for boreholes. All field screening was negative, and the sampling team then sampled the outfall drainage by locating one borehole at the drain pipe outfall and two at 12.5- and 25-ft intervals downgradient from the outfall. These boreholes were located in sediment depositional areas, and all borings were sampled at the surface and soil/tuff interface.

Field sampling locations for both sampling events are identified in Figure 4.1-1.

The sump contents were sampled twice: once in June, 1994, and again in September, 1994. The samples taken in June were submitted for HE analysis and, although holding times were exceeded, the results are usable (Request No. 17801). The HE compound, 2,4,6,-trinitrotoluene was reported in one sample at 0.38 µg/L. The samples taken in September were analyzed for VOCs were found to contain acetone and chloroethane were reported at low levels: 0.028 and 0.025 mg/L, respectively.

Detected organic chemicals at PRS 22-015(b) are presented in Table 4.2-1. Toluene was detected in sample 0522-97-0023 at 0.0068 mg/kg. Otherwise, no volatile target analytes were detected in any of the soil samples. Tetryl, reported at 0.428 mg/kg in one surface soil sample, was the only HE target analyte detected

Table 4.2-1

Detected Organic Chemicals for PRS 22-015(b)

Location ID	Sample ID	Depth (ft)	Toluene (mg/kg)	Tetryl (mg/kg)
SAL	NA[a]	NA	520	550
EQL	NA	NA	0.005	0.65
22-3024	0522-97-0023	3.5–4.0	**0.0068**[b]	0.098 (U)
22-6068	0522-97-0028	0–0.5	0.006 (U)	0.428

a. NA = not applicable

b. Bold values indicate results above EQL.

It should be noted that in the TA-22 RFI report (LANL 1997, 56749) Table 5.3.7-1 incorrectly included toluene as a detected organic analyte for samples 0522-97-0028 and 0522-97-0029. The data packages were reviewed and it was confirmed that only one sample (0522-97-0023) was reported to have toluene, albeit at a concentration slightly above the EQL.

4.2.2 Conceptual Model

The conceptual model for this unit includes the assumption that levels of contamination are likely to be low because of the limited amount of hazardous materials used in the operation. The model is based on the following scenario:

- Small bench-scale batches of PETN dissolved in acetone (1.5 to 3 liters) were mixed with water to precipitate out purified PETN. The PETN crystals were washed with water. The acetone water mixture and small amounts of PETN were discharged to the sump.

- Suspended PETN particles settled out in the sump.

- Supernatant from the sump, with a reduced waste loading, was released through a drainline to a downgradient outfall area, where it contributed to evapotranspiration processes or percolated into the surrounding soil matrix.

- It would be expected that any HE released to the outfall area would be retained in the upper fraction of the surface soils. Acetone released to the outfall area would diffuse as vapors through the soil and volatilize from the surface or infiltrate with water into the outfall soils.

The sump, drainline, and outfall area are possible primary sources of contaminants. The outfall area is the most likely part of the system to contain contaminants because it received outflow from the sumps since their installation, whereas solids are removed periodically from the sumps, and the drainlines are subject to flushing by continued flow.

Because the sump is designed to allow solids to settle out, the constituents most likely to have been carried to the outflow areas are those that are soluble in water, those that are lighter than water, or fine particulates that could have been entrained in the water flow. Although the explosives used in operations at TA-22 are very insoluble in water, fine particulates may have been carried to the outflow areas. Solvents are expected to have been lost through biodegradation, volatilization from surface areas or diffusion into the surrounding geologic media. Explosives, being less volatile and water-soluble and being more resistent to biodegradation, can be expected to remain in place.

Discharge from the outfall drainline would have flowed into the subsurface soil at the outfall area. The outfall area is relatively level, with no defined drainage pathways. Any wastewater that may have surfaced would have ponded in shallow surface depressions at the outfall area.

The direction of overland flow drainage is into the Southeast Fork of Two-Mile Canyon. Transport mechanisms include overland flow and associated sediment transport, infiltration, percolation, wind erosion, and uptake by plants. Receptors include plants, animals, and humans. The plants and animals are potential ecological receptors. Exposure routes to receptors include direct skin contact with contaminated soils or sediments, ingestion, and inhalation when a contaminated area is disturbed. Herbivores living on-site may be exposed by eating plants that grow in contaminated soils. On the basis of the information currently available, sources of contaminants are expected to be small. Therefore, potential public health and environmental affects are expected to be extremely limited.

4.2.2.1 Nature and Extent of Contamination

The nature of the contamination, as determined by the previous sampling, in PRS 22-015(b) is low level HE and VOC contamination in soil. At the outfall area, three surface soil and three subsurface soil samples were collected. One HE compound, tetryl (N,2,4,6-tetranitro-N-methylaniline), was detected at one surface sample interval (sample 0522-97-0028 at location 22-6068) at the outfall area at a concentration of 0.428 mg/kg (Figure 4.1-1). No other HE compounds(including PETN) were detected in the soil samples. The extent of the HE contamination (tetryl), based on current knowledge, is confined to surface soil at the outfall area. No tetryl was detected at the next sampled interval (0.7 to 1.3 ft) at the same sampling location (22-6068). No tetryl was detected in the remaining 25 surface and subsurface samples collected from around the sump and outfall area. The proposed field screening and sampling will determine the horizontal extent of contamination at the outfall area. The nature of VOC contamination is that one VOC compound, toluene, was detected at a very low concentration of 0.0068 mg/kg at one subsurface interval (sample 0522-97-23 at location 22-3024). No other VOC compounds (including acetone) were detected in the soil samples. The extent of VOC contamination, again based on current, knowledge, is confined to an area near the northeast corner of the sump and near the end of the Building TA-22-25 asphalt parking area. The nature and extent of contamination for the drainline is unknown. The proposed sampling will determine the nature and extent of contamination for the area around and under the drainline from the sump to the outfall area.

4.2.2.2 Fate and Transport

Solvents (particularly acetone) released to the surface from possible overflowing of the sump would have quickly volatilized. HE compounds released to the surface could have remained as a residue on

the asphalt, infiltrated through cracks or seams in the asphalt into the subsurface, and/or been transported off the asphalt to uncovered soil north of Building TA-22-25. Contaminants released to the subsurface around the sump would most likely have remained near these structures because the asphalt pavement restricts the potential driving force of rainfall infiltration. The concentrations of any released solvents in the subsurface will decrease over time due to biodegradation and or diffusion. Reduction of HE concentrations by biodegradation would be minimal, so the HE would remain in the subsurface soil.

4.2.2.3 Data Gaps

A low concentration (0.428 mg/kg) of one HE compound, tetryl, was detected at the furthest downgradient sampling location in the outfall area. Therefore, the horizontal extent of contamination was not determined. The drainline running from building TA-22-25 to the outfall area was not sampled during prior sampling events. Therefore, it is not known if waste water was released to the soil through possible breaches in the line between the outfall area and the sump.

4.2.3 Sampling Activities

Sampling activities will include soil and tuff media characterization as discussed in subsection 4.2.3.2. Samples to be collected are shown in Table 4.2-2. Figure 4.2-1 shows the locations from which the samples are planned to be collected.

Table 4.2-2
Samples to be Collected for PRS 22-015(a)

Sample Type	Number of Samples	Analytical Suite	Analytical Method	Matrix	Planned Depth(ft)
Outfall surface soil	2	HE	SW-846 Method 8330	Soil/Tuff	0–0.5, 3–4
Outfall surface soil	2	VOCs	SW-846 Method 8260	Soil/Tuff	0–0.5, 3–4
Drainline soil	4	HE	SW-846 Method 8330	Soil/Tuff	3–4, 6–7
Drainline soil	4	VOCs	SW-846 Method 8260	Soil/Tuff	3–4, 6–7

4.2.3.1 Contaminant Source

No contaminant source sampling is planned.

4.2.3.2 Media Characterization

One sampling location will be used to complete the determination of nature and extent of contamination at PRS 22-015 (b) out fall area. Soil samples from the surface and from the underlying tuff (estimated to be at a depth of 3 ft) will be collected at a location 6 ft downgradient from location ID 22-6068. They will be analyzed for HE and VOCs. The sampling location will be selected by field screening at least three points: 6 ft northeast, 6 ft northwest, and 6 ft southeast from 22-6068 (Figure 4.2-1).

If the field-screening results are all negative for HE (which is the expected scenario), then one of the three points will be randomly selected for sample collection. If, however, positive HE results are obtained with the HE field screening, then the field team will continue to screen surface soil at points determined appropriate and/or downgradient from the outfall area, continuing if necessary, to the drainage channel of the

Southeast Fork of Two-Mile Canyon. The sampling plan will then be modified to include additional soil sampling, with fixed laboratory analysis to adequately bound the horizontal and vertical extent of HE contamination. In order to penetrate the underlying tuff, the samples will be collected using a hollow-stem auger drill rig.

The drainline from the sump to the outfall area will be excavated and removed for disposal. The drainline pipe is believed to be of similar construction to the PRS 22-015(d) drainline (i.e., vitrified clay pipe). The length of the individual drainline sections is also unknown, but the sections of the exposed PRS 22-015(d) drainline pipe, previously discussed in subsection 2.1.1, were 30 in. long. As the drainline is excavated, soil from below the drainline will be field screened for HE and volatile organic vapors. This will begin at the sump-outlet and be done at every fourth drainline section joint to the end of the pipeline. Screening will also be conducted on soil from any areas below the drainline that appears to be stained or where there are obvious breaches in the line. Soil will be field screened at such sites immediately below the line.

The field team will select two locations with the highest HE spot test kit results. The field team will attempt to determine the vertical extent of potential HE and VOC contamination through the use of field methods (HE spot test kits and/or other HE field-test methods, photoionization detectors). Soil sampling will be conducted at approximately 1 ft below the suspected depth of furthest contamination. Samples will be analyzed for HE (including PETN) and for VOCs at off-site, fixed analytical laboratory. It is anticipated that four soil samples will be collected; however, actual sampling locations will be determined by the Sampling Field Team Leader.

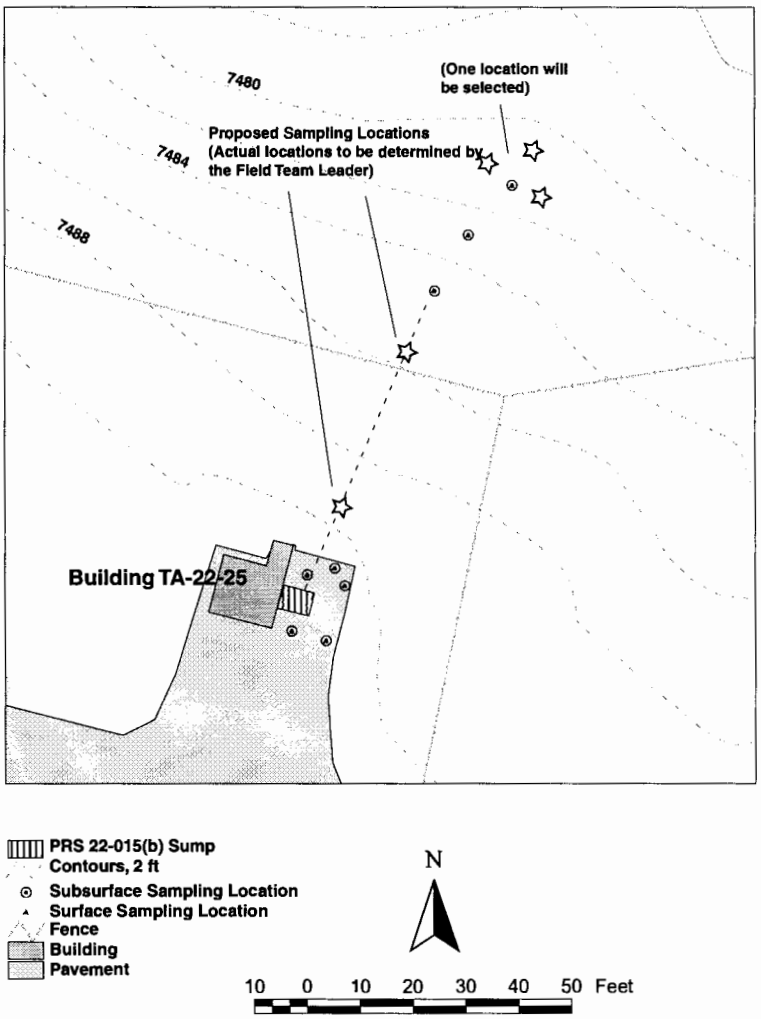

Figure 4.2-1. Proposed Sampling Locations for PRS 22-015(b) Sump and Drainline.

5.0 DATA COLLECTION DESIGN AND PROCEDURES

5.1 Data Quality Objectives

Previous investigations have determined that HE compounds, VOCs, and copper are present in the soil and tuff around sump, seepage pit, and outfall area disposal units; however, the complete nature and/or extent of the contamination is not known for these units. Limited or no previous characterization was conducted for the soil and tuff around drainlines connecting the disposal units. The New Mexico Environment Department rejected a previously submitted RFI Report (LANL 1997, 56749) for failing to determine the nature and extent of contamination.

The problem to be addressed by this sampling and analysis plan is that the determination of nature and/ or extent of contamination for these units is not complete. The previous investigations provided approximate boundaries of the extent of contamination. The objective of this sampling and analysis plan is to collect data to complete the nature and extent of HE, VOC and/or copper contamination and to address the concerns raised in the NMED rejection notice. It is expected that the boundaries of contamination at these PRSs are within 10 feet horizontally of the sumps, drainlines, seepage pits, outfall area units and not greater than 5-15 feet below the bottom of the units. The boundaries will be extended, if needed, based on the results of the field sampling efforts. A marsh area discussed in Section 3.0, is at a greater distance than 10 feet away from the PRS 22-015(a) seepage pits. The marsh area will be addressed in a larger scale separate RFI investigation to be completed by the ER Canyons Focus Area. Once nature and extent have been adequately defined, these data, along with the previously collected data will be used to evaluate human health and ecological risks presented by the contamination and to decide whether or not further action is needed for these PRSs.

The bias and precision of fixed-site laboratory analyses for inorganic and organic chemicals will be assessed using the standard quality control (QC) procedures described in the EPA SW-846 methods. The ER Project analytical services statement of work contains the LANL-specific acceptance criteria for these QC procedures

5.2 Quality Assurance/Quality Control

QA samples are collected to assess the quality of sampling and measurement techniques and may also be used to support future decisions about specific samples and PRSs at TA-22. Field QA samples will be collected at a minimum rate of 1 per 10 (10%). All QA/QC activities associated with field measurements and surveys will be carried out as specified in the applicable SOP.

5.3 Field Activities

Land Surveys

Sample collection points will be staked, documented, and surveyed using land surveying methods. The location of drain line pipes will be surveyed as the lines are excavated. The data will be recorded on a base

map. The surveying will be performed in accordance LANL-ER SOP-3.01, R1. Each sample location will be marked or permanently monumented (where possible), photographed, and assigned a unique ER Project sample location identification number.

Screening

The soil samples will be screened for HE in the field using the HE spot test kit with modified Griess reagents (LANL-ER-SOP-10.06, R1, "High Explosives Spot Test"). Samples will be screened for TNT and RDX using the D-Tech immunoassays HE field screening kit, following LANL-ER-SOPs-10.12, R0 and 10.13, R0, respectively. X-Ray fluorescence screening of soils will follow LANL-ER-SOP-10.08, R0.

Sampling

The Spade and Scoop Method (LANL-ER-SOP 6.09, R0) will be used for the collection of surface soils for inorganic and HE analyses. The Core Barrel Sampling for Subsurface Earthen Materials (LANL-ER-SOP 6.26, R0) will be used for the collection of subsurface soils. EPA sampling method SW-846 5035 will be followed for the collection of soils for VOC analysis. En Core™ samplers will be used for sampling of unconsolidated soils for VOC analysis. For subsurface consolidated soils, sleeves will be used in the core barrel samplers for VOC analyses. Samples for VOC analysis will be frozen at the LANL Sample Management Office prior to shipment to the analytical laboratories.

Trenching will be used to expose grab sample points associated with buried drainlines. Samples for VOC analysis will be collected using the appropriate method as determined by the FTL, with consideration given to the size and stability of the trench and H&S concerns. If the depth of the excavated trench is shallow and all safety considerations can be met, a hollow stem auger drill rig will be used to collect the subsurface samples below the drainline. Otherwise (because of safety concerns and the dimensions of the trench) extension handles will be used with standard hand-auger and thin-wall tube samplers to collect the VOC samples directly from the bottom of the trench. If safety concerns or the presence of consolidated geologic materials do not allow sampling by hand methods, samples may be collected from a backhoe bucket or similar excavation equipment using conventional methods. Regardless of the method used, the FTL will ensure the integrity of the samples and will document the sampling method in the Daily Activity Log.

All samples will be collected in accordance with the applicable ER Project SOPs (LANL 1991, 51575) for the collection, preservation, identification, storage, transport, and documentation of environmental samples, as described in the ER Project QAPP (LANL 1996, 55298). All samples will be identified in accordance with LANL-ER-SOP-01.04, "Sample Control and Field Documentation." Chain-of-custody requirements described in LANL-ER-SOP-01.04 will be implemented. The ER project's Field Support Facility (FSF) will be consulted regarding the appropriate sample containers and preservation. Samples will be packaged and shipped in accordance with LANL-ER-SOP-01.03, "Handling, Packaging and Shipping of Samples." All samples will be shipped from the FSF to off-site laboratories for analysis.

Soil and borehole core samples collected will undergo full-suite analyses for VOCs, HE compounds and copper. All analyses will be performed at ER Project–approved fixed-site laboratories. The analytical methods for analysis of VOCs, HE and copper are Method 8260, 8330 and 6010, respectively. All analyses for organic chemicals will be performed according to EPA SW-846 protocols (EPA 1986, 56034). The

detailed analyte lists, estimated quantitation limits (EQLs), required QC procedures, and the acceptance criteria are found in the ER Project analytical services statement of work (LANL 1995, 49738). Analysis for copper will be performed according to EPA SW-846 protocols using mineral acid sample extraction procedures for the ICPES technique.

Data Verification and Validation

Data generated by the analytical laboratories will undergo the verification and baseline validation procedures described in Sections D1 and D2 of the ER Project QAPP (LANL 1996, 55298). Field data will be reviewed for accuracy and completeness by the field team at the time of collection.

6.0 PROJECT MANAGEMENT

6.1 Project Scheduling and Reporting Requirements

The schedule for conducting the field work is pending the completion of a current baseline re-plan. It is anticipated that the work will be completed by personnel from the ER Remedial Actions Focus Area in the years 2003 or 2004. A report on the sampling results should be completed by the Remedial Actions Focus Area within 6 to 9 months after all the analytical data has been received and validated.

6.2 Health and Safety Plan

A site-specific Health and Safety Plan will be developed in accordance with The Environmental Restoration Project Site-Specific Health and Safety Plan (SSHASP), LANL EM/ER:95-PCT-012, April 13, 1995 (LANL 56448) and the site-specific waste characterization strategy forms.

6.3 Investigation-Derived Waste Plan

Investigation-derived waste, if any, will be handled in accordance with LANL-ER-SOP-1.06 (LANL 57367).

6.4 Community Relations Plan

Community Relations are governed by the Public Involvement Plan in Chapter 7 of 1996 IWP (LANL 1996, 57368).

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ATTACHMENT
Rejection of
RFI Report for Potential Release Sites 22-012, 22-015(a,b,d,e)

Basis for rejection:

1. LANL failed to include all sampling results for each PRS.

2. LANL failed to describe how the wetlands (Page 8, section 2.3.1 Surface Water) in Tributary B of Two-Mile Canyon and the potential impact to the Pajarito Canyon system will be addressed. LANL failed to include the wetlands as part of the RFI.

3. LANL failed to discuss the following:

   a). The location of these PRSs and their potential contamination occurring in relation to this zones of intensely welded platy fractures occurring at elevations between 7300 and 7480 (Page 7, Figure 2.2.1-1. Unit 4 of the Tshirege member, TA 22), and,

   b.) The location of these PRSs and the possible contamination occurring in relation to fault zone mentioned on page 6, section 2.2.1, paragraph 4.

4. LANL failed to describe whether or all subsurface samples were collected as discrete samples.

5. LANL failed to describe what is meant by " organic chemicals positively identified" (Page 14, section 3.2.3 Organic Chemicals).

6. LANL failed to describe what is meant by "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" (Page 14, section 3.2.4 Risk-Based Screening Assessment).

7. In the organic analysis for PRS 22-015(d), LANL failed to re-sample for samples 0522-97-0031 through -0035. These samples are unacceptable because of the acetone, which is one of the contaminants of potential concern (COPCs), found in the method blank.

8. The following items are regarding 22-015(a) the inactive seepage pits:

   a) The request #17835 quality control for high explosives (HE) indicated recoveries were out of control. The detected values may be 1/5 of expected values. LANL failed to resample for HE at this PRS.

   b) LANL failed to determine if there may have been cross contamination at the seepage pits.

   c) LANL failed to determine the horizontal and vertical extent of acetone associated with a Pit A.

   d) LANL failed to determine the horizontal extent of acetone associated with Pit B.

e) LANL failed to determine the nature and extent of contamination (especially copper and HE) occurring in the wetland.

f) LANL failed to locate the drain lines from the building to the seepage pits and sample for COPCs beneath the joints and breaches beneath these lines.

9. LANL failed to determine extent of contamination of all COPCs for 22-012, 22- 015(d,e).

10. Regarding 22-015(b), LANL failed to do the following:

a) Determine vertical and horizontal extent of toluene and HE depth at the sump.

b) Determine vertical and horizontal extent of toluene and HE in depth and vertically at the outfall area.

c) Determine vertical and horizontal extent of toluene and HE beneath the joints and breaches in the lines.

11. LANL failed to report on the status of the following " active" SMWUs originally in Aggregate 3 as described in the RFI Work Plan for Operable Unit 1111. Are they still active and permitted? If not LANL should submit a RFI Work Plan for their investigation (or a schedule for the work plan to be submitted). The wastes and processes are similar in these PRS's should be investigated concurrently.

22-014 (a) - Explosive sump serving TA-22-93, discharging to a seepage pit in the upper part of Tributary B (COPCs - explosives and unknown);

22-014 (b) - Active explosives and chemical waste line serving building TA-22-34 outfalling into Tributary B of Two-Mile Canyon directly into a cattail pond (COPCs - explosives, solvents, acids, and photographic chemicals); and

40-005- an active sump and outfall discharging into the Tributary B of Two-Mile Canyon (COPCs - explosives, alcohol and acetone).