CERTIFICATION

I certify under penalty of law that these documents and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violation.

Document Title: RFI Report for at TA-22, PRSs 22-012 and 22-015 (a,b,d,e) (Located in Former OU 1111)

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RFI Report for Potential Release Sites

22-012

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

(located in former
Operable Unit 1111)

Field Unit 5

Environmental Restoration Project

September 1997

A Department of Energy
Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

LA-UR-97-3340

EXECUTIVE SUMMARY

This Resource Conservation and Recovery Act (RCRA) facility investigation report describes the results of surface and shallow subsurface sampling at inactive potential release sites (PRSs) 22-012 and 22-015(a, b, d, e) at Technical Area (TA) 22, formerly known as Trap Door Site. All PRSs were associated with detonator development activities, generally involving the use of limited amounts of high explosives (HE) in small component assemblies. Large-scale production and testing, which consume great quantities of hazardous materials, did not occur at TA-22. Therefore, very little, if any, contamination was expected to be present at these sites.

The PRSs described in this report are

- 22-012, an HE wash pad; 22-015(d), a liquid waste disposal pit; and 22-015(e), a liquid waste sump. These PRSs made up the liquid waste treatment and disposal system for Building 22-1.
- 22-015(a), a liquid waste sewer line and two seepage pits receiving effluent from a printed circuit board etching process in Building 22-91.
- 22-015(b), an HE liquid waste sump and drain line for treating and disposing of effluent from Building 22-25.

The three aggregated PRSs that made up the HE liquid waste treatment system for Building 22-1 were in operation from the assembly of the Fat Man weapon in 1946 until the building was abandoned in 1984. This aggregate received effluent from an acetone-based pentaerythritol tetranitrate (PETN) recrystalization process. Seepage pits 22-015(a) were operated from 1985 until 1987 when effluent from the etching process was captured in tanks and transported for treatment. The liquid waste sump and drain line, 22-015(b), operated from 1949 until the 1960s, when Building 22-25 was abandoned.

Radioactive materials were not used in these PRSs, and except for field screening for alpha, beta, and gamma radiation (which yielded no activity above background), no assessment for radionuclides was conducted.

The objectives of the investigations were

- to determine whether media associated with the explosive sumps, wash pad, or seepage pits were contaminated from past operational releases, and
- if contamination was present, to determine if it represented an unacceptable human health risk based on the results of the human health screening assessment.

During the summer of 1994, surface and shallow subsurface samples were collected from these five PRSs. Data from the 1994 sampling activities was problematic; samples were lost, all sample holding times were exceeded for HE analyses, and the requested suite of HE analyses did not include PETN. To eliminate doubts about the 1994 data, a sampling and analysis plan was developed, and a second set of samples was collected in the spring of 1997. This second sampling event was planned and executed in a focused effort to eliminate uncertainties in the analytical data identified in the first sampling event and to characterize the potentially worst-case impacted site media, i.e., potentially, the most severely contaminated site media.

Chemicals at the PRSs included HE (particularly PETN), solvents, and metals; the investigation characterized the following:

- surface and subsurface soils associated with the sumps and wash pad,
- soils and sediments associated with the sump drain lines, and
- surface and subsurface soils and tuff associated with the seepage pits and residual seepage pit contents.

All data for both sampling events received baseline as well as focused validation and were useable to meet site characterization objectives.

PRSs 22-012, 22-015(d), and 22-015(e). In the PRS aggregate, PETN was detected at a level less than a screening action level (SAL) in the seepage pit contents. This represents a small volume of PETN-contaminated material located 10 ft below the ground surface. There is no indication of migration of any contamination away from the seepage pit and no viable exposure pathway to this material. Trace levels of a high-melting explosive (HMX) were reported in two surface soil samples associated with the sump and wash pad. There is no further indication of surface or subsurface contamination in the aggregate, and the risk-based screening assessment indicates no potential for health risk based on the aggregates total normalized multiple chemical evaluation (MCE) of 0.2. The aggregate is recommended for NFA.

PRS 22-015(a). Because waste from the etching process was pretreated, any contamination present was expected to be at extremely low levels. No HE compounds were expected or observed in any site samples. Trace organic contamination (acetone) was reported and assessed. Copper was the only metal reported above background. It was reported at low levels (substantially less than SAL) in surface soil samples and seepage pit content samples. Some migration of copper was also observed below one seepage pit. No substantial release was observed. The MCE performed for the PRS resulted in a total normalized value of 0.1, which indicates the site presents no potential for human health risk. The PRS is therefore recommended for NFA.

PRS 22-015(b). No PETN was reported in any site samples, and no reported chemical concentrations exceeded SAL. Trace levels of the organic solvent toluene were reported in a soil sample outside the sump. A trace level of tetryl, an HE not used at this PRS, was reported in one surface soil sample collected in the outfall area. The MCE performed for the PRS resulted in a total normalized value four orders of magnitude less than the threshold value of 1.0, which indicates the site presents no potential for human health risk. The PRS is therefore recommended for NFA.

Table ES-1 summarizes proposed actions for these PRSs.

TABLE ES-1
SUMMARY OF PROPOSED ACTIONS

PRS No.	HSWA[a, b]	Radionuclide Component	PROPOSED ACTION				
			NFA Criterion	**Further Action**	**Add to HSWA Module**	**Rationale**	**Section No.**
22-012, 22-015(d,e)	x	—	5	—	—	RCRA contamination is below SALs.	5.1.11
22-015(a)	x	—	5	—	—	RCRA contamination is below SALs.	5.2.11
22-015(b)	x	—	5	—	—	RCRA contamination is below SALs.	5.3.11

a. HSWA = Hazardous and Solid Waste Amendments

b. An X in this column indicates that the site is listed on the HSWA module of the Laboratory's hazardous waste facility permit.

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FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

COPC	Chemical of potential concern
DOE	Department of Energy
DX	Dynamic Experimentation (Division)
EDL	Estimated detection limits
EPA	Environmental Protection Agency
EQL	Estimated quantitation limits
ER	Environmental restoration
FIMAD	Facility for Information Management, Analysis, and Display
HE	High explosives
HMX	High melting explosive
HSWA	Hazardous and Solid Waste Amendments
IWP	Installation work plan
Laboratory	Los Alamos National Laboratory
LANL	Los Alamos National Laboratory
MCE	Multiple chemical evaluation
NFA	No further action
OU	Operable unit
PETN	Pentaerythritol tetranitrate
PRG	Preliminary remediation goals
PRS	Potential release site
QA	Quality assurance
QAPP	Quality assurance program plan
QC	Quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RPD	Relative percent difference
SAL	Screening action level
SMO	Sample Management Office
SOP	Standard operating procedure
SVOC	Semivolatile organic compound
TA	Technical area
TAL	Target analyte list
UTL	Upper tolerance limit
VOC	Volatile organic compound

1.0 INTRODUCTION

This report presents the results of the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) of five potential release sites (PRSs) in Technical Area (TA) 22 of the Los Alamos National Laboratory (Laboratory). This report includes site history, environmental setting, the approach to data analysis and assessment, quality assurance (QA)/quality control (QC) results, specific results, conclusions, and recommendations.

1.1 General Site History

TA-22, in former Operable Unit (OU) 1111, is part of the Laboratory's Environmental Restoration (ER) Project and is shown in Figure 1.1-1. The TA is located on the south side of Two-Mile Mesa in the northwestern portion of the Laboratory (Figure 1.1-2). 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 1.1-3) described in this report are

- 22-012, 22-015(d), and 22-015(e), inactive explosives sump aggregate;
- 22-015(b), inactive explosives sump; and
- 22-015(a), inactive seepage pits.

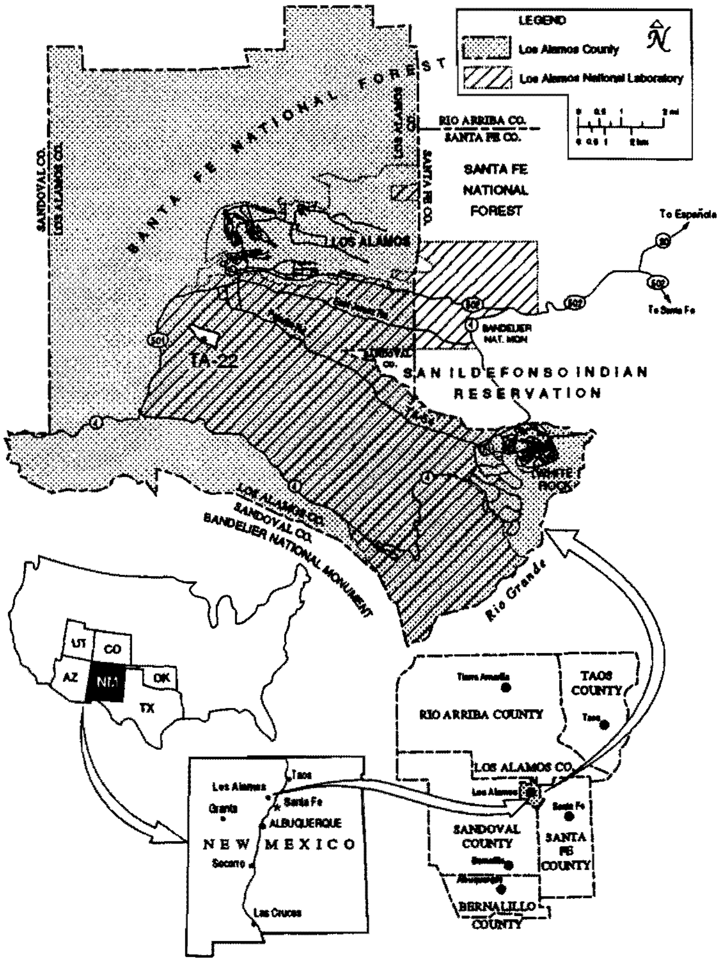

Figure 1.1-1. Location of Los Alamos National Laboratory.

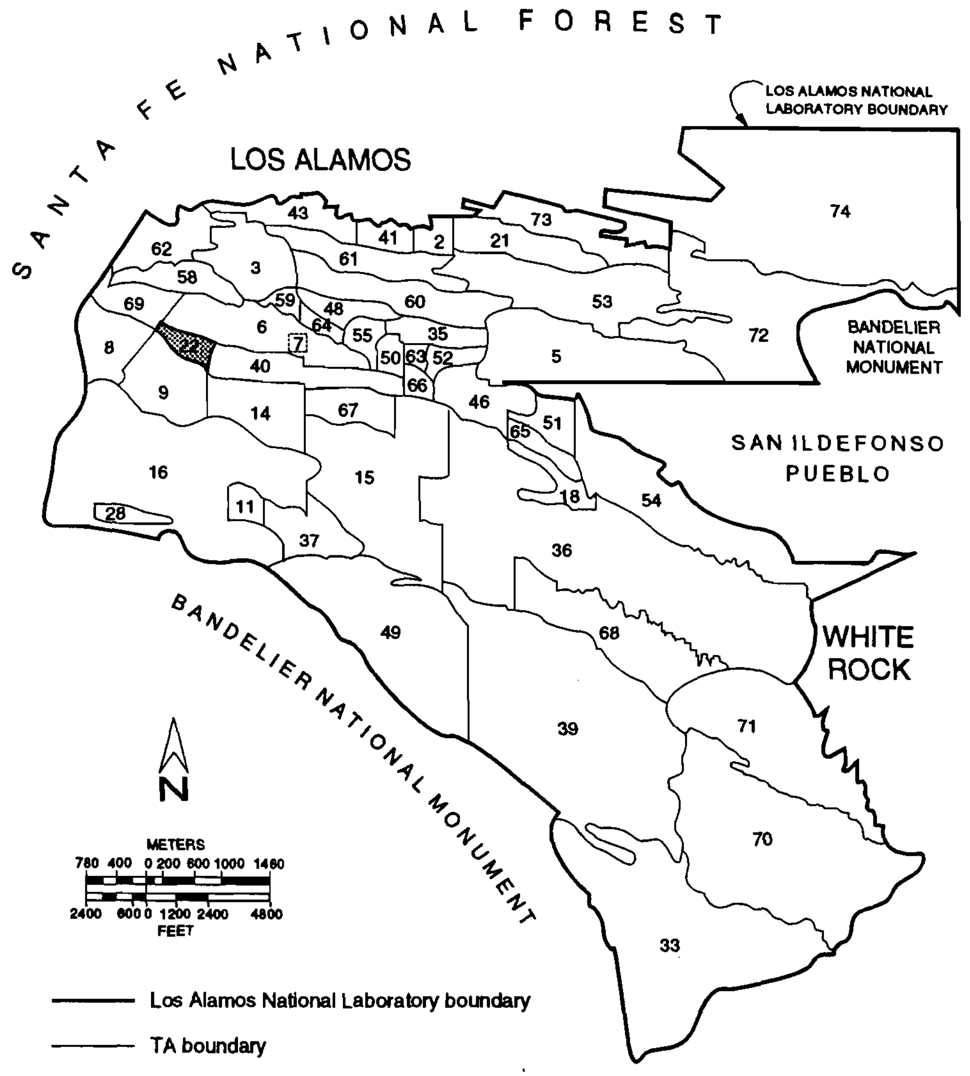

Figure 1.1-2. Location of TA-22 with respect to other Laboratory technical areas.

In late 1944 during the Manhattan Project, buildings were constructed in the area designated as Trap Door Site for the assembly of the Fat Man weapon. After the assembly, the buildings were abandoned until they were remodeled in 1948. Building 22-1 housed a laboratory and a machining operation for detonator development. In this laboratory, the high explosive (HE) pentaerythritol tetranitrate (PETN) was recrystallized from an acetone and water solution for subsequent machining into wedge-shaped charges. Initially, the acetone-water-PETN solution flowed through a drain line to seepage pit 22-015(d). In 1950, a sump [PRS 22-015(e)] was constructed on the south side of Building 22-1 for collection of solid explosives particles. In 1960, a concrete pad (PRS 22-012) was constructed for washing explosives-contaminated equipment. The pad also drained into sump PRS 22-015(e). Hazardous chemicals used at this site include PETN, acetone, and possibly other solvents. These PRSs are grouped together because they made up the hazardous liquid waste treatment and disposal system from Building 22-1. In 1984, Building 22-1 was abandoned, and the explosives sump (PRS 22-015[e]) was drained and filled with concrete.

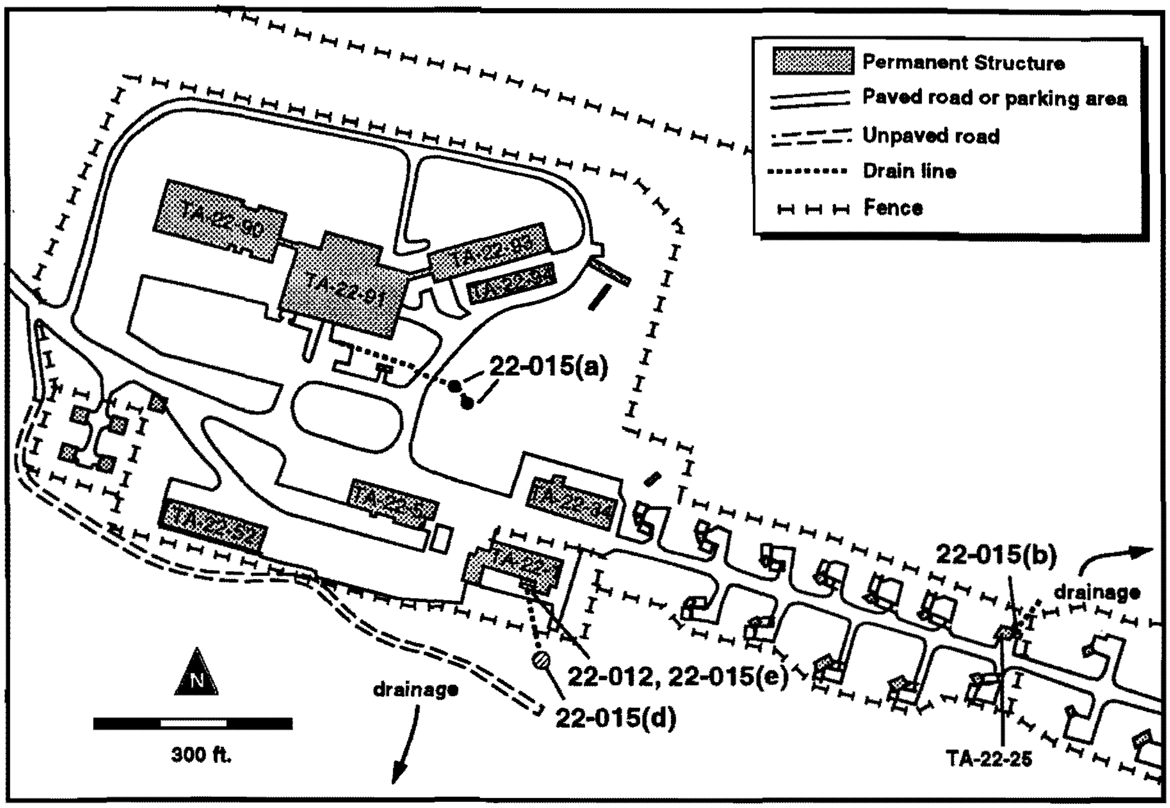

Figure 1.1-3. Location of PRSs investigated in this report.

PETN recrystallization also took place in Building 22-25 from 1949 to the 1960s when the building was abandoned. Waste from the process drained into sump 22-015(b). The outfall is still in place. Hazardous chemicals used at this site are PETN and solvents.

In the early 1980s, a new detonation systems laboratory was constructed in Building 22-91. From 1985 to 1987, waste from printed circuit board etching operations in this building discharged through drain lines into two seepage pits [PRS 22-015(a)]. The system failed because the infiltration rate of liquid into the tuff was slower than the production rate of the effluent. The seepage pits were replaced in 1987 with waste treatment and storage tanks from which the waste is regularly collected and disposed. Potential contaminants from these operations include metals and trichloroethylene.

These PRSs are discussed in more detail in Chapter 5.

1.2 RFI Overview

The HE sumps, outfall area, and the seepage pits were identified as the primary sources of contaminants for this investigation. The primary release mechanisms include leakage, infiltration, erosion, spills, and discharges. Media investigated include surface and subsurface soils, although primary exposure routes to receptors include direct contact, inhalation, and ingestion of contaminants in surface soils. The primary human receptors of contaminants are workers on site. Nonhuman receptors and native flora and fauna may be exposed to contaminants from the site.

Current Laboratory plans are to continue the use of TA-22. If the Laboratory were to release the land, the most likely future use would be as part of the Bandelier National Monument or the Santa Fe National Forest. For these uses, a recreational scenario would be appropriate for the conceptual exposure model.

These PRSs were investigated to assess whether contaminants were present at the sites, to evaluate the potential for release and redistribution into the surrounding soils or outflow areas, and to determine if they posed an unacceptable risk to human health, based on the results of the screening assessment process. Only small amounts of PETN were processed and discharged from the explosives waste streams. Historical records indicate that the estimated maximum amount of PETN that could have drained into the HE sumps at PRS 22-015(b) was 1 lb.; at PRS 22-015(e), the estimated maximum amount was only .02 lb. (Meyers 1993, 15072). No radionuclides were used at this site, and field screening showed no activity above background; therefore, no radiochemical assessments were conducted at these PRSs. The evaluation focused on biased, worst-case scenario sampling strategies and resulted in all five PRSs being proposed for no further action (NFA) status. This proposal is based on screening level risk assessments performed for each of the PRSs.

Field activities performed and potential contaminants are specified in the RFI work plan for OU 1111 (LANL 1993, 26068). These PRSs were investigated during two sampling events: the first in 1994 and the second in 1997. After evaluation of the 1994 sampling data, a sampling and analysis plan (Environmental Restoration Project 1997, 56176) for these PRSs was developed. The 1997 field activities were conducted as described in the sampling and analysis plan.

1.3 Field Activities

The first sampling event took place from June 22 to July 11, 1994; the second took place from April 21 to April 24, 1997. Problems with sample analysis during the 1994 sampling event necessitated the second sampling. Thirty-three volatile organic compound (VOC) samples from PRSs 22-015(b, e) were lost, all (64) samples for HE exceeded holding times, and the requested HE analysis suite did not include PETN.

Field activities for both sampling events consisted of land surveys, on-site screening, and sampling. Details of sampling performed at each PRS are provided in Chapter 5. All applicable Laboratory ER standard operating procedures (SOPs) (LANL, 51575) were followed.

All sample locations were field surveyed by conventional land-surveying methodologies employing a Wild TC 1000 theodolite system. Land surveying was completed in accordance with LANL-ER-SOP-3.01.R1 (LANL, 51575). Field sample locations were also referenced according to the New Mexico State plane coordinate system, and this information is archived in the Laboratory's Facility for Information Management, Analysis, and Display (FIMAD).

Immediately before samples were collected, radioactivity, VOC, and HE screenings were conducted at each sample location, in accordance with worker safety and transportation requirements. Each sample location was screened for radioactivity with an ESP-1 beta-gamma meter equipped with an HP 260 pancake probe and a Ludlum 139 alpha meter

(LANL ER SOP 10.07, R1) (LANL, 51575). Each sample location was also screened for organic vapors with a photoionization detector following guidance established by the Laboratory ER Project manual for health and safety activities (Environmental Restoration Decommissioning Project 1995, 55423). Soil material from each sample location was tested for HE with an HE spot test kit (LANL-ER-SOP 10.06, R0) (LANL, 51575) according to the modified Griess reagent spot test for explosives. This procedure is required by the Laboratory's Dynamic Experimentation (DX) Division for all solid samples collected at TA-22 in compliance with division safety requirements and Department of Transportation regulations.

All surface (0–6 in.) soil samples were collected as discrete samples using a stainless steel scoop (LANL-ER-SOP-06.09); subsurface (>6 in.) samples were collected with a stainless steel hand auger (LANL-ER-SOP-06.10) (LANL, 51575). Samples taken at 8 ft or more in depth were collected with a CME-45 drill rig (LANL-ER-SOP-04.01 and LANL-ER-SOP-06.26) (LANL, 51575). Maximum depth of soil samples collected with the CME-45 drill rig was 30 ft at PRS 22-015(a). Discrete, clean, stainless steel scoops, bucket augers, and split-spoon core barrels were dedicated for collection of soil material at each sampling location to preclude any possibility of cross contamination. Care was exercised to exclude rocks, twigs, leaves, and other nonrepresentative material from the soil before samples were placed into appropriate sample containers. One-gram aliquots of all sample material were screened for gross alpha/beta radioactivity by gas proportional counting employing a Berthold (Model LB 770) ten-channel low-level counter (LANL-ER-SOP 14.01. R0) (LANL, 51575).

All samples were collected according to ER sampling protocol, which ensures all sample containers are labeled, sealed, and submitted under chain-of-custody procedures, placed in a locked cooler, and promptly delivered to an analytical laboratory through the Sample Management Office (SMO).

2.0 ENVIRONMENTAL SETTING

The environmental setting of the Laboratory is described in Section 2.4 of the "Installation Work Plan for Environmental Restoration" (LANL 1995, 52009). A detailed discussion of the environmental setting for TA-22, including climate, geology, hydrology, and a conceptual hydrogeologic model for the area and its surroundings, is presented in the RFI work plan (LANL 1993, 26068). A summary is presented in the following sections.

PRSs in TA-22 are located on Two-Mile Mesa, which is bordered by Pajarito Canyon on the south and Two-Mile Canyon on the north.

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 summer temperatures to range between 50° and 86° F. During the winter, temperatures typically range between 15° and 50° F. The average annual rainfall at TA-22 is approximately 18 in. with approximately half occurring during summer thunderstorms. Streamflow in canyons can occur as a result of these storms. Spring runoff from snowmelt may also induce streamflow in the area canyons.

Winds at a weather station in TA-6 (Figure 1.1-2) are predominantly from the south during midday and from the west-northwest during evening and nighttime hours. Average wind speeds are 3 to 7 mph. Spring is usually the windy season when wind velocities are up to 10 mph from the west during the midafternoon, and wind gusts typically reach 50 mph.

2.2 Geology

2.2.1 Geologic Setting

A detailed discussion of the geology of the entire Los Alamos area can be found in Section 2.5.1 of the installation work plan (IWP) (LANL 1995, 52009). A summary of the geologic setting of TA-22 is presented below.

Pajarito Plateau lies on the east side of the Jemez Mountains in northern New Mexico. The plateau is bounded on the west by the Pajarito fault zone and on the east by the Rio Grande. TA-22 lies near the western boundary of the plateau and, thus, near the Pajarito fault zone. The TA ranges in elevation between approximately 7100 ft above mean sea level at the easternmost boundary and 7800 ft along the western edge. This area has a varied topography; it consists primarily of mesa tops and canyons and ranges from steep slopes and cliffs to broad, moderately sloping mesa tops. Most of the canyon systems are relatively undisturbed; however, locations that have exhibited varying degrees of disturbance on the mesa tops include roads (paved and unpaved), drainages, cleared fields, and Laboratory facilities (explosive test sites, decommissioned and rehabilitated sites, and current buildings).

The rocks exposed within TA-22 are Unit 4 of the Tshirege Member of the Bandelier Tuff (Figure 2.2.1-1). Between and within units of the Tshirege Member are widespread pyroclastic surge beds. These surge beds provide useful stratigraphic markers and appear to have greater permeability than the surrounding tuffs. One such surge deposit outcrops in a tributary to Pajarito Canyon located on the southern boundary of TA-22 and was observed in a shallow borehole in TA-22 during a PRS field investigation.

Minor fracture sets may be associated with either tectonic fractures or cooling joints. A fracture noted in Pajarito Canyon along the south boundary of TA-22 appears to exhibit a few inches of offset but no apparent fault gouge or standoff. This fracture appears to parallel the Pajarito fault zone and may be associated with the fault zone. Most sub-vertical fractures in Unit 4 of the Tshirege are probably cooling joints. Fractures associated with the Pajarito fault zone might provide continuous flow paths for contaminant migration, whereas cooling joints, flow boundaries, and unit boundaries are less likely to provide such migration paths.

2.2.2 Soils

A detailed discussion of soils in the Los Alamos area can be found in Section 2.5.3.1 of the IWP (LANL 1995, 52009) and in Section 3.4.3 of the work plan (LANL 1993, 26068). A summary of material specific to TA-22 is presented below.

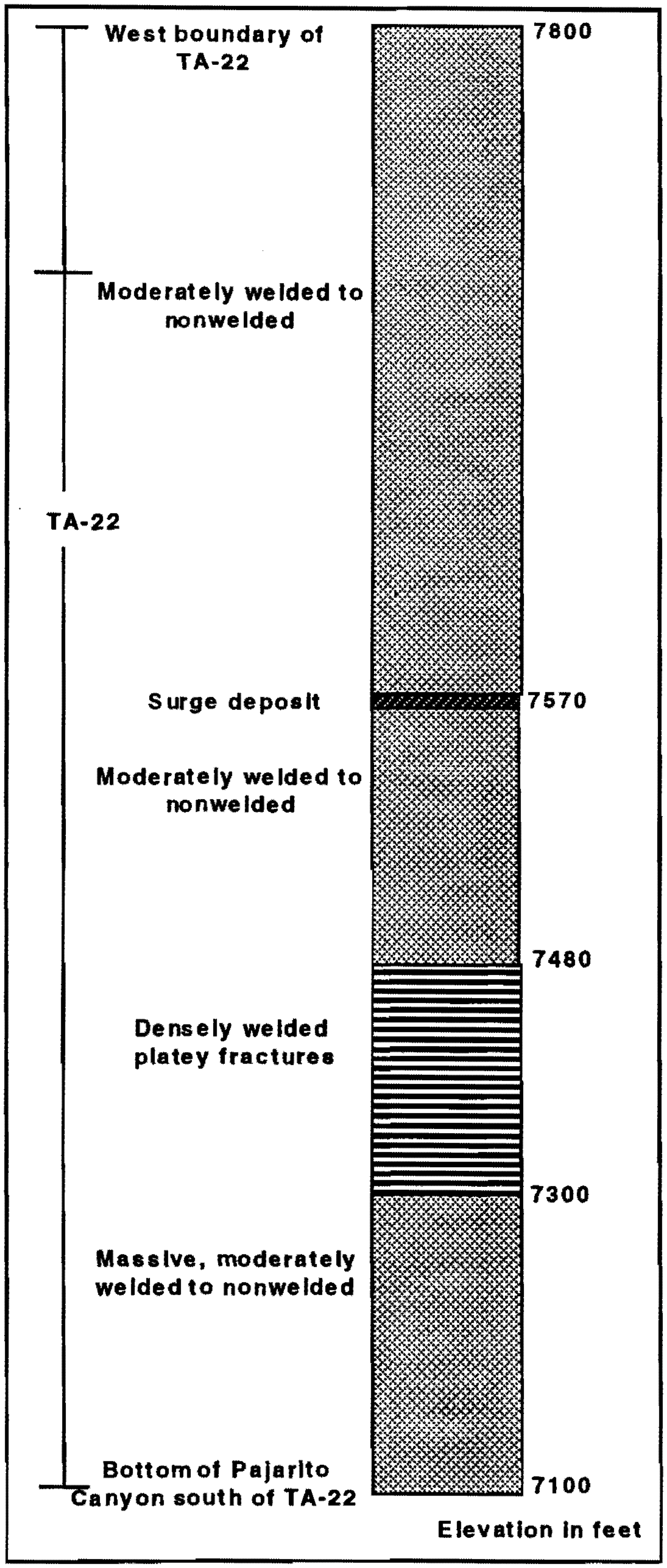

Figure 2.2.1-1. Unit 4 of the Tshirege Member, TA-22.

Information related to the soils and soil characteristics that might influence contaminant transport is limited for TA-22. PRSs that are located on mesa tops in this area are within the Carjo soil series (Nyhan et al. 1978, 5702). The Carjo soil series is similar to, but deeper than, the Tocal series; depth to tuff/soil interface is nominally 24 in. and 16 in. for the Carjo and Tocal series, respectively. The upper horizon (8–10 in.) of these two soils is typically a loam or a fine sandy loam with a clay-rich horizon at about 10 in. Soils near the center of the mesa are more likely to show such a horizon than those closer to the mesa edge. However, at almost all sites investigated for this report, construction, testing, or past cleanup activities have altered and mixed the soil materials so that properties associated with described soils have been obscured.

Erosion on the mesa top is caused primarily by surface water runoff to the relatively flat part of the mesa and by higher energy runoff in channels cut into the mesa surfaces. However, the area is relatively stable because undisturbed or vegetated soils have low erosion potential, and there is no evidence of major recent episodes of downcutting or deposition.

2.3 Hydrology

The surface and subsurface hydrology of the Pajarito Plateau is summarized in Section 2.5.2 of the IWP (LANL 1995, 52009). Conditions specific to TA-22 are discussed in some detail in Section 3.5 of the work plan (LANL 1993, 26068) and are summarized below.

2.3.1 Surface Water

Figure 2.3.1-1 shows the topography of the area. Runoff on the relatively flat mesa top is generally by sheet wash, which may coalesce into small channels and eventually lead to flow into the canyons. Contaminant transport in this setting would most likely be associated with eroded sediments with subsequent collection in soil traps or marshes and further movement into local stream channels.

Surface water runoff from the main facilities at TA-22 and effluent from the recently terminated (June 1995) National Pollutant Discharge Elimination System Outfall 128128 recharged a .94-acre wetland downgradient from PRS 22-015(a). The wetland formed in Tributary B of Two-Mlle Canyon (LANL 1993, 26068).

2.3.2 Ground Water

The current understanding of the ground water system underlying TA-22 is described in Chapter 3 of the OU 1111 work plan (LANL 1993, 26068). There has been no deep drilling in TA-22; however, drilling has been conducted at points east of the area in canyons transecting the mesas. Based on extrapolations from test wells several miles from TA-22, the depth to the main aquifer is estimated to be between 1025 and 1285 ft. Intervening volcanic tuff and sediments of the Bandelier and Puye formations and Cerros del Rio basalts appear to be unsaturated, and no perched aquifers have been identified (LANL 1993, 26068). The extensive thickness of the unsaturated zone minimizes the potential for transport of water and any dissolved contaminants through the Bandelier Tuff and into the main aquifer. Thus, deep penetration is considered a minor contaminant transport mechanism because of the low moisture content of the upper tuff units (LANL 1993, 26068) and the high evaporation potential and vegetative transpiration.

A spring, known as Homestead Spring, on the south flank of Pajarito Canyon and approximately 0.2 mi. southwest of PRS 22-015(d) was found in mid-March 1992. The spring was flowing into the upper reaches of the canyon at approximately 5 gpm. Based on the rainfall-equivalent tritium content measured in a sample, the source for this spring is probably soil-level infiltration of recent snowmelt and rain draining from the southwest (TA-9) (LANL 1993, 26068).

2.4 Biological Surveys

Biological resource field surveys have been conducted in TA-22 for compliance with the Federal Endangered Species Act of 1973; the New Mexico Wildlife Conservation Act; the New Mexico Endangered Species Act; Executive Order 11990, "Protection of Wetlands"; Executive Order 11988, "Floodplain Management"; 10 CFR 1022; Compliance With Floodplain/Wetlands Environmental Review Requirements (DOE 1979); and DOE Order 5400.1, General Environmental Protection Program (DOE 1988).

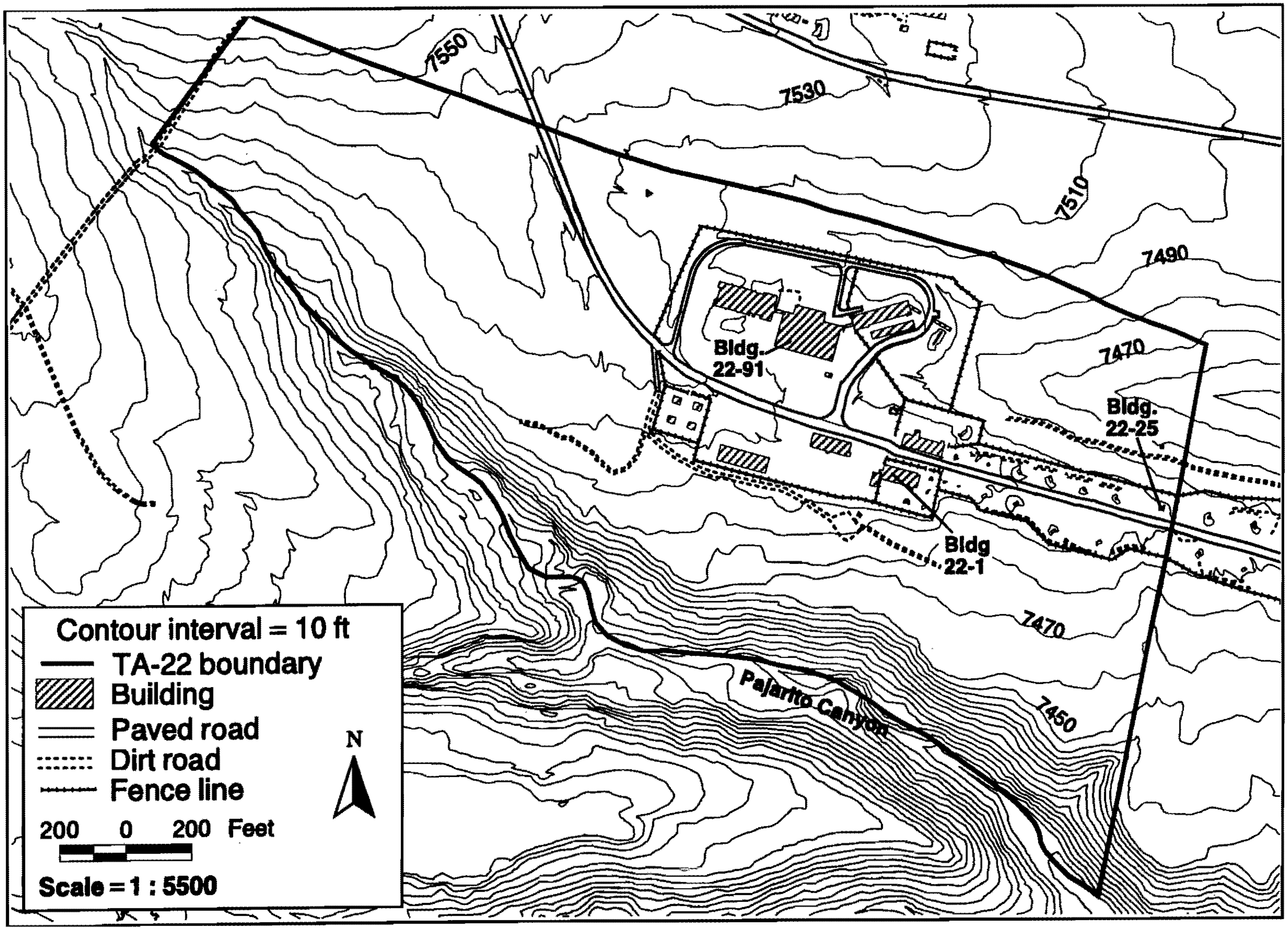

Figure 2.3.1-1. Topography of TA-22 and surrounding area.

The field surveys were conducted during 1992 by the Biological Resource Evaluations Team of the Environmental Protection Group. The purpose was to determine whether habitats for endangered species or the species themselves were present and whether sites needed to be protected during site characterization. Survey results are described in Salisbury (1995, 55596). No potential habitats were affected by the characterization studies described in this report. These results and the habitat description for TA-22 will be included in the ecological report prepared by the Ecological Risk Assessment Team for the ecological exposure units in which these PRSs are located.

2.5 Cultural Surveys

Cultural resource surveys were conducted at TA-22, as required by the National Historic Preservation Act (amended).

Thirty archaeological or historical sites are identified in Table 3-4 of the OU 1111 work plan (LANL 1993, 26068). One of the five sites eligible for inclusion on the National Register of Historical Places is TA-22-1, the Fat Man Assembly Building. This site was not affected by the characterization studies described in this report.

3.0 APPROACH TO DATA ASSESSMENT AND ANALYSES

The approach to data assessment used by the ER Project is described in the policy document, "Risk-Based Corrective Action Process" (Dorries 1996, 55575). The approach includes

- sampling and analysis design,
- field investigation and collection of field and QA samples,
- chemical and radiochemical analyses of samples and reporting of analytical data,
- baseline verification and validation of analytical data,
- organization of field and analytical data into PRS-specific data sets,
- exploratory data analysis,
- focused validation when necessary to further assess questionable data,
- comparison of validated analytical results with Laboratory background data,
- comparison of validated analytical results with screening action levels (SALs),
- evaluation of sufficiency of data sets to support site decisions, and
- assessment of human health risk.

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

3.1 Sample Analyses

Samples were collected in accordance with sampling design specified in the RFI work plan for OU 1111 (LANL 1993, 26068) and the "Sampling and Analysis Plan for PRSs 22-012 and 22-015 (a, b, d, and e)" (Environmental Restoration Project 1997, 56176);

exceptions are identified in Chapter 5 of this report. All samples requiring chemical analyses and chain-of-custody documentation were submitted to the SMO for analyses.

Samples were dried and screened at a fixed laboratory to measure radioactivity for shipping and sample consignment and to detect elevated levels of alpha or beta radiation as an indication of elevated uranium concentrations. Details of the field screening and laboratory radioactivity evaluations are presented in Sections 1.3, 5.1.4, 5.2.4, and 5.3.4.

3.1.1 Analytical Methods

The following analytical suites were used for the sample analyses in this RFI report: inorganic chemicals, VOCs, semivolatile organic compounds (SVOCs), and HE. A list of the target analytes for which analyses were performed for the purpose of this report can be found in Appendix A.

All samples were analyzed by contract analytical laboratories using methods specified in ER SMO analytical subcontracts and by using the Laboratory DX-2 HE field test kit. The field test kit, which yields detection limits near 200 ppm for target analytes, was used in accordance with LANL-ER-SOP-10.06 (LANL, 51575). The fixed laboratory methods are current Environmental Protection Agency (EPA) SW-846 and Contract Laboratory Program methods (or an equivalent method) for inorganic chemicals, VOCs, SVOCs, and HE and current US Army Toxic and Hazardous Material Agency methods for PETN and nitroglycerin. Before analysis for inorganic chemicals, solid samples were digested according to EPA SW-846 method 3050 or an equivalent method (EPA 1993, 40070). Analytical method selection is described in Appendix IV of the ER Project "Quality Assurance Project Plan Requirements for Sampling and Analysis" (LANL 1996, 54609). 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 Quality Assurance Program Plan (QAPP) (LANL 1996, 54609) along with the target analytes for each analytical suite.

3.1.2 Data Validation

Data verification and baseline validation procedures are used to determine whether data packages received from the analytical laboratory were generated according to specifications and contain the information necessary to determine data sufficiency for decision making. For analytical data used for decisions discussed in this RFI report, baseline data validation under the ER protocol was performed as described in the QAPP (LANL 1996, 54609).

During these investigations, the baseline data validation process changed. The older validation process (sample identification numbers beginning with AAA or AAB) produced reports using the following validation flags for data, if a potential deficiency was identified.

- J Reported value is an estimated quantity. The analyte was detected in the sample, but there were one or more QC parameters whose values were outside of established quality limits. Therefore, the analytical uncertainty or bias could be greater than if all QC parameters were within established acceptance limits.

• R	Reported value is rejected. The data are qualified as not usable because one or more of the QC parameters exhibited values that were outside of established limits to such a degree that the reported value is highly questionable.
• U	The analyte was not positively identified in the sample, and the associated value is the sample-specific EQL/EDL.
• UJ	Reported value is an undetected, estimated quantity. The analyte was not detected in the sample, but there were one or more QC parameters whose values were outside of established quality limits.

The current baseline data validation process produced reports with an expanded list of data qualifiers to designate potential data deficiencies. Sample identification numbers used the format 0522-97-xxxx; x's indicate the specific sample. Each data qualifier is accompanied by a reason code that provides information about the deficiency that led to qualification of the data.

Data qualifiers used in the current baseline validation process are

• A	The data required for data review and evaluation are not available.
• U	The analyte was not positively identified in the sample, and the associated value is the sample-specific EQL/EDL.
• J	The analyte was positively identified, and the associated numerical value is estimated to be more uncertain than would normally be expected for that analysis.
• J+	The analyte was positively identified, and the result is likely to be biased high.
• J-	The analyte was positively identified, and the result is likely to be biased low.
• UJ	The analyte was not positively identified in the sample, and the associated value is an estimate of the sample-specific EQL/EDL.
• RPM	Without further review of the raw data, the sample results are unusable because of serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence cannot be verified. NOTE: Any results qualified as RPM must be evaluated for relevance to data use.
• P	Professional judgment should be applied to using the data in decision making.
• PM	Professional judgment should be applied to using the data in decision making. A manual review of raw data is recommended to determine if the defect impacts data use for decision making.

In both cases, the baseline validation reports were used in the decision-making process and to direct the focused validations required to evaluate the usability of the data for this report.

Data were qualified (i.e., one or more of the qualifiers indicated above was associated with the data) for a variety of reasons during the baseline validation process. The baseline validation procedure used for routine analytical services provides information about the reason the qualifier was applied and its potential impact on the affected data. The purpose is not to reject data but rather to ensure that the relative quality of the data is understood so that the data may be used appropriately. The assignment of a U qualifier to a datum does not indicate that the datum's quality is substandard or that its use should be limited. Rather, the U qualifier simply indicates that the corresponding analyte was not detected.

A focused data validation may be required as a follow-up to the baseline validation. The purpose of a focused validation is to determine the technical adequacy of measurement data when

- the data are qualified as deficient or as requiring professional judgment during the verification/baseline validation process. For example, when holding times are exceeded or interferences are present, a focused validation may be required to assist in determining data adequacy for the intended use.
- the data quality assessment process requires additional information about the
    - ◊ variability or uncertainty of the reported data or
    - ◊ data quality before making a data use decision because of anomalies detected in a data set.

Details of QA/QC activities are presented in Chapter 4 of this report. Qualifiers resulting from baseline and focused validation are shown in the analytical results tables included in Chapter 5 of this report. Summaries of data quality evaluations and focused validation of analytical data relevant to this report are given in Appendix B. The RPM, P, and PM qualifiers do not appear in Chapter 5 data tables, nor in Appendix B, because they are replaced during focused validation according to the data use.

3.2 Process for the Identification of Chemicals of Potential Concern

3.2.1 Inorganic Chemicals

Detected inorganic chemicals are compared with natural background distributions to determine if they should be retained as chemicals of potential concern (COPCs) or eliminated from further consideration. The inorganic background data used in this report are from the following source:

- soil, sediment, and tuff samples collected throughout Los Alamos County for which chemical analyses were performed for certain inorganic (metal) chemicals (Longmire et al. 1995, 55115 and 52227). The all soil horizons background data set was used for all surface soil samples because the soil master horizon was not identified when the samples were collected. The upper 30 ft of tuff within TA-22 is identified as belonging to the Qbt 4 cooling unit of the Tshirege Member. All investigation tuff samples were collected from within this interval and, therefore, were compared to the upper tolerance limit (UTL) for Qbt 4.

Comparisons between site data and background data are initially performed by comparing each observed concentration datum with a chemical-specific background screening value that is the UTL, the maximum reported concentration, or the detection limit of a nondetected chemical. These background screening values are derived from Laboratory-wide soil, sediment, and tuff background data, and details on the calculation of these values are presented in Longmire et al. (1995, 52227). Certain inorganic chemicals in certain media have no Laboratory-wide background data. For these exceptions, PRS sample-specific detection limits are used as nominal background screening values. In this report, silver lacks background data.

3.2.2 Radionuclides

No radionuclides were used at this site, and field screening showed no activity above background; therefore, no radiochemical assessments were conducted at these PRSs.

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 in the screening assessment process for the PRSs in this RFI report. Chemicals not detected in any sample have been removed from further consideration.

3.2.4 Risk-Based Screening Assessment

Inorganic chemicals that exceed background and organic chemicals positively identified in one or more samples 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 tap water. 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, a multiple chemical evaluation (MCE) is performed to determine if the potentially additive effect of chemicals detected below SALs warrants additional investigation. The method for performing an MCE is summarized in the policy document, "Risk-Based Corrective Action Process" (Dorries 1996, 55575). These 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 to evaluate 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.

3.3 Human Health Assessment

3.3.1 Risk Due to Naturally Occurring Inorganic Chemicals in Soils (Background)

Risk is associated with exposure to inorganic chemicals occurring naturally in soil. 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 10^{-6} or hazard index of 1. Background risks can also affect decisions at sites that have chemicals for which there is a toxicity threshold. For some inorganic chemicals, background intakes may be near a toxicity threshold such that incremental intakes associated with contamination may be unacceptable.

Background risk estimates provided in Table 3.3.1-1 were calculated using the same exposure assumptions by which SALs are calculated. SALs are based on health-protective assumptions for a residential scenario (EPA 1995, 53970). For soil exposure, the pathways include incidental soil ingestion, inhalation of resuspended dust, and dermal contact with soil. The background soil data used for these calculations were collected from several soil horizons at geographically diverse locations. Background risks are estimated for two statistics. One statistic is the median of the observed contaminant concentrations, which represents the midpoint in the concentration range (technically, the median is the concentration value that divides the results into two equal groups or where half of the data are above and half are below this value). The second statistic represents the upper range on background concentration values and is either calculated as a UTL or a maximum concentration value.[1]

The background risks based on the Laboratory SAL residential exposure model are provided in Table 3.3.1-1. Risks due to exposure to chemicals at background concentrations are presented for both noncarcinogenic and carcinogenic outcomes. The potential for adverse noncarcinogenic health effects is estimated by computing a hazard quotient. A chemical intake leading to a hazard quotient of up to 1 is 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, exposure to naturally occurring manganese is not expected to have significant health consequences because of the unlikely occurrence of the UTL concentration over an entire exposure area, the conservative assumptions used in the exposure assessment, and the margin of safety incorporated into the reference dose.

Three of the background inorganic chemicals provided in Table 3.3.1-1 are also carcinogens. Applying the default exposure assumptions used for SALs, the lifetime cancer risks due to residential soil exposure to background concentrations (UTL column) are estimated at approximately 1 excess case of cancer in 100,000 people for beryllium, 2 in 100,000 for arsenic, and 2 in 1,000,000,000 for cadmium (carcinogenic only by

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[1] UTLs and maximum concentration values are identical to those described in Section 3.2.1 (Inorganic Chemicals).

inhalation). EPA uses a range of 1 excess case of cancer in 10,000 people to 1 in 1,000,000 as guidance for an acceptable range of cancer risk (EPA 1990).

TABLE 3.3.1-1

RISK DUE TO BACKGROUND CONCENTRATIONS OF INORGANIC CHEMICALS IN SOIL ASSUMING A RESIDENTIAL SCENARIO[a]

Soil Inorganic	Background Soil Concentration[b] (mg/kg)		Hazard Quotient		Lifetime Cancer Risk	
	Median	**UTL**	**Median**	**UTL**	**Median**	**UTL**
Aluminum	10 000	38 700	0.1	0.5	NC[c]	NC
Antimony	0.6	1[d]	0.02	0.03	NC	NC
Arsenic	4	7.82	0.2	0.4	1×10^{-5}	2×10^{-5}
Barium	130	315	0.03	0.06	NC	NC
Beryllium	0.895	1.95	0.003	0.006	6×10^{-6}	1×10^{-5}
Cadmium[e]	0.2	2.6[d]	0.005	0.07	1×10^{-10}	2×10^{-9}
Chromium[f]	8.6	19.3	0.00009	0.0002	NC	NC
Cobalt	6	19.2	0.001	0.004	NC	NC
Copper	5.75	15.5	0.002	0.01	NC	NC
Lead[g]	12	23.3	0.03	0.06	NC	NC
Manganese	320	714	0.8	1.9	NC	NC
Mercury	0.05	0.1[d]	0.002	0.004	NC	NC
Nickel	7	15.2	0.005	0.01	NC	NC
Selenium	0.3	1.7[d]	0.0008	0.005	NC	NC
Thallium	0.2	1[d]	0.03	0.2	NC	NC
Uranium	0.9	1.87	0.004	0.008	NC	NC
Vanadium	21	41.9	0.04	0.08	NC	NC
Zinc	30.7	50.8	0.001	0.002	NC	NC

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

b. Background concentrations taken from the Longmire et al. all soil horizons data set (1995, 55115).

c. NC = noncarcinogen

d. Maximum detected background value.

e. Cancer risks for cadmium are based solely on inhalation of resuspended dust.

f. Naturally occurring chromium is assumed to exist in a trivalent state.

g. Hazard quotient based on biokinetic uptake model.

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 site/scenario-specific assumptions to assist in the remedial action decisions for the site.

3.3.2 Risk Assessment

No human health risk assessments were performed for these PRSs.

3.4 Ecological Assessment

In cooperation with the New Mexico Environment Department 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.

4.0 RESULTS OF QA/QC ACTIVITIES

Samples collected in 1994 were processed and analyzed in accordance with the ER QA/QC program documented in "Site-Specific Quality Assurance Project Plan," Annex II of the RFI work plan for OU 1111 (LANL 1993, 26068). The QA objectives (precision, accuracy) for measured data were based on "Los Alamos National Laboratory Quality Program Plan for Environmental Restoration Activities" (LANL 1991, 7651). Samples collected in 1997 were collected under the governance of the Laboratory "Quality Assurance Project Plan Requirements for Sampling and Analysis" (LANL 1996, 54609).

Several types of QC samples and chemical compounds are routinely used as analytical data quality indicators. These include

- laboratory and field blanks, which indicate whether samples might have been contaminated during the sampling or analysis processes;
- field and laboratory duplicate samples, which estimate the degree of heterogeneity of samples and PRSs and estimate analytical precision, as appropriate;
- laboratory control samples and check standards, which were analyzed to determine whether the calibration of an instrument was acceptable throughout the analyses;
- surrogate compounds and matrix spikes, which indicate the potential for chemical or physical interferences that could affect an observed analyte concentration relative to its true value; and
- QC samples, which are generated external to the analytical laboratory (ER Project QC blend samples) and are analyzed by the laboratory and evaluated by the ER Project to determine if the overall measurement system is functioning properly.

During baseline data validation, QC data are reviewed by data validation chemists for compliance with pre-established acceptance criteria. These criteria are based on the US EPA Contract Laboratory Program "USEPA Contract Laboratory Program National

Functional Guidelines for Organic Data Review" (EPA 1994, 48640). The validation reports summarizing those findings are reviewed by a field unit chemist, and the technical quality of the data is summarized in this chapter. If compliance with validation criteria is not evident or apparent anomalies are discovered after baseline validation, the chemist performs a focused review of the data to determine whether a particular anomaly is an actual data deficiency. This may require a review of sample-specific QC data or a review of QC data associated with batches of samples that are handled and analyzed as a group. If necessary, the analytical laboratory is tasked to provide additional information concerning the apparent deficiency. This chapter and the tables in Appendix B summarize the technical evaluation for each PRS and indicate to data users whether the reported results might be biased or unusually uncertain or whether they may be used as reported.

Samples collected during the first sampling event (June 22 to July 11, 1994) had numerous QA/QC problems. However, data from this sampling have received focus validation review and have been deemed usable (with consideration) for site decisions. The subsequent discussion addresses these samples and their usability. These samples are recognizable by the AAAxxxx sample number or the 94.xxxxx sample number (QC samples).

The 1997 sample collection was intended to support the 1994 data set and eliminate data limitations or uncertainties. Discussion of data from the second sampling event (April 21 to April 24, 1997) is brief because no analytical problems were encountered, and there were few QA/QC problems. These samples are recognizable by the field unit, TA, year, and sample number format, i.e., 0522-97-xxxx. With the exception of possible laboratory contamination in a field blank (organics analysis of request number 3077R) from PRS 22-015(d) and exceeded holding times from analysis of aqueous field blank [0522-97-0030, PRS 22-015(b)], there were no QA problems in the 1997 sampling effort.

At the beginning of each of the three analyte class sections below (inorganic, radiochemical, and organic), general observations and conclusions that apply to each PRS in that section are presented. Then PRS-specific information is presented as a series of subsections.

4.1 Inorganic Analyses

Recoveries in soil matrix spikes for aluminum, calcium, iron, magnesium, potassium, and sodium were occasionally greater than expected (by factors of 1.5 to 3). This occurred because the matrix spike levels prescribed in the standard analytical method were too low relative to the native metal concentration in the soils. Because these metals are not typically of significant environmental concern, poor spike recoveries are not discussed except in extreme cases, where it is unclear if the problem is due only to low spiking levels or if it is an actual analytical performance problem.

4.1.1 PRSs 22-012, 22-015(d), and 22-015(e); Explosives Sump Aggregate

No inorganic analyses were performed at this site.

4.1.2 PRS 22-015(a), Inactive Seepage Pits

QC deviations for this PRS are summarized in Table B-2.

Request Number 18038. Seven soil samples, AAA8698, AAA8702 through AAA8704, and AAA8706 through AAA8708, were analyzed for EPA target analyte list (TAL) metals, cyanide, fluoride, and nitrate/nitrite. Soil blind QC samples 94.14006 and 94.14007 were analyzed for cyanide and mercury, respectively. Aqueous blind QC sample 94.14008 was analyzed for TAL metals, except mercury.

Cyanide recovery in sample 94.14006 was 74.6%, just 0.4% less than the lower acceptance limit. Silver recovery in sample 94.14008 was 40.3%. However, solutions of >2 mg/L silver are known to suffer from instability problems, especially when exposed to light, and the *known* silver concentration in this sample was 2.01 mg/L. Although the silver and cyanide results are qualified as UJ (undetected estimated) because of the low blind QC recoveries, it is unlikely that the results are biased significantly low because cyanide and silver recoveries in the matrix spike samples were 103%. Originally, the arsenic recovery in sample 94.14008 was reported as 0.8% of the expected value, indicating a potentially serious low bias for that analyte. However, the low arsenic recovery was determined to be a laboratory reporting error. The correct arsenic recovery is 112% (Frey 1997, 56232). Therefore, the arsenic results which were qualified as R (rejected) during baseline data validation are actually acceptable, and the qualification is revoked.

Sample AAA8698 was analyzed in duplicate for TAL metals and yielded relative percent difference (RPD) values less than 10% for most analytes, with manganese exhibiting the greatest RPD equal at 22%. The copper, manganese, antimony, lead, and thallium matrix spike recoveries are 223%, 60%, 39%, 213% and 130%, respectively, in this sample. These are outside of the 100% ± 25% acceptance criteria and indicate some potential matrix interferences for these metals. The high percent recoveries are of no concern because they indicate a potential high bias, and the respective analytes were not detected in the field samples near concentrations of concern. The 60% manganese recovery and the 39% antimony recovery indicate a potential low bias in those results, although the data were not qualified as undetected estimated (UJ) during baseline data validation. Sample AAA8702 was analyzed in duplicate for cyanide, but cyanide was not detected in either of the aliquots.

Request Number 18520. Two soil samples, AAA8699 and AAA8700, were analyzed for TAL metals, cyanide, fluoride, and nitrate/nitrite. All QC data are within acceptance criteria, and the data for this request number may be used as reported.

Request Number 3074R. Four soil samples, 0522-97-0010, 0522-97-0011, 0522-97-0014, and 0522-97-0015 were analyzed for TAL metals and cyanide.

The TAL metal recoveries in the matrix spike and solid laboratory control sample were within acceptance criteria for this request number. The RPD between duplicate manganese results was 34.2%. This value is greater than the advisory limit of 20% but is within the limits typically observed for inorganic analytes in Laboratory soils (commonly as high as 35% RPD and occasionally exceeding 50% RPD). Beryllium and vanadium were detected in the preparation blank at concentrations of 0.084 mg/kg and 1.48 mg/kg, respectively. This is less than five times the concentration detected in the method blank. Because of this, results for beryllium in samples 0522-97-0010, 0522-97-0011, and 0522-97-0014 and results for vanadium in samples 0522-97-0011 and 0522-97-0015 are classified as undetected (U). The reported concentrations for those analytes in the samples are <0.5 mg/kg for beryllium and ≤5.1 mg/kg for vanadium. Cyanide was reported present at less than 0.25 mg/kg in the four soil samples, but all of those detects were between the instrument detection limit and the reportable method detection limit. Therefore, cyanide should be considered to be undetected (U), confirming the results of the original sampling under request numbers 18038 and 18520. All inorganic analyte data for this request number may be used as reported.

4.1.3 PRS 22-015(b), Inactive Explosives Sump and Outfall

No inorganic analyses were performed at this site.

4.2 Radiochemical Analyses

4.2.1 PRSs 22-012, 22-015(d), and 22-015(e); Explosives Sump Aggregate

No radiochemical analyses were performed at this site.

4.2.2 PRS 22-015(a), Inactive Seepage Pits

No radiochemical analyses were performed at this site.

4.2.3 22-015(b), Inactive Explosives Sump and Outfall

No radiochemical analyses were performed at this site.

4.3 Organic Analyses

4.3.1 PRSs 22-012, 22-015(d), and 22-015(e); Explosives Sump Aggregate

QC deviations for these PRSs are summarized in Table B-1.

PRS 22-012

Request Number 17835. Nine soil samples, AAA8771 through AAA8779, were analyzed for SW-846 Method 8330 HE. Five soil blank samples, 94.12493 and 94.14257 through 94.14260 and three soil blind QC samples, 94.12494, 94.12495, and 94.12509, were submitted for the same analyses.

All blank samples and blind sample 94.12494 were in control. Except for high-melting explosive (HMX), no target analytes were detected in the field samples for this request number. HMX was detected at 2.46 mg/kg in sample AAA8777 and at 1.48 mg/kg in sample AAA8778. Sample holding times were exceeded by a few months for all samples. All analyte recoveries in blind QC samples 94.12495 and 94.12509 were out of control to the low side; analyte recoveries were generally 28% to 47% of expected values. The surrogate recoveries in samples AAA8771 through AAA8774 ranged between 31% and 49%, indicating a low bias in the analytical process. Because of these low recoveries, the data for samples AAA8771 through AAA8774 were qualified as rejected (R) during the baseline validation. Focused validation shows that the data may still be used during the screening assessment, recognizing that organic concentrations should be viewed as biased significantly low, being perhaps as much as one-fifth of expected values. The uncertainty in the reported values should also be viewed as significantly greater than normal. The surrogate recoveries for samples AAA8775 through AAA8779 ranged between 94% and 100%, indicating no analytical measurement problems. The results for samples AAA8775 through AAA8779 should also be viewed as potentially biased low because of the exceeded holding times and the low blind QC sample recoveries.

PRS 22-015(d)

Request Number 18091. Four soil samples, AAA8741 through AAA8744, an aqueous trip blank (AAA8823), and an aqueous field blank (AAA8824), were analyzed for SW-846 Method 8260 VOCs. The blind QC sample, 94.14502, and blanks, 94.14489, 94.14490, and 94.27389, analyzed with this request number had all target analytes in control.

No VOC target analytes were detected in these samples. Results for sample AAA8741 are qualified as undetected estimated (UJ) because of low 4-bromofluorobenzene surrogate recovery (71%) on repeat analyses and because of low internal standard recoveries. The low recoveries indicate a potentially low bias in the results for this sample; however, the low surrogate recovery is just 3% below the lower acceptance limit. Although sample AAA8741 results are qualified as UJ, they should be viewed as potentially biased only slightly low with the usual degree of uncertainty. All other VOC results may be used as reported.

Request Number 18092. Eight soil samples, AAA8737 through AAA8740 and AAA8745 through AAA8748, an aqueous trip blank (AAA8859), and an aqueous field blank (AAA8860), were analyzed for SW-846 Method 8260 VOCs.

No VOC analytes were detected in these samples. Blind QC sample (94.15078) and blank (94.14503, 94.14505, and 94.14506) results are all in control except for the ethylene dibromide recovery in sample 94.15078, which was 4.6%. Consequently, all ethylene dibromide results are qualified as rejected (R). Samples AAA8737 and AAA8745 had surrogate bromofluorobenzene recoveries at 56% and 53%, respectively, and they had low internal standard area recoveries. All target analyte (except ethylene dibromide) results for these two samples are qualified as undetected estimated (UJ).

Request Number 3077R. Because of the problems encountered in sample data quality for request number 18092, focused resampling of this PRS was initiated in 1997. Five soil samples, 0522-97-0031 through 0522-97-0035, and one aqueous field blank, 0522-97-0036, were analyzed for SW-846 Method 8260 VOCs.

Acetone, benzene, carbon disulfide, and methylene chloride were reported at concentrations below the laboratory quantitation limit in the method blank and all samples except sample 0522-97-0036. This pattern of analyte detection is consistent with the presence of low levels of laboratory contamination. Consequently, these four analytes have been classified as nondetected (U) in the field samples. Low chlorobenzene and 1,4-dichlorobenzene internal standard recoveries were reported for sample 0522-97-0035. This could indicate a slight low bias in the target analyte results, if the low internal standard areas are caused by matrix interference or poor sample purging efficiency. However, the internal standards are added to the samples to compensate for such effects, and low internal standard recoveries do not, by themselves, lead to a conclusion of low bias in the target analyte concentrations. A review of the raw data reveals no chromatographic evidence of matrix effects. Moreover, the surrogate compounds for this sample are all within acceptance limits, which indicates that analyte quantitation is adequate. Field blank sample 0522-97-0036 was analyzed seven days after the prescribed holding time. However, because no analytes were detected in the field samples and field blanks are used as indicators of field contamination, exceeding the holding time for the field blank should not invalidate field sample analytical results. The results for sample 0522-97-0035 are generally classified as UJ (undetected estimated); however, the data may be used as reported. All VOC data for this request number may be used as reported.

Request Number 18096. Eight soil samples, AAA8737 through AAA8740 and AAA8745 through AAA8748, were analyzed for SW-846 Method 8330 HE. Also analyzed were a blank, 94.14557, and a soil blind QC sample, 94.14558.

No HE target analytes were detected in any of the field samples. The blank exhibited no detectable HE target analytes and is in control. The blind QC sample target analyte recoveries are also within QC acceptance ranges. Holding times were exceeded by a few months for all samples under this request number, and the field sample data are qualified as UJ (undetected, estimated) as a result. However, because the target analyte recoveries in the blind QC sample, which contained representative HE target analytes, are acceptable and surrogate recoveries in all samples are acceptable, there is no indication of any increased uncertainty or bias, and the data may be used as reported.

Request Number 18120. Four soil field samples, AAA8741 through AAA8744, were analyzed for SW-846 Method 8330 HE. Also analyzed were a soil blank, 94.14770, and a soil blind QC sample, 94.145771.

No HE target analytes were detected in any of the field samples. The blank exhibited no detectable HE target analytes and is in control. Holding times were exceeded by a few months for all field samples. In a laboratory control sample containing all target analytes, recovery of nitrobenzene, 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene was 0%, and the recovery of the other Method 8330 target analytes was variable. However, 2-nitrotoluene, 3-nitrotoluene and 4-nitrotoluene were recovered in the blind QC sample, 94.14771. Recoveries of 2,6-DNT, 2-nitrotoluene, 3-nitrotoluene, 4-nitrotoluene, and tetryl in the blind QC sample range between 20% and 50% and are unacceptably low. Surrogate recovery values in all samples range between 93% and 109% and are acceptable. Because of the exceeded holding times and the poor target analyte recoveries in the blind QC sample and laboratory control sample, all field sample results are qualified. Results for 2,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-nitrotoluene, and tetryl are qualified UJ (undetected, estimated) because of the demonstrated ability to recover those analytes from the blind QC sample. All other results are qualified as R (rejected) because of the poor recoveries for those analytes in the laboratory control sample and the failure to demonstrate recovery of those analytes in other QC samples. Using the blind QC sample as the primary indicator of data quality, it should be expected that the results for field samples qualified as UJ (undetected estimated) at this PRS are biased low by a factor of as much as five. PETN was not a target analyte for the analyses conducted for this PRS.

Request Number 3078R. Because of the problems encountered in sample data quality for request numbers 18096 and 18120, focused resampling of this PRS was initiated in

1997. Five soil samples, 0522-97-0031 through 0522-97-0035, were analyzed for SW-846 Method 8330 HE, PETN, and nitroglycerin.

All sample preparations and analyses were completed within the recommended holding times. PETN was detected in sample 0522-97-0032 at a concentration of 311 mg/kg. Otherwise no target analytes were detected in these samples. The laboratory control sample target analytes and the surrogate recoveries in all QC and environmental samples were within acceptance criteria. The data from this resampling and analysis are usable as reported.

PRS 22-015(e)

Request Number 17832. Thirteen soil samples, AAA8752 through AAA8762, AAA8764, and AAA8765, an aqueous trip blank (AAA8815) and an aqueous field blank (AAA8816), were submitted for SW-836 VOC analyses. These samples were lost by the analytical laboratory and were not analyzed.

Request Number 17835. Seventeen soil samples, AAA8752 through AAA8762, AAA8764, AAA8765, and AAA8767 through AAA8770, were analyzed for SW-846 Method 8330 HE. Five soil blank samples, 94.12493 and 94.14257 through 94.14260, and three soil blind QC samples, 94.12494, 94.12495, and 94.12509, were submitted for the same analyses. All blank samples and blind sample 94.12494 were in control. No target analytes were detected in these field samples.

Sample holding times were exceeded by a few months for all samples under this request number. All analyte recoveries in blind QC samples 94.12495 and 94.12509 were out of control to the low side, exhibiting analyte recoveries that were generally 28% to 47% of expected values. The surrogate recoveries in samples AAA8767 through AAA8770 ranged between 30% and 33%, indicating a low bias in the analytical process. Because of these low recoveries, the data for samples AAA8767 through AAA8770 are qualified as rejected (R) during the baseline validation. Focused validation shows data may still be used during the screening assessment, recognizing that the organic concentrations should be viewed as biased significantly low, being perhaps as much as one-fifth of expected values. The uncertainty in the reported values should also be viewed as significantly greater than normal. The surrogate recoveries for samples AAA8752 through AAA8762, AAA8764, and AAA8765 ranged between 56% and 136% and are within acceptance criteria. However, the range of recoveries indicates that these results are possibly less certain than those for which recoveries are spread over a significantly narrower acceptance range. The results for these samples should also be viewed as potentially biased low because of the exceeded holding times and the low blind QC sample recoveries.

4.3.2 PRS 22-015(a), Inactive Seepage Pits

QC deviations for this PRS are summarized in Table B-2.

Request Number 18052. Seven soil samples, AAA8698, AAA8702 through AAA8704, and AAA8706 through AAA8708, a trip blank (AAA8721), and a field blank (AAA8722) were analyzed for SW-846 VOCs.

Acetone, a common laboratory contaminant, was detected only in sample AAA8702 at 22 µg/kg which is just 10% greater than the EQL. Otherwise no target analytes were detected in these samples. There is not necessarily any bias in the results because final analyses yielded acceptable target analyte and surrogate results. Samples AAA8704 and AAA8708 exceeded the recommended holding time by one day, but this is not viewed as detrimental to the quality of the associated analytical results. Although holding time was exceeded by one day (7% of the holding period), the highest rate of analyte degradation typically occurs soon after sampling and early in the storage period; therefore, the one-day holding time exceedance minimally impacts analyte recovery. Initial analyses of samples AAA8698, AAA8702, and AAA8706 showed a low recovery in the last intemal standard out of control to the low side. Reanalyses yielded all surrogates in control (ranging from 74% to 114%), but the internal standard was still out of the acceptance criteria to the low side. All target analytes for QC blind sample 94.14244 and blank samples 94.14222, 94.14215, 94.14216, 94.14218, and 94.27403 are within control limits. Because of the low recovery, all target analytes associated with that low internal standard (bromobenzene, *n*-butylbenzene, *sec*-butylbenzene, *tert*-butylbenzene, 4-chlorotoluene, 1,2-dibromo-3-chloropropane, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, isopropylbenzene, 4-isopropyltoluene, propylbenzene, 1,2,3-trichloropropane, 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene) are qualified as undetected estimated (UJ); otherwise, results are not qualified. The qualified results are left qualified to be conservative; however, any biases or increased uncertainties in those results are expected to be slight.

Request Number 18091. Two soil samples, AAA8699 and AAA8700, a blind QC sample, 94.14502, and blanks, 94.14489, 94.14490 and 94.27389, were analyzed for SW-846 VOCs.

No VOC target analytes were detected in these samples. Results for samples AAA8699 and AAA8700 are qualified as UJ (undetected estimated) because of a low 4-bromofluorobenzene surrogate recovery on repeat analyses and because of a low internal standard recovery. These low internal standard and surrogate recoveries indicate a potentially slight low bias in the results for these samples. The blind QC sample, 94.14502, and blanks, 94.14489, 94.14490 and 94.27389, analyzed with this request number had all target analytes in control.

Request Number 3073R. Four soil samples, 0522-97-0010, 0522-97-0011, 0522-97-0014, and 0522-97-0015, and two aqueous field blanks, 0522-97-0016 and 0522-97-0017, were analyzed for SW-846 Method 8260 VOCs.

The two water samples exceeded the 7-day holding time by 2 days, whereas all of the soil samples were analyzed within the recommended 14-day holding time. All matrix spike and matrix spike duplicate target analyte recoveries are within acceptance criteria. The 1,4-bromofluorobenzene recovery averaged 86% for this request number with a standard deviation equal to 4% (14 data points). With the exception of the 1,4-bromofluorobenzene recovery in one blank sample (81% recovery), the 1,4-bromofluorobenzene recovery for this request number ranged between 83% and 91%. These data indicate that one might expect a low bias of up to 20%. However, the two other surrogate compounds (toluene-d8 and dibromofluoromethane) recoveries ranged between 94% and 114% with most recoveries greater than 105%. Based on these results, it is reasonable to use the data as reported without qualification.

Request Number 18052. Seven soil samples, AAA8698, AAA8702 through AAA8704, and AAA8706 through AAA8708, were analyzed for SW-846 SVOCs.

No SVOC target analytes were detected in these samples. The percent recovery of 2-fluorobiphenyl (23%) was less than the lower acceptance limit (30%) in sample AAA8704, although this single unacceptable surrogate is not cause for data qualification. The nitrobenzene-d5, 2-fluorobiphenyl, and 2-fluorophenol recoveries (12%, 13%, and 22%) in sample AAA8708 were less than their respective lower acceptance limits (23%, 30%, and 25%), causing most results for that sample to be qualified as UJ (undetected estimated). Less than a 50% recovery of anthracene, 4-chlorophenylphenyl ether, 1,2-dichlorobenzene, fluorene, pentachlorophenol, 2,4,6-trichlorophenol, 2-chlorophenol, dibenzofuran, 2,4-dichlorophenol, 2-methylphenol, and 1,2,4-trichlorobenzene was reported for the soil blind QC sample. Most surrogate recoveries in the field samples were also less than 50%, although within acceptance criteria. The surrogate recovery statistics are as follows: 2-fluorophenol, 28% ± 8%; phenol-d5, 38% ± 13%; nitrobenzene, 28% ± 9%; 2-fluorobiphenyl, 31% ± 11%; 2,4,6-tribromophenol, 60% ± 16%; and 4-terphenyl-d14, 114% ± 5%. In conclusion, although sample AAA8708 was the only sample to have had results qualified during baseline validation, all SVOC results for this request number should be expected to be biased low by as much as a factor of three. Based on the surrogate data alone, the analytical uncertainty (one standard deviation, nine data points) in reported results is expected to be near 15% or less.

Request Number 18091. Two field soil samples, AAA8699 and AAA8700, were analyzed for SW-846 SVOCs. A blank sample, 94.14493, was also analyzed.

No target analytes were detected in these samples. The blank sample, 94.14493, analyzed with this batch of samples was in control. The surrogate recoveries were generally within acceptance criteria with two exceptions: in the surrogate samples, the recovery of 2-fluorobiphenyl was 29%, which is 1% less than the lower acceptance limit of 30%, and the 4-terphenyl-d14 recovery was 148%, which is 11% greater than the upper acceptance limit of 137%. These data may be used as reported.

Request Number 18093. Seven soil samples, AAA8698, AAA8702 through AAA8704, and AAA8706 through AAA8708, were analyzed for SW-846 Method 8330 HE. A soil blank sample, 94. 14518, and a blind QC sample, 94.14519, were also analyzed.

Holding times were exceeded by a few months for all samples. The soil blank, 94.14518, exhibited no detectable target analytes and is in control. Recoveries of 2,6-DNT, o- m- and p-nitrotoluene, and tetryl were approximately 40% to 50% in the blind QC sample. Surrogate recoveries range between 95% and 109% and are acceptable. Because of the exceeded holding times, the data are qualified as UJ (undetected, estimated). Using the blind QC sample as the primary indicator of data quality, analyte recoveries in the field samples could be expected to be biased low by a factor of approximately two. PETN was not a target analyte for this sampling event.

Request Number 18120. Two samples, AAA8699 and AAA8700, were analyzed for HE under request number 18120. Data quality for these analyses is discussed in Section 4.3.1.

Request Number 3075R. Because of the problems encountered in sample data quality for request number 18093, focused resampling of this PRS was initiated. Four soil samples, 0522-97-0010, 0522-97-0011, 0522-97-0014, and 0522-97-0015, were analyzed for SW-846 Method 8330 HE, PETN, and nitroglycerin.

All sample preparations and analyses were completed within the recommended holding times. No target analytes were detected in any of these samples The laboratory control sample target analytes and the surrogate recoveries in all QC and environmental sample results were within acceptance criteria. The data for this request number are usable as reported.

4.3.3 PRS 22-015(b), Inactive Explosives Sump and Outfall

QC deviations for this PRS are summarized in Table B-3.

Request Number 17799. Fifteen soil samples, AAA8716 through AAA8726, and AAA8728 through AAA8731, an aqueous trip blank (AAA8813), and an aqueous field blank (AAA8814) were analyzed for SW-846 VOCs. All these samples were lost by the analytical laboratory and were not analyzed. Focused resampling was conducted in 1997 (request number 3081R) to compensate for the lost samples.

Request Number 3081R. Twelve soil samples, 0522-97-0018 through 0522-97-0029, and one aqueous field blank, 0522-97-0030, were analyzed for SW-846 Method 8260 VOCs.

Toluene was detected in sample 0522-97-0023 at 6.8 µg/kg. Otherwise, no target analytes were detected in any of the samples. The soil samples were all analyzed within the 14-day holding time, but the water sample was analyzed five days after the 7-day holding time had expired. Because only toluene was detected in a single soil field sample at very low concentration and all field samples were analyzed within the soil holding time, the failure to analyze the aqueous field blank within prescribed water holding times is of no concern. Samples 0522-97-0021, 0522-97-0023, 0522-97-0024, and 0522-97-0028 had low 1,4-dichlorobenzene internal standard recovery. This could indicate a potential low bias in analyte results if the low internal standard areas are caused by matrix interference or poor sample purging efficiency. However, the internal standards are added to the samples to compensate for such effects, and low internal standard recoveries do not, by themselves, lead to a conclusion of low bias in analyte concentrations. A high bias in analyte concentrations would result if the amount of internal standard added to the samples was lower than intended. High recoveries of surrogate 1,4-bromofluorobenzene in samples 0522-97-0021, 0522-97-0023, 0522-97-0026, and 0522-97-0028 range between 126% and 139%. Sample 0522-97-0024 exhibits a recovery of 116%, which is also elevated but within the 121% upper acceptance limit. Other surrogate recoveries are within acceptable ranges. Therefore, no definitive conclusion can be drawn concerning whether the target analyte results are biased high or low. The single detected target analyte, toluene, is not quantitated against 1,4-dichlorobenzene, so the low recovery of that internal standard has no bearing on the reported toluene concentration. All nondetected target analytes in these samples have been qualified as UJ (undetected, estimated) because of the low internal standard recoveries and high surrogate recovery. The data may be used as reported with the consideration that reported analyte concentrations could be slightly less certain than expected, and the detected toluene result in 0522-92-0023 is qualified J (estimated).

Request Number 17801. Fifteen soil samples, AAA8716 through AAA8726 and AAA8728 through AAA8731, were analyzed for SW-846 Method 8330 HE. No HE compounds were detected in the samples for this PRS.

Holding times were exceeded for all field and QC samples, except for QC blind sample 94.12208. In some cases, the samples were held nearly seven months beyond holding times. One soil blank sample, 94.12209, and four aqueous blank samples, 94.12210, 95.14230, 95.14231, 95.14232, exhibited no detectable HE compounds and are in control. Two QC blind soil samples, 94.12206 and 94.12207, for which holding times were exceeded by a few months, have target analyte concentrations from 20% to 50% of expected values and are generally out of control. Water QC blind sample 94.12208, which was analyzed within holding times, had all analytes in control with only nitrobenzene approaching an out-of-control condition. Five of 25 surrogate recovery values for surrogate field and QC samples are less than 60% and range between 28% and 58%. Recovery values for two surrogates are greater than 125%, the higher of which is 162%. The average surrogate percent recovery is 75%, indicating a low bias in the analysis step alone. Because the holding times were exceeded, analyte results for the QC blind samples submitted at the same time as the field samples should be the best indicators of any biases associated with field sample results. QC blind sample recovery data indicate a low bias of as much as a factor of five (20% recovery). The analyte 2,4,6-trinitrotoluene, in particular, had a 36% recovery (0.54 mg/kg) in soil blind QC sample 94.12206. This result compares to the 0.38 mg/kg of 2,4,6-trinitrotoluene reported for field sample AAA8714 and leads one to expect that the reported 2,4,6-trinitrotoluene concentration for sample AAA8714 should be closer to 1.2 mg/kg. All method 8330 analyte results are qualified UJ. PETN was not a target analyte for this round of sampling and analysis.

Request Number 3082R. Because holding times were exceeded for the first round of sampling at this PRS and it was necessary to include PETN in the TAL, a resampling and analysis of this PRS was undertaken. Twelve soil samples, 0522-97-0018 through 0522-97-0029, were analyzed for SW-846 Method 8330 HE, PETN, and nitroglycerin. All sample preparations and analyses were completed within the recommended holding times. Tetryl was detected in sample 0522-97-0028 at a concentration of 0.4 mg/kg, and 2,4-dinitrotoluene was reported at 5.8 mg/kg in 0052-97-0029. However, the detection of 2,4-dinitrotoluene is a reporting error; 2,4-dinitrotoluene was not present in that sample (Tom Johnston with Stephanie Schultz, personal communication, July 1997). With the exception of tetryl in sample 0052-97-0028, no target analytes were detected in these samples. The laboratory control sample target analytes and the surrogate recoveries in all QC and environmental samples were within acceptance criteria. Data are usable as reported.

5.0 SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 PRSs 22-012, 22-015(d), and 22-015(e); Explosives Sump Aggregate

The TA-22 explosives sump aggregate, shown in Figure 5.1-1, consists of an inactive explosives sump (22-015[e]) and wash pad (22-012) with an associated inactive seepage pit (22-015[d]); all served Building 22-1. No constituents were reported in any sample at a concentration greater than SAL, and the aggregate is recommended for NFA.

5.1.1 History

This aggregate is discussed in further detail in Section 5.3 of the RFI work plan for OU 1111 (LANL 1993, 26068).

In 1948, an acetone-based process for recrystallization of PETN 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 22-1 and the seepage pit. The purpose of this sump was to allow the settling and recovery of suspended PETN from process waste water associated with HE wet grinding and pressing operations at TA-22-1. The estimated total amount of HE that drained into the seepage pit is approximately 0.02 lb. (Meyers 1993, 15072). A concrete wash pad (PRS 22-012) for cleaning explosives-contaminated equipment was 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 drained and filled with concrete, and discharges to PRS 22-015(d) were discontinued.

PRSs 22-012 (wash pad) and 22-015(e) (sump) are located on the south side of Building 22-1. The area surrounding the sump and wash pad is covered with asphalt for at least 20 ft in all directions. A 6-in. vitrified clay pipe drain line from the sump extends approximately 150 yards in a southeasterly direction to the seepage pit [22-015(d)], which was excavated through soil and into tuff. As discussed in the work plan, the pit is a simple excavation that was dug in 1948 and filled with a layer of gravel and a layer of sand to catch solid explosives from waste water. No as-built drawings are available; however, the pit does not appear to have an internal waste water distribution or vent system. The RFI determined that the pit bottom is approximately 10.5 ft below ground surface. The elevation of the drain line at the point of entry to the pit is unknown, and no information is available regarding the amount of sludge material that may be present in the pit. The drain line and the seepage pit make up PRS 22-015(d).

Potential contaminants at these PRSs include HE (particularly PETN), acetone, and other organic solvents.

5.1.2 Description

Area geology, hydrology, soils, or wildlife habitat information associated with this PRS aggregate is presented in Chapter 2.

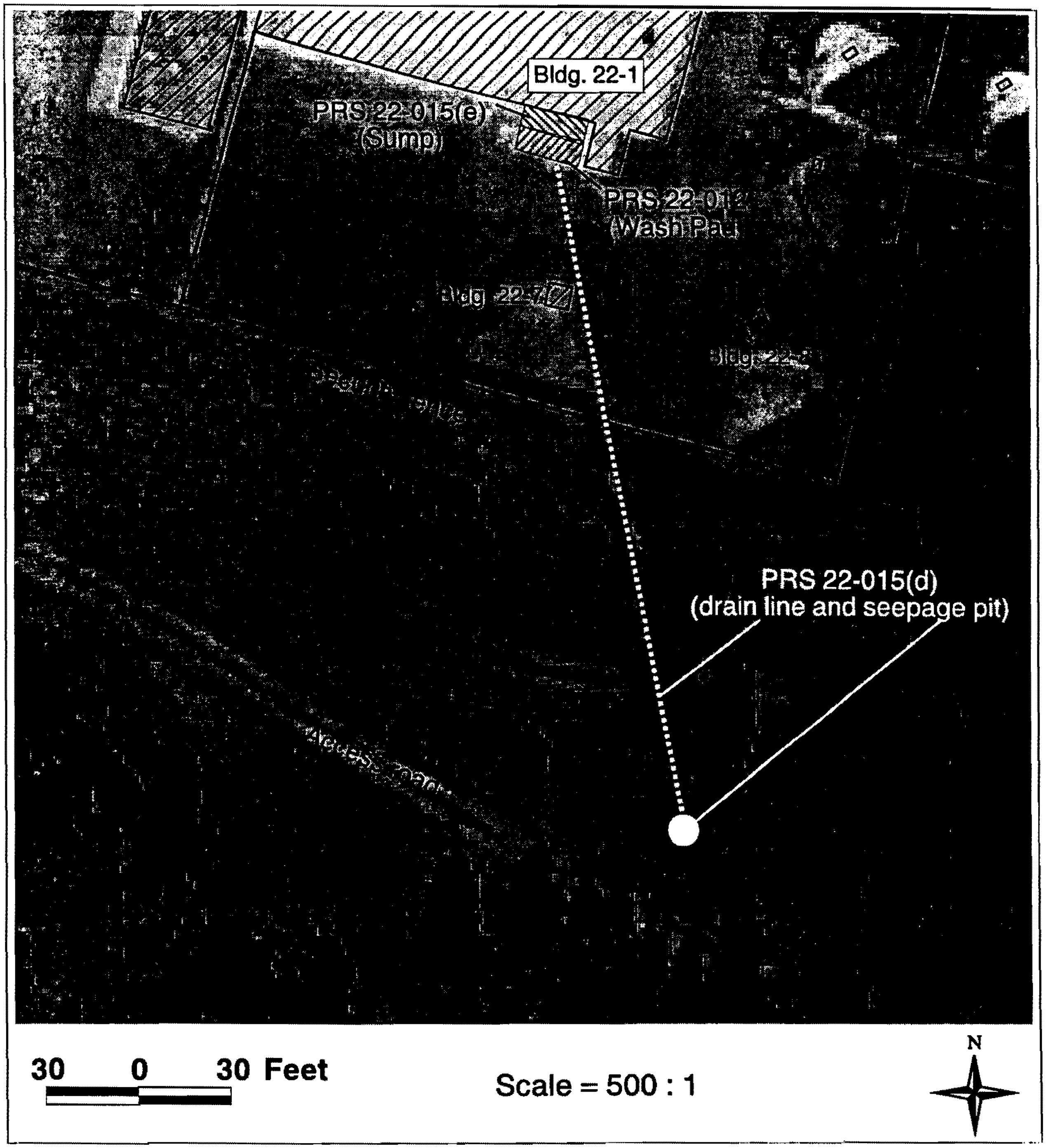

Figure 5.1-1. Facilities and features at PRSs 22-012, 22-015(d), and 22-015(e), Explosives sump aggregate.

5.1.3 Previous Investigation(s)

No previous investigations have been performed at this site.

5.1.4 Field Investigation

The objectives of the RFI investigations at this PRS aggregate were

- to determine whether media associated with the explosive sump, wash pad, or seepage pit were contaminated from past operational releases, and
- if contamination was present, to determine if it represented an unacceptable human health risk, based on the results of the human health screening assessment.

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 release scenario. Waste effluent drained through the sump, where most bulk and suspended contaminants settled. Supematant from the sump, with less contamination and reduced waste loading, was then released through an underground drain line to the seepage pit, where it percolated into the surrounding soil matrix. Aqueous effluent from equipment washing at PRS 22-012 (wash pad) drained directly to the sump; any spillage or overspray was the source of potential surface soil contamination. Any remaining contaminants from the recrystallization or equipment-washing processes were retained in the seepage pit media or surrounding soil matrix.

The sump, wash pad, seepage pit, and surrounding soils are the primary sources of possible contaminants, and the seepage pit fill material is assumed to be the most impacted media. Site investigations were designed to assess the presence of environmental releases from leaks, spills, and normal operations related to the system during its history.

All locations, during each sampling activity, were field screened for radioactivity, organic vapors, and HE before samples were collected. All field screening results were negative or at background levels.

The first sampling activities occurred between June 22 and July 11, 1994.

- *PRS 22-012.* Nine surface samples (0–0.5 ft) were collected from around the perimeter of the inactive sump and wash pad. Three of these samples consisted of asphalt material (collected at the surface) to be analyzed for HE compounds. Six surface soil samples were collected around the perimeter of the pad. Two samples were collected from each of the three sides, one at 3 in. from the side of the pad and a second at 12 in. from the pad. These samples were collected from the middle of the side or from areas judged downgradient by the field team. Two of these surface soil samples (AAA8774 and AAA8775) were collected following the removal of the overlying asphalt pad. All samples were analyzed for HE compounds (excluding PETN). No VOC or 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 by 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).* Soil borehole samples were collected from four hand-augered boreholes (one at each corner of the sump). Each boring was sampled at three intervals. These borings were sampled at 0–0.5-ft, 3-ft, and 6.5-ft depths, except for the southwest corner boring, which was not sampled at the 6.5-ft depth. Four surface asphalt samples (0–0.5 ft) were collected at three locations around the inactive sump. These samples were analyzed for HE only. The sump contents or interior were not sampled because the sump had been filled with concrete. The area of the sump outfall pipe was also sampled at the 0–0.5-ft and 3.5-ft depth. 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 equidistant around the perimeter and just outside the pit. Samples were taken from the borings at 0–0.5 ft, 10 ft, 20 ft, and 25 ft (approximately 3 ft below what was then reported to be the bottom of the pit) (Richard Romero with Wilbert Meyers, personal communication, May 6, 1994). 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 first sampling event characterized 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 drain line 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 eliminate the PETN data gap through the characterization of source term material in the seepage pit.

- *PRS 22-015(d).* 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 at 19–20 ft. One sample was collected from the area of a pipe joint in an exposed section of the drain line. This sample (location 22-6070) consisted of soil taken from beneath the open end of the pipe and sediment deposited inside the pipe. These samples were analyzed for HE compounds, including PETN and VOCs.

Table 5.1.4-1 summarizes samples taken at these PRSs. Figure 5.1.4-1 shows sampling locations for both sampling events. Sample numbers with the format AAAxxxx are from the 1994 investigation, while numbers with the format 0522-97-xxxx are from the 1997 investigation.

5.1.5 Evaluation of Inorganic Chemicals

No inorganic analyses were performed at this PRS aggregate.

5.1.6 Evaluation of Radionuclides

No radionuclide analyses were performed at this PRS aggregate.

TABLE 5.1.4-1
SUMMARY OF SAMPLES TAKEN AT THE PRS AGGREGATE

Location ID	Sample ID	Depth (ft)	Media	HE[a]	Organics[a]
22-015(d)					
22-3028	AAA8737	0–0.5	soil	18096	18092
22-3028	AAA8738	9–10	soil	18096	18092
22-3028	AAA8739	19–20	tuff	18096	18092
22-3028	AAA8740	23–24	tuff	18096	18092
22-3029	AAA8741	0–0.5	soil	18120	18091
22-3029	AAA8742	9–10	soil	18120	18091
22-3029	AAA8743	19–20	tuff	18120	18091
22-3029	AAA8744	24–25	tuff	18120	18091
22-3030	AAA8745	0–0.5	soil	18096	18092
22-3030	AAA8746	9–10	soil	18096	18092
22-3030	AAA8747	19–20	tuff	18096	18092
22-3030	AAA8748	27.5–28.5	tuff	18096	18092
22-6069	0522-97-0031	9–10	pit fill	3078R[b]	3077R
22-6069	0522-97-0032	10.5–11.5	pit/tuff interface	3078R[b]	3077R
22-6069	0522-97-0033	15–16	tuff	3078R[b]	3077R
22-6069	0522-97-0034	19–20	tuff	3078R[b]	3077R
22-6070	0522-97-0035	0–0.5	soil	3078R[b]	3077R
22-012					
22-3039	AAA8771	0–0.5	soil	17835	NA[c]
22-3040	AAA8772	0–0.5	soil	17835	NA
22-3041	AAA8773	0–0.5	soil	17835	NA
22-3042	AAA8774	0–0.5	soil	17835	NA
22-3043	AAA8775	0–0.5	soil	17835	NA

a. Request numbers.
b. HE suite includes PETN.
c. NA = not applicable.

TABLE 5.1.4-1 (concluded)

Location ID	Sample ID	Depth (ft)	Media	HE[a]	Organics[a]
22-012					
22-3044	AAA8776	0–0.5	soil	17835	NA
22-3045	AAA8777	0–0.5	soil	17835	NA
22-3046	AAA8778	0–0.5	soil	17835	NA
22-3047	AAA8779	0–0.5	soil	17835	NA
22-015(e)					
22-3031	AAA8752	0–0.5	soil	17835	17832
22-3031	AAA8753	3.5	soil	17835	17832
22-3031	AAA8754	6.5	soil	17835	17832
22-3032	AAA8755	0–0.5	soil	17835	17832
22-3032	AAA8756	3.5	soil	17835	17832
22-3032	AAA8757	6.5	soil	17835	17832
22-3033	AAA8758	0–0.5	soil	17835	17832
22-3033	AAA8759	3.5	soil	17835	17832
22-3033	AAA8760	6.5	soil	17835	17832
22-3034	AAA8761	0–0.5	soil	17835	17832
22-3034	AAA8762	3.5	soil	17835	17832
22-3035	AAA8764	0–0.5	soil	17835	17832
22-3035	AAA8765	3.5	soil	17835	17832
22-3036	AAA8767	0–0.5	soil	17835	NA
22-3037	AAA8768	0–0.5	soil	17835	NA
22-3038	AAA8769	0–0.5	soil	17835	NA
22-3038	AAA8770	0–0.5	soil	17835	NA

a. Request numbers.

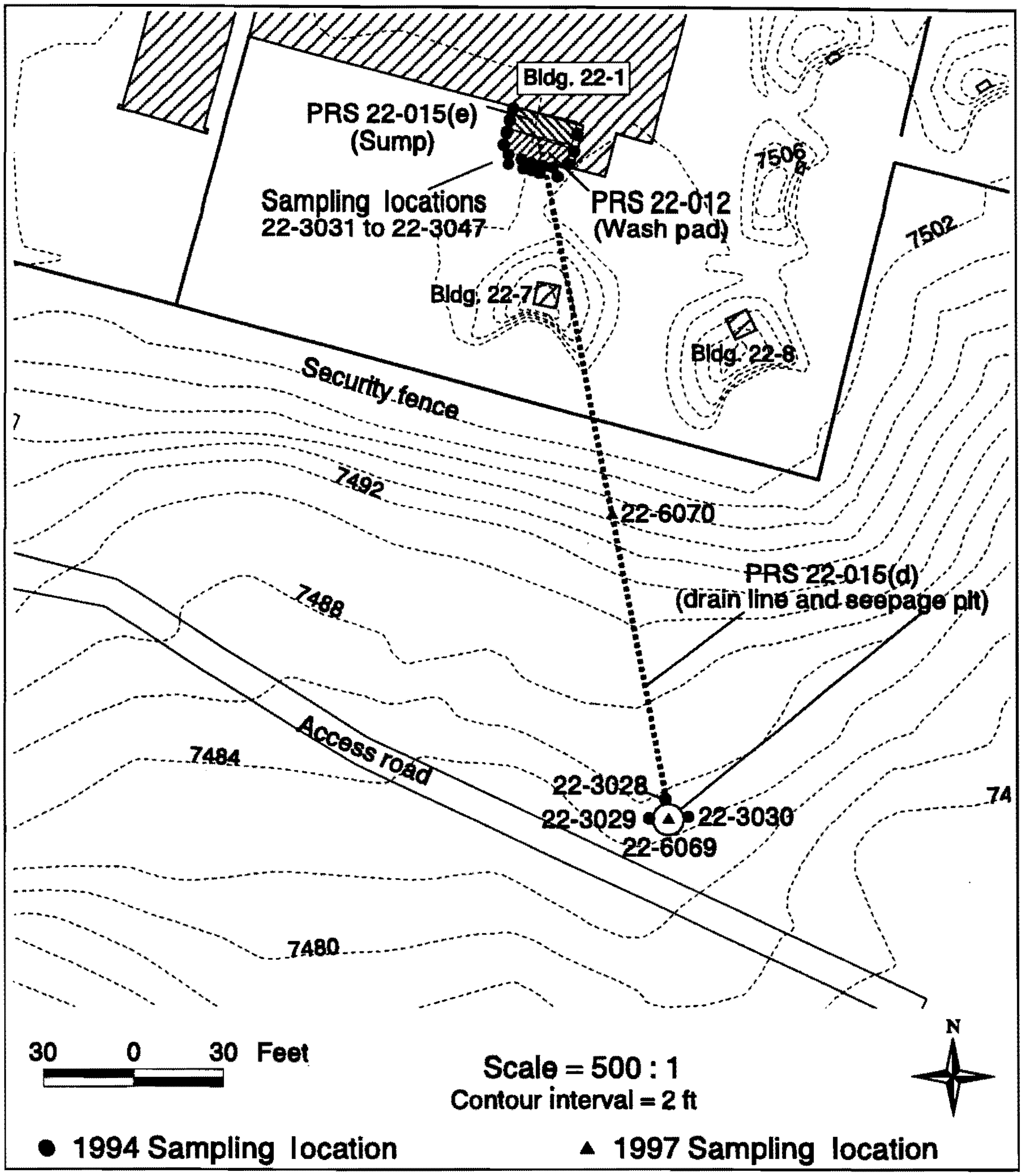

Figure 5.1.4-1. Sampling locations at the PRS aggregate.

5.1.7 Evaluation of Organic Chemicals

Detected organic chemicals for this PRS aggregate are presented in Table 5.1.7-1. The results of the focused data validation (Section 4.3) indicate that the HMX data from the first sampling event may have been reported at one-fifth of actual concentrations. However, the data was used with that consideration, recognizing that even if the concentration of HMX were multiplied by a factor of five (to values of 12.3 and 7.25

mg/kg), it would still be well below the SAL of 3300 mg/kg. All HE analyses for the second sampling event under request number 3078R are usable as reported.

TABLE 5.1.7-1
DETECTED ORGANIC CHEMICALS FOR PRS AGGREGATE

Sample ID	Depth (ft)	HMX (mg/kg)	PETN (mg/kg)
SAL	NA	3300	1600
EQL	NA	2.2	0.5
AAA8777	0–0.5	**2.46***	NA
AAA8778	0–0.5	1.48	NA
0522-97-0032	10.5–11.5	0.165	**311**

*****Bold**, enlarged values indicate concentrations above EQLs.*

No VOCs or SVOCs were reported as detected in any samples collected during the 1994 or 1997 sampling. All HE analyses exceeded holding times for the 1994 sampling, and PETN was not identified for analysis in the HE suite. HMX was detected in surface soils associated with the sump and wash pad at 2.46 and 1.48 mg/kg in samples AAA8777 and AAA8778, respectively. However, no HMX was detected during the second sampling event.

PETN was detected in one 1997 sample (0522-97-0032) taken at the pit/tuff interface of the seepage pit at a concentration of 311 mg/kg. PETN was reported as undetected in the other three pit samples. No other HE was reported as detected in any other sample taken during the 1997 investigation.

As a result of this evaluation, HMX and PETN were identified as COPCs and will be evaluated further during the screening assessment.

5.1.8 Risk-Based Screening Assessment

No COPCs were identified at concentrations that exceed SALs. Two HE compounds, PETN and HMX, were reported in site samples at levels that exceeded EQLs. PETN and HMX, both noncarcinogens, were included in the calculation for an MCE. The results of the MCE are presented in Table 5.1.8-1.

The sum of the normalized values for PETN and HMX is 20% of unity, which indicates that detrimental human health effects from exposure to these measured concentrations is highly unlikely.

5.1.9 Human Health Risk Assessment

No human health risk assessment was performed for these PRSs because no COPCs were identified.

TABLE 5.1.8-1

MCE FOR NONCARCINOGENS AT PRS AGGREGATE

Chemical	Location ID	Sample ID	Maximum Sample Value*	Soil SAL*	Normalized Value
PETN	22-6069	0522-97-0032	311	1600	0.19
HMX	22-3045	AAA8777	2.46(U)	3300	0.0007
				Total	**0.2**

* Concentrations are in mg/kg.

5.1.10 Preliminary Ecological Assessment

In cooperation with the New Mexico Environment Department and EPA Region 6, the Laboratory ER Project is developing an approach for ecological risk assessment. Further ecological risk assessment at this aggregate, PRSs 22-012 and 22-015(d and e), will be deferred until this PRS aggregate can be assessed as part of the ecological exposure unit methodology currently being developed.

5.1.11 Conclusions and Recommendations

This PRS aggregate has been characterized and assessed based on the results of two investigations to support a screening assessment decision. Based on operational history, it was believed that any contamination present at the aggregate would be at low levels. The first sampling event indicated low levels of HMX contamination associated with the sump and wash pad area; HMX was detected at 1.48 and 2.46 mg/kg in surface soils. These results are more than two orders of magnitude below the risk-based soil SAL. No HE or other organic compounds were reported as positively detected in any samples from the initial seepage pit investigation.

Data review and assessment indicated that the first sampling results were limited by analytical problems, i.e., missed holding times for HE, the failure to include PETN in the requested suite for HE analysis, and a failure to characterize the worst-case source term at the PRS aggregate, i.e., the seepage pit contents.

While focused data validation indicates that the HE data are acceptable for use in site decision making, additional sampling of the seepage pit was conducted to fully characterize the potential source term (seepage pit media) and fill the data gap in PETN analysis. It was assumed that HE and PETN concentrations in the seepage pit would represent the maximally impacted media, and if no result exceeded SAL or no MCE total equaled or exceeded 1.0, no additional action would be necessary, and the aggregate could be proposed for NFA (Environmental Restoration Project 1997, ER ID 56176).

The additional investigation of the seepage pit resulted in a single reported occurrence of PETN at less than 20% of SAL at the bottom of the pit. No HE was detected in two undisturbed tuff samples below the bottom of the pit. No target analytes were detected in the single drain line sample analyzed.

Based on the results of both sampling events, it is concluded that no significant contamination was present at this PRS aggregate. No substantial HE or organic contamination was associated with the seepage pit fill media, surrounding soil, or drain line, and no viable human exposure pathway exists for the limited observed contamination in the seepage pit. There was also no substantial contamination associated with the surface and subsurface soils surrounding the inactive sump and wash pad. The lack of substantial PETN contamination in the seepage pit is consistent with the operational history and conceptual model of the site. In addition, it supports the conclusion that no significant contamination exists at these PRSs, based on the assumption that the seepage pit contents would represent worst-case contamination because the seepage pit was the ultimate disposal site from the contributing processes. The data indicate that the aggregate presents no unacceptable human health risk, and the PRS aggregate is recommended for NFA.

These sites are proposed for NFA, based on NFA Criterion 5. A Class III permit modification will be requested to remove this site from Hazardous and Solid Waste Amendments (HSWA) Module of the Laboratory's hazardous waste facility permit.

5.2 PRS 22-015(a)

PRS 22-015(a), shown in Figure 5.2-1, consists of two inactive seepage pits that served Building 22-91. Phase I sampling indicated the limited presence of inorganics and VOCs. The PRS is recommended for NFA.

5.2.1 History

This PRS is discussed in further detail in Section 5.3 of the RFI work plan for OU 1111 (LANL 1993, 26068).

PRS 22-015(a) is located east of Building 22-91 (Figure 5.2-1). The pits served Rooms B102, 107, 121, 123, 145, and 160, which housed printed circuit board etching operations (LANL 1993, 26068). The pits are bored through the soil and volcanic tuff and filled with 1/2-in. to 2 1/2-in. screened gravel. The southernmost pit (Pit A) is 4 ft in diameter and 26 ft deep while the northernmost pit (Pit B) is 4 ft in diameter and 20 ft deep.

From 1985 to 1987, waste from the etching operations in Building 22-91 was discharged through a 6-in.-diameter PVC drain line to the seepage pits. Before discharge, waste material was pretreated to remove most contaminants (DX-1: SOP 196, Treatment of process water from the printed circuit). 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 drain lines and abandoned in place.

Possible contaminants associated with the seepage pits and drain line are sulfuric, chromic, hydrochloric, nitric, hydrofluoric, and phosphoric acids; cyanide; aluminum and magnesium oxides; calcium oxide; sodium hydroxide; metals; trichloroethylene; and sodium carbonate.

5.2.2 Description

Area geology, hydrology, soils, or wildlife habitat information associated with this PRS is presented in Section 2.

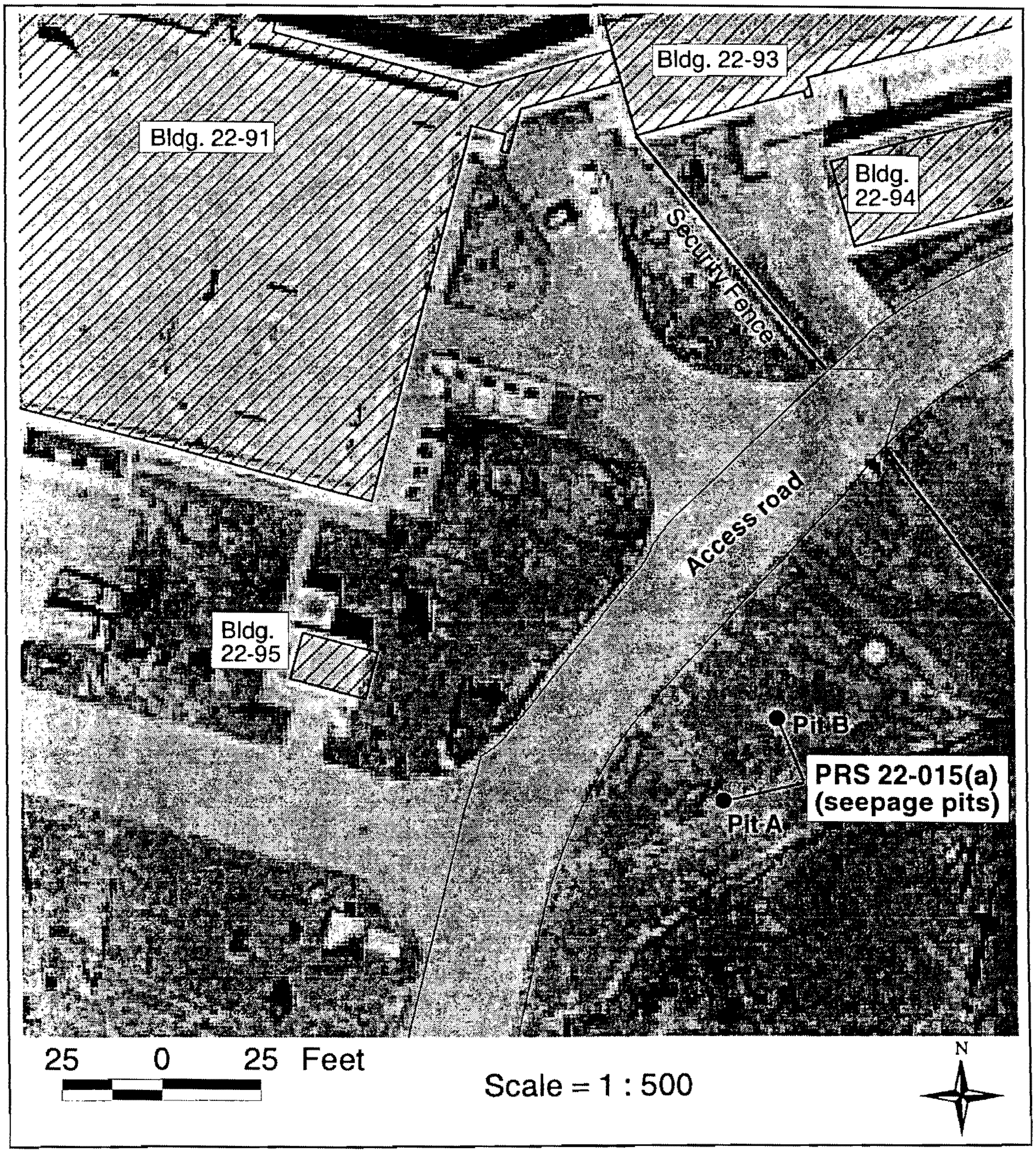

Figure 5.2-1. Facilities and features at PRS 22-015(a).

5.2.3 Previous Investigation(s)

Based on the operational history and overflow events at PRS 22-015(a), there was the potential for site-related contamination of the downgradient surface soils in the marsh area east of the seepage pits. This scenario was considered during the planning of the 1997 sampling and analysis plan. At that time, information from a 1989 DOE soil survey (LANL 1989, 21495) and a 1994 investigation of the marsh was reviewed, and the 1994 data were presented in the sampling and analysis plan (Environmental Restoration Project 1997, 56176). In the 1994 data, only one inorganic chemical had been reported in the marsh area at levels that exceed the Laboratory background UTL. Copper was reported in one of six surface soil samples at 23.8 mg/kg (UTL is 15.5, and SAL is 2800 mg/kg). Copper was not detected in the other five marsh samples, and no other target analytes were reported to exceed screening criteria in any sample. Based on this information, it was concluded that no substantial release from the seepage pits to the downgradient marsh had occurred and no further investigation of seepage pit releases to downgradient surface soils was warranted.

5.2.4 Field Investigation

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.

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 and is based on the following scenario. Waste effluent drained to a sump where settling and chemical pretreatment removed most of the bulk and suspended contaminants. Supernatant, with reduced waste loading, was then released from the sump through an underground drain line to the seepage pits, where it infiltrated into the surrounding soil matrix. Particulates and less soluble constituents were retained in the seepage pit fill material and surrounding soil matrix.

The sump, surrounding soils, and overflow area are the primary sources of possible contaminants. Site investigations were designed to assess the presence of environmental releases from normal operations or spills during the operational history.

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 5.2.4-1) 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: at the soil surface (0–6 in.), at the depth of the bottom of the pit (23–26.5 ft), and at a midpit interval (14–16 ft).

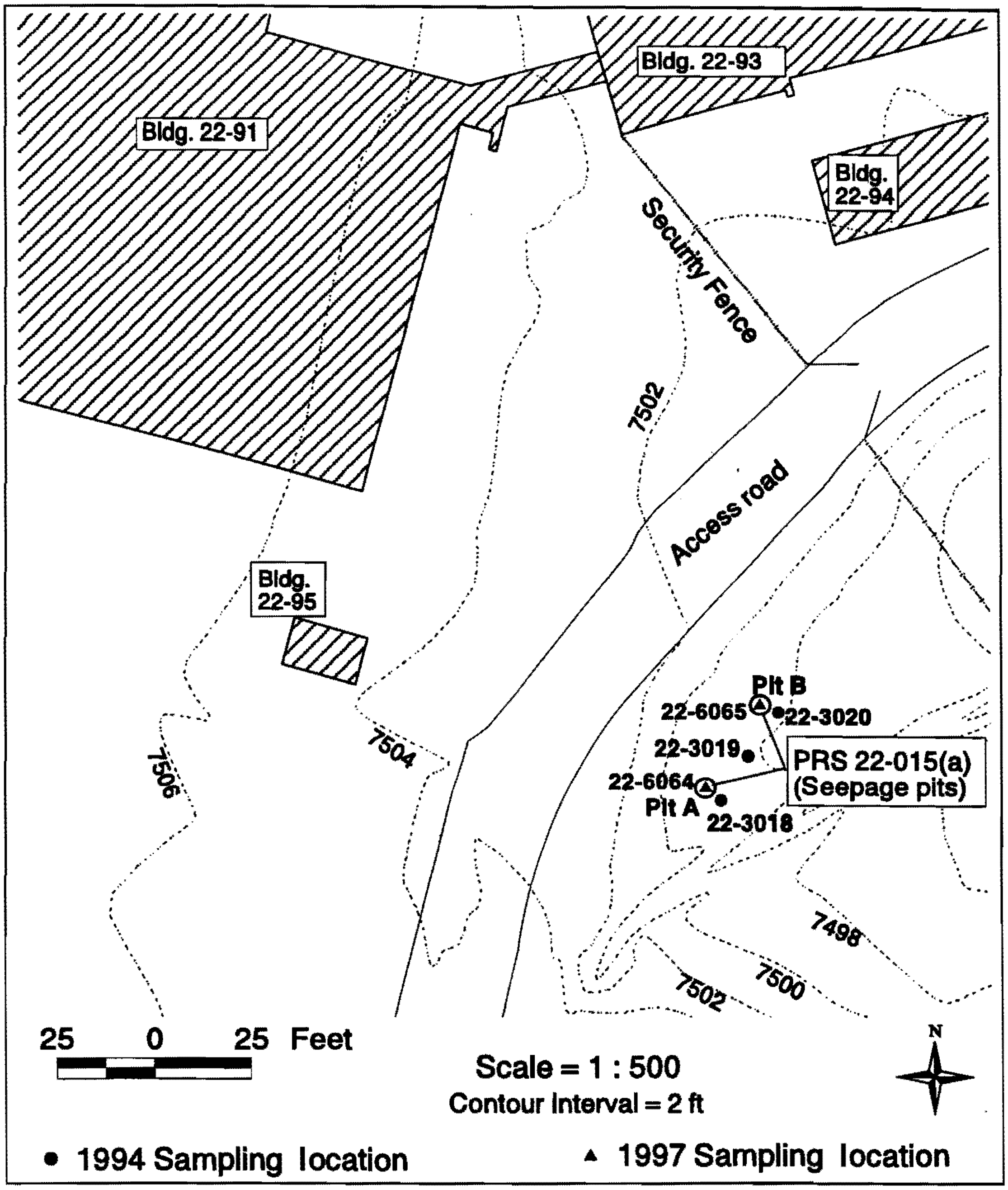

Figure 5.2.4-1. Sampling locations at PRS 22-015(a).

The samples were submitted for laboratory analysis of metals, VOCs, SVOCs, and HE. Holding times for the HE analyses were exceeded, and PETN analysis was not requested.

An additional field sampling activity to characterize the source material within the seepage pits was conducted between April 21 and April 24, 1997. One borehole was drilled through each seepage pit into the underlying tuff. Each boring was to be sampled at four intervals: Pit A at 12–14 ft, 19–20 ft, 24–26 ft, and 3 ft below the bottom of the pit and Pit B 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 consolidating 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.

Field sampling locations for both sampling events are identified in Figure 5.2.4-1. Table 5.2.4-1 presents a summary of samples taken at PRS 22-015(a). Sample ID numbers with the format AAAxxxx are from the 1994 investigation, while numbers with the format 0522-97-xxxx are from the 1997 investigation.

TABLE 5.2.4-1
SUMMARY OF SAMPLES TAKEN AT PRS 22-015(a)

Location ID	Sample ID	Depth (ft)	Media	Inorganics	HE[a]	Organics[a]
22-3018	AAA8698	0–0.5	soil	18038	18093	18052
22-3018	AAA8699	15	soil/tuff	18520	18120	18091
22-3018	AAA8700	26	Qbt4	18520	18120	18091
22-3019	AAA8702	0–0.5	soil	18038	18093	18052
22-3019	AAA8703	15	soil/tuff	18038	18093	18052
22-3019	AAA8704	26	Qbt4	18038	18093	18052
22-3020	AAA8706	0–0.5	soil	18038	18093	18052
22-3020	AAA8707	15	soil/tuff	18038	18093	18052
22-3020	AAA8708	26	Qbt4	18038	18093	18052
22-6064	0522-97-0008	no recovery	NA[b]	NA	NA	NA
22-6064	0522-97-0009	no recovery	NA	NA	NA	NA
22-6064	0522-97-0010	27.7–28.5	pit fill/tuff	3074R	3075R[c]	3073R
22-6064	0522-97-0011	29–30	Qbt4	3074R	3075R[c]	3073R
22-6065	0522-97-0012	no recovery	NA	NA	NA	NA
22-6065	0522-97-0013	no recovery	NA	NA	NA	NA
22-6065	0522-97-0014	20.5– 1.5	pit fill/tuff	3074R	3075R[c]	3073R
22-6065	0522-97-0015	23–24	Qbt4	3074R	3075R[c]	3073R

a. Request numbers
b. NA = not applicable
c. HE suite includes PETN analysis

5.2.5 Evaluation of Inorganic Chemicals

Inorganic chemicals with concentrations at or above background at PRS 22-015(a) are presented in the Table 5.2.5-1. All data are usable as reported (Section 4.1.2).

Analyses of samples taken during the investigation indicate that copper is present in seven of eight samples at concentrations that exceed media-specific background screening values. No further statistical evaluation of the results was performed; copper was identified as a COPC and will be evaluated further during the screening assessment.

TABLE 5.2.5-1
INORGANIC CHEMICALS WITH CONCENTRATIONS AT OR ABOVE BACKGROUND SCREENING VALUES FOR PRS 22-015(a)

Sample ID	Depth (ft)	Media	Copper (mg/kg)
SAL	NA[a]	NA	2800
Soil UTL[b]	NA	NA	15.5
Qbt4 UTL	NA	NA	6.43
0522-97-0010	27.7–28.5	fill/tuff	**119.2**[c]
0522-97-0010[d]	27.7–28.5	fill/tuff	**122**
0522-97-0011	29–30	Qbt4	**9.6**
0522-97-0014	20.5–21.5	fill/tuff	**126**
0522-97-0015	23–24	Qbt4	**127**
AAA8698	0–0.5	soil	**362**
AAA8698	0–0.5	soil	**402**
AAA8706	0–0.5	soil	**35.4**

a. NA = not applicable
b. UTL of Laboratory-wide soil background data from A, B, and C soil horizons
c. Enlarged, **bold** values are above the background UTL.
d. Laboratory duplicate.

Calcium, magnesium, and barium were each reported in one sample (AAA8707) at concentrations that exceeded Qbt4 background but did not exceed the surface soil UTL. Because these samples were a mixture of soil and tuff, it would not be unexpected that the analytical result would somewhat exceed the Qbt4 UTL value. Because these chemicals were above the background UTLs in only one sample, and other samples failed to exceed the surface soil UTLs, calcium, barium, and magnesium were eliminated from further consideration.

5.2.6 Evaluation of Radionuclides

Because past operations did not include the use of radionuclides, no radionuclide analyses were performed.

5.2.7 Evaluation of Organic Chemicals

Detected organic chemicals at PRS 22-015(a) are presented in Table 5.2.7-1. Qualifiers were assigned during baseline data validation (Section 4.3.2); all data are usable as reported. Relevant decisions on organic data usage are discussed below. HE data from the first site investigation were qualified UJ, all results are potentially biased low by a factor of two. If concentrations of acetone were multiplied by a factor of two to account for low recovery (yielding acetone concentrations of .052 and .016 mg/kg), resulting concentrations are still well below the SAL.

TABLE 5.2.7-1
DETECTED ORGANIC CHEMICALS FOR PRS 22-015(a)

Sample ID	Depth (ft)	Acetone (mg/kg)
SAL	NA[a]	2100
EQL	NA	0.02
0522-97-0011	29–30	**0.026**[b]
0522-97-0014	20.5–21.5	0.008(J)

a. NA = not applicable
b. **Bold**, enlarged value indicates results above EQL.

Samples from the first sampling event were not analyzed for PETN, but samples from the second sampling event were. Based on the results of both sampling events and no reported use of HE in this PRS, HE was eliminated from further consideration. 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 samples were associated with laboratory contamination. Therefore, acetone was identified as a COPC and will be evaluated further during the screening assessment.

5.2.8 Risk-Based Screening Assessment

No COPCs at PRS 22-015(a) were reported at concentrations exceeding SALs.

Copper and acetone were identified as COPCs. Both COPCs are noncarcinogens; the maximum observed concentration for each chemical was included in the calculation for an MCE. The total normalized MCE for noncarcinogenic effects is <0.1, and the results are presented in Table 5.2.8-1. The MCE result indicates that detrimental human health effects from exposure to these measured concentrations is highly unlikely.

5.2.9 Human Health Risk Assessment

No human health risk assessment was performed for PRS 22-015(a) because no COPCs were identified.

5.2.10 Preliminary Ecological Assessment

In cooperation with the New Mexico Environment Department and EPA Region 6, the Laboratory ER Project is developing an approach for ecological risk assessment. Further ecological risk assessment at PRS 22-015(a) will be deferred until the site can be assessed as part of the ecological exposure unit methodology currently being developed.

TABLE 5.2.8-1
MCE FOR SOIL SAMPLES AT PRS 22-015(a)

Chemical	Location ID	Sample ID	Maximum Sample Value*	Soil SAL*	Normalized Value
Acetone	22-6064	0522-97-0011	0.026	2100	0.00001
Copper	22-3018	AAA8698	402	2800	0.14
				Total	**0.1**

* Concentrations are in mg/kg.

5.2.11 Conclusions and Recommendations

The first sampling event indicated the presence of copper at levels greater than background in surface soil samples downgradient of the seepage pits. This is consistent with the operational history and conceptual model of the site, which identified the occasional overflow from the pits before their abandonment. No concentration exceeded SAL, and no other TAL metals exceeded the background UTL. In addition, no HE was detected in any sample, although holding times were missed, and PETN analysis was overlooked.

The second sampling event indicated copper was present inside both pits and immediately below Pit B at levels greater than media-specific background. Acetone was reported at trace levels in both pits, and although it could be associated with laboratory contamination, it was included as a COPC for an MCE. The total normalized value of 0.1 indicates that the site does not present an unacceptable human health risk.

Both site characterizations support the assumption that, if present, contamination would consist of low levels of inorganic chemicals. No substantial use and discharge of organics and HE was expected or found at the PRS. As characterized, the sampling events have adequately addressed the potential worst-case impacted media during the biased sampling, and additional review of downgradient marsh data indicates no migration or release to that area. The combined weight of evidence from all investigations indicates that no substantial contamination is present at the site.

No human health COPCs were identified, and NFA is recommended. This recommendation is based on NFA Criterion 5. A Class III permit modification will be requested to remove this site from HSWA Module of the Laboratory's hazardous waste facility permit.

5.3 PRS 22-015(b)

PRS 22-015(b), shown in Figure 5.3-1, is an inactive explosives sump and associated outfall area. No contamination of concern is present, and the PRS is proposed for NFA.

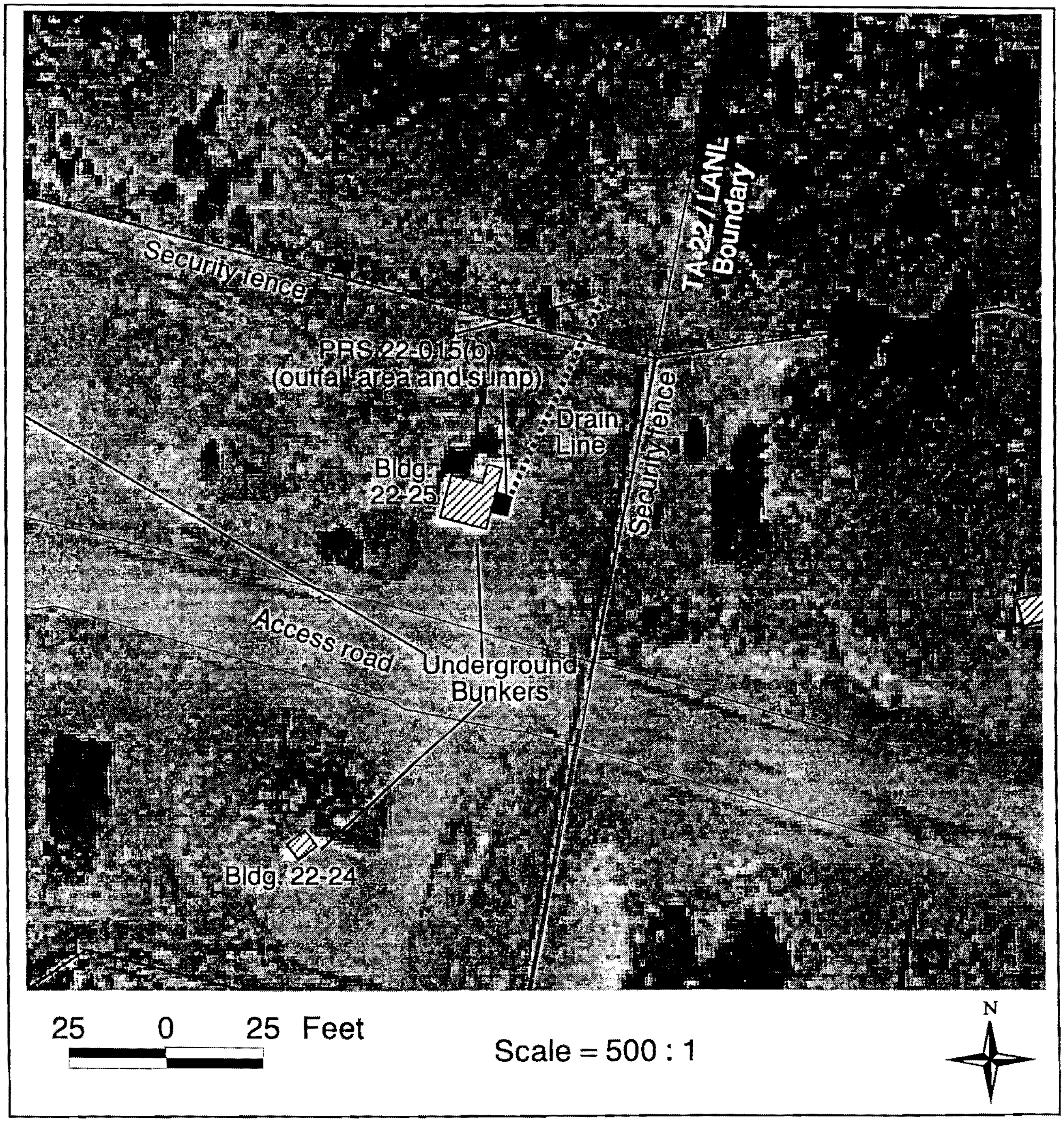

Figure 5.3-1. Facilities and features at PRS 22-015(b).

5.3.1 History

This PRS is discussed in further detail in Section 5.3 of the RFI work plan for OU 1111 (LANL 1993, 26068).

The inactive sump is located on the east side of Building 22-25 and received mixtures of PETN and solvents (acetone) from a PETN recrystallization process. It was used from 1949 to the 1960s when it was abandoned in place. The drain line to the outfall area is still in place. The maximum amount of HE that could have drained into the sump is approximately 1 lb. (Meyers 1993, 15072). The volume of acetone and other solvents that may have passed through the lines is unknown. HE and VOCs were identified as potential contaminants for investigation.

5.3.2 Description

Area geology, hydrology, soils, or wildlife habitat information associated with this PRS is presented in Chapter 2.

5.3.3 Previous Investigation(s)

No previous investigations have been performed at this site.

5.3.4 Field Investigation

The objectives of the investigations at PRS 22-015(b) were

- to determine if media associated with the sump or outfall area were contaminated because of past operational releases, and
- if contamination was present, to determine if it represented an unacceptable human health risk, based on the results of the human health screening assessment.

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 and is based on the following scenario. Waste effluent was released to the sump where settling of most bulk and suspended contaminants occurred. Supernatant from the sump, with a reduced waste loading, was released through an underground drain line 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. Any solvents released to the outfall area would further volatilize or percolate into the surrounding soils.

The surface and subsurface soils associated with the sump, drain line, and outfall area are the primary sources of possible contaminants. The investigations were designed to assess the presence of environmental releases from leaks, spills, and normal operations related to the system during its history.

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.

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 point of connection of the sump and drain line were characterized as outlined in the work plan. 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. No samples were taken in the sump because there was no liquid or sludge present. 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.

A second sampling event, conducted between April 21 and April 24, 1997, was performed to fully characterize the sump and outfall area and 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 4 ft at the northeast comer 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 5.3.4-1. Table 5.3.4-1 presents a summary of samples taken. Sample ID numbers with the format AAAxxxx are from the 1994 investigation, while numbers with the format 0522-97-xxxx are from the 1997 investigation.

5.3.5 Evaluation of Inorganic Chemicals

No inorganic analyses were performed for this PRS.

5.3.6 Evaluation of Radionuclides

No radionuclide analyses were performed for this PRS.

5.3.7 Evaluation of Organic Chemicals

Detected organic chemicals at PRS 22-015(b) are presented in Table 5.3.7-1. The results of the focused data validation are presented in Section 4.3.3. All undetected VOCs were qualified UJ because of low intemal standard and high surrogate recoveries. However, as a result of focused validation, the data are usable as reported, and all VOC target analytes, except toluene, are considered to be undetected.

The first HE sampling results detected no HE target analytes, and focused validation of the data indicated potential low bias of up to 80% in the results. Focused validation of the second sampling event indicated that all data are usable as reported, and tetryl, reported at 0.428 mg/kg in one surface soil sample, was the only HE target analyte detected.

Toluene and tetryl have been identified as COPCs and will be evaluated further during the screening assessment.

5.3.8 Risk-Based Screening Assessment

No COPCs were identified at concentrations that exceed SALs.

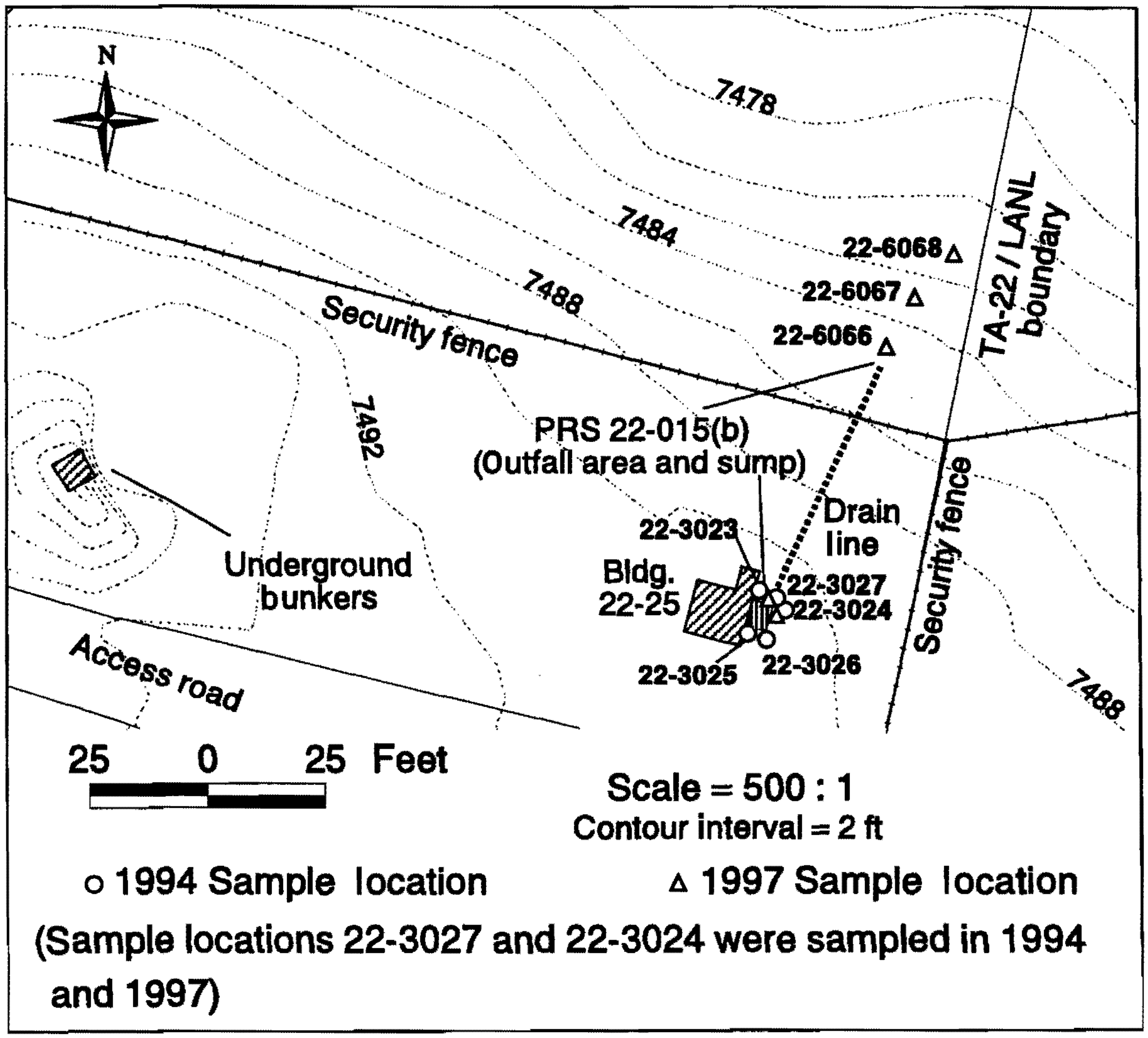

Figure 5.3.4-1. Sampling locations at PRS 22-015(b).

Two organic compounds, toluene and tetryl, were identified as COPCs at this PRS. Both are noncarcinogenic compounds; the total normalized MCE for noncarcinogenic effects is less than 0.04, and the results are summarized in Table 5.3.8-1. The MCE result indicates that detrimental human health effects from exposure to these measured concentrations is highly unlikely.

TABLE 5.3.4-1
SUMMARY OF SAMPLES TAKEN AT PRS 22-015(b)

Location ID	Sample ID	Depth (ft)	Media	HE	Organics
22-3023	AAA8716	0–0.5	soil	17801	17799
22-3023	AAA8717	3.5	soil	17801	17799
22-3023	AAA8718	6.5	soil	17801	17799
22-3024	AAA8719	0–0.5	soil	17801	17799
22-3024	AAA8720	3.5	soil	17801	17799
22-3024	AAA8721	6.5	soil	17801	17799
22-3025	AAA8722	0–0.5	soil	17801	17799
22-3025	AAA8723	3.5	soil	17801	17799
22-3025	AAA8724	6.5	soil	17801	17799
22-3026	AAA8725	0–0.5	soil	17801	17799
22-3026	AAA8726	3.5	soil	17801	17799
22-3027	AAA8728	0–0.5	soil	17801	17799
22-3027	AAA8729	3.5	soil	17801	17799
22-3027	AAA8730	6.5	soil	17801	17799
22-3027	AAA8731	6.5	soil	17801	17799
22-3027	0522-97-0018	0–0.5	soil	3082R*	3081R
22-3027	0522-97-0019	3.5–4.5	soil	3082R*	3081R
22-3027	0522-97-0020	6.5–7.5	soil	3082R*	3081R
22-3024	0522-97-0021	0–0.5	soil	3082R*	3081R
22-3024	0522-97-0022	3–3.5	soil	3082R*	3081R
22-3024	0522-97-0023	3.5–4.0	soil	3082R*	3081R
22-6066	0522-97-0024	0–0.5	soil	3082R*	3081R
22-6066	0522-97-0025	1.3 –2.0	soil	3082R*	3081R
22-6067	0522-97-0026	0–0.5	soil	3082R*	3081R
22-6067	0522-97-0027	2.0 –2.7	soil	3082R*	3081R
22-6068	0522-97-0028	0–0.5	soil	3082R*	3081R
22-6068	0522-97-0029	0.7–1.3	soil	3082R*	3081R

* Includes PETN analysis

5.3.9 Human Health Risk Assessment

No human health risk assessment was performed for PRS 22-015(b) because no COPCs were identified.

5.3.10 Preliminary Ecological Assessment

In cooperation with the New Mexico Environment Department and EPA Region 6, the Laboratory ER Project is developing an approach for ecological risk assessment. Further ecological risk assessment at PRS 22-015(b) will be deferred until the site can be assessed as part of the ecological exposure unit methodology currently being developed.

TABLE 5.3.7-1
DETECTED ORGANIC CHEMICALS FOR PRS 22-015(b)

Sample ID	Depth (ft)	Toluene (mg/kg)	Tetryl (mg/kg)
SAL	NA[a]	1900	650
EQL	NA	0.005	0.65
0522-97-0023	3.5–4.0	**0.0068**[b]	0.098
0522-97-0028	0–0.5	**0.006**	0.428
0522-97-0029	0.5–1.3	**0.006**	0.095

a. NA = not applicable
b. **Bold**, enlarged values indicate results above EQL.

TABLE 5.3.8-1
MCE FOR SOIL SAMPLES AT PRS 22-015(b)

Chemical	Location ID	Sample ID	Maximum Sample Value*	Soil SAL*	Normalized Value
Tetryl	22-6068	0522-97-0028	0.428	650	0.0007
Toluene	22-3024	0522-97-0023	0.0068	1900	0.000004
				Total	**<0.04**

* Concentrations in mg/kg.

5.3.11 Conclusions and Recommendations

PRS 22-015(b) has been characterized and assessed based on the results of two sampling events. Based on operational history and process knowledge, it was believed that any contamination present at the PRS would be at low levels. No COPCs were identified at the site during the first sampling event. These findings were confirmed by the results of the second sampling event, which was a more complete investigation of all potentially impacted areas. The second sampling event also provided higher-quality usable data and filled previously identified data gaps.

No PETN, the principle HE associated with PRS activities, was detected in any site samples. Two organic compounds were identified as COPCs for an MCE. The single detected occurrence of HE in surface soil from the most downgradient sample location does not indicate a failure to determine the extent of contamination at this PRS. This HE, tetryl, was reported at a very low level relative to its SAL, is not associated with PRS activities, and could be the result of general activities in TA-22. The total normalized MCE of <0.04 indicates that the site presents no unacceptable human health risk.

Because no human health COPCs were identified, this PRS is recommended for NFA. This recommendation is based on NFA Criterion 5. A Class III permit modification will be requested to remove this site from HSWA Module of the Laboratory's hazardous waste facility permit.

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APPENDIX A
ANALYTICAL DATA

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

Chemicals that are reported by analytical laboratories as nondetects (U qualifier) have not been included in the tables of this report. Nonetheless, nondetected chemicals are often part of the decision-making process, and it is important to note that analyses for these chemicals were performed. This appendix provides a list of the target analytes in each analytical suite for which samples were taken (see Tables 5.1.4.1, 5.2.4-1, and 5.3.4-1, Summary of Samples Taken).

Inorganic Suite

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

Volatile Organic Suite

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

Chlorodibromomethane
Chloroethane
c-1,2-Dichloroethene
t-1,2-Dichloroethene
Styrene
1,1,1-Trichloroethane

Semivolatile Organic Suite

Acenaphthene
Acenaphthylene
Aniline
Anthracene
Azobenzene
Benzo(a)anthracene
Benzoic acid
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(g,h,i)perylene
Benzo(a)pyrene
Benzyl alcohol
Bis(2-chloroethoxy)methane
Bis(2-chloroethyl)ether
4-Bromophenylphenyl ether
Butylbenzylphthalate
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
Dimethyl phthalate
2,4-Dimethylphenol
2,4-Dinitrophenol
Di-n-butylphthalate
4,6-Dinitro-2-methylphenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Di-n-octylphthalate
Bis(2-ethylhexyl)phthalate
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
2,2'-oxybis(1-Chloropropane)
Pentachlorophenol
Phenanthrene
Phenol
Pyrene
1,2,4-Trichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol

High Explosive Suite

2-Amino-4,6-dinitrotoluene (2-Am-DNT)

4-Amino-2,6-dinitrotoluene (4-Am-DNT)

1,3-Dinitrobenzene (1,3-DNB)

2,4-Dinitrotoluene (2,4-DNT)

2,6-Dinitrotoluene (2,6-DNT)

Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)

Methyl-2,4,6-trinitrophenylnitramine (Tetryl)

Nitrobenzene (NB)

Nitroglycerin (NG)

2-Nitrotoluene (2-NT)

3-Nitrotoluene (3-NT)

4-Nitrotoluene (4-NT)

Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)

Pentaerythritol tetranitrate (PETN) on selected samples

1,3,5-Trinitrobenzene (1,3,5-TNB)

2,4,6-Trinitrotoluene (2,4,6-TNT)

APPENDIX B
DATA VALIDATION

TABLE B-1
SUMMARY OF QUALITY ASSURANCE/QUALITY CONTROL RESULTS FOR TECHNICAL AREA 22, POTENTIAL RELEASE SITES 22-012, 22-015(d) and 22-015(e)

REQUEST NUMBER	SAMPLE ID	SUITE	COMMENTS[a]
17835	AAA8752 through AAA8762 AAA8764 AAA8765	HE[b]	All SW-846 Method 8330 analytes qualified UJ (undetected estimated) and may be used with due consideration of potential low bias in the reported results.
17835	AAA8767 through AAA8774	HE	All SW-846 Method 8330 analytes qualified as R (rejected), but may be used with due consideration of significant potential low bias and uncertainty in the reported results.
17835	AAA8775 AAA8776 AAA8779	HE	All SW-846 Method 8330 analytes are qualified UJ (undetected estimated) and may be used with due consideration of potential low bias in the reported results.
17835	AAA8777 AAA8778	HE	All SW-846 Method 8330 analytes, except high melting explosive (HMX), are qualified UJ (undetected estimated) and may be used with due consideration of potential low bias in the reported results. HMX is qualified as estimated with a potential low bias.
18091	AAA8741 and 0522-97-0036	VOCs[c]	Results qualified as UJ (undetected estimated) because of low surrogate and internal standard area counts.
18092	AAA8737 AAA8745 AAA8859 AAA8860	VOCs	Ethylene dibromide results qualified as R (rejected). All other results qualified as UJ (undetected estimated).

a. For additional explanation of these table entries, refer to Sections 4.1.1 and 4.3.1
b. HE = high explosives
c. VOCs = volatile organic compounds

TABLE B-1 (concluded)

REQUEST NUMBER	SAMPLE ID	SUITE	COMMENTS[a]
18092	AAA8738 through AAA8740 AAA8746 through AAA8748	VOCs	Ethylene dibromide results qualified as R (rejected). All other results not qualified.
18096	AAA8737 through AAA8740 AAA8745 through AAA8748	HE	All SW-846 Method 8330 analytes qualified UJ (undetected estimated), and may be used with due consideration of potential low bias in the reported results.
18120	AAA8741 through AAA8744	HE	2,6-dinitrotoluene, 2-, 3-, and 4- nitrotoluene, and tetryl results qualified as UJ (undetected estimated). All other SW-846 Method 8330 analytes qualified as R (rejected). Expect all UJ results to be biased low by as much as a factor of five.
3077R	0522-97-0035	VOCs	Data qualified as UJ (undetected estimated) but may be used.

a. For additional explanation of these table entries, refer to Sections 4.1.1 and 4.3.1

TABLE B-2
SUMMARY OF QUALITY ASSURANCE/QUALITY CONTROL RESULTS FOR TECHNICAL AREA 22, POTENTIAL RELEASE SITE 22-015(a)

REQUEST NUMBER	SAMPLE ID	SUITE	COMMENTS[a]
18038	AAA8698 AAA8702 through AAA8704 AAA8706 through AAA8708	INORG[b]	Cyanide results are qualified as undetected estimated (UJ) because of a slightly low (74.6%) recovery in blind quality control (QC) sample 94.14006. Cyanide matrix spike recovery is 103%. Silver results are qualified as undetected estimated (UJ) because of a significantly low (40.3%) recovery in blind QC sample 94.14008. Silver matrix spike recovery is 103%. Antimony and manganese results are not qualified but should be qualified as undetected estimated (UJ).
18052	AAA8698	SVOCs[c]	All data usable as reported. However, expect low bias of as much as a factor of three.
18052	AAA8702 AAA8703 AAA8704 AAA8706 AAA8707	SVOCs	No qualification of data during baseline validation. However, expect low bias of as much as a factor of three.
18052	AAA8708	SVOCs	Most results qualified as undetected estimated (UJ). However, expect low bias of as much as a factor of three for all results.
18052	AAA8698 AAA8702 AAA8706	VOCs	Target analytes quantitated against the last internal standard (primarily benzenes and toluenes) are qualified as UJ (undetected estimated) because of initial low surrogate, and final low internal standard recoveries. Otherwise, results are not qualified.
18091	AAA8699 AAA8700	VOCs	Results qualified as UJ (undetected estimated) because of low surrogate and internal standard area counts.

a. For additional explanation of these table entries, refer to Sections 4.1.2 and 4.3.2.
b. INORG = inorganics
c. SVOCs = semivolatile inorganic compounds

TABLE B-2 (concluded)

REQUEST NUMBER	SAMPLE ID	SUITE	COMMENTS[a]
18093	AAA8698 AAA8702 through AAA8704 AAA8706 through AAA8708	HE	All SW-846 Method 8330 analytes qualified as UJ (undetected estimated), with potentially low bias of approximately a factor of two.
18120	AAA8699 AAA8700	HE	2,6-dinitrotoluene, 2-, 3-, and 4- nitrotoluene, and tetryl results qualified as UJ (undetected estimated). All other SW-846 Method 8330 analytes qualified as R (rejected). Expect all UJ results to be biased low by as much as a factor of five.

a. For additional explanation of these table entries, refer to Sections 4.1.2 and 4.3.2.

TABLE B-3
SUMMARY OF QUALITY ASSURANCE/QUALITY CONTROL RESULTS FOR TECHNICAL AREA 22, POTENTIAL RELEASE SITE 22-015(b)

REQUEST NUMBER	SAMPLE ID	SUITE	COMMENTS*
17801	AAA8716 through AAA8726 AAA8728 through AAA8731	HE	All SW-846 Method 8330 analytes qualified as UJ (undetected estimated), with potentially low bias of approximately a factor of five.
3081R	0522-97-0023	VOCs	Toluene results qualified as J (estimated); otherwise all other VOC results qualified as UJ (undetected, estimated).
3081R	0522-97-0018 through 0522-97-0022 and 0522-97-0024 through 0522-97-0030	VOCs	All VOC results qualified as UJ (undetected, estimated).

* For additional explanation of these table entries, refer to Sections 4.1.3 and 4.3.3.

APPENDIX C
RISK ASSESSMENT CALCULATIONS

No quantitative risk assessment was performed on Potential Release Sites 22-012 and 22-015 (a, b, d, e).