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Refer to: EM/ER:96-140

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MAR 19 1996

SUBJECT: SUBMITTAL OF THE RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION (RFI) REPORT FOR POTENTIAL RELEASE SITES (PRSs) AT TECHNICAL AREAS (TAs) 20, 53, AND 72

Dear Mr. Neleigh:

Enclosed is the Los Alamos National Laboratory's RFI Report concerning PRSs at TAs 20, 53, and 72. This RFI Report is due to your office by March 19, 1996. This RFI Report documents field work performed at TAs 20, 53, and 72 as detailed in the approved RFI Work Plan for Operable Unit 1100.

Please ask your office to contact Gene Gould at (505) 667-0402 or Everett Trollinger at (505) 667-5801 if you have any questions.

Sincerely,

Jorg Jansen, Program Manager
Environmental Restoration

Sincerely,

Theodore J. Taylor, Program Manager
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JJ/TT/am

Enclosure: Two copies of the RFI Report for PRSs at TAs 20, 53, and 72
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Document Title: Submittal Of The Resource Conservation And Recovery Act Facility Investigation Report For Potential Release Sites At Technical Areas 20, 53, and 72

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HSWA LANL 2/1100

RFI Report for Potential Release Sites at TA's-20, -53, and -72

(located in former Operable Unit 1100)

Field Unit 2

Environmental Restoration Project

March 1996

A Department of Energy
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RFI Report for Potential Release Sites in TA-20, TA-53, and TA-72

(located in former Operable Unit 1100)

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EXECUTIVE SUMMARY

This Resource Conservation and Recovery Act (RCRA) Facility Investigation Report describes the Phase I investigations performed at formerly designated Operable Unit (OU) 1100. OU 1100 is located in Los Alamos and Santa Fe counties in north-central New Mexico and consists of Technical Area (TA)-53 and TA-72, which are active TAs, and TA-20, which is inactive. The OU covers approximately 2,400 acres of mesas and canyon terrain and extends from the TA-53 entrance road eastward to New Mexico State Road (SR) 4. The OU includes most of Sandia Canyon on the south, Mesita de Los Alamos in the center, and a portion of Los Alamos Canyon in the northeast.

Former TA-20 was located in Sandia Canyon south of TA-53, the Los Alamos Meson Physics Facility, which is located on Mesita de Los Alamos. TA-72 is located in Sandia Canyon, approximately 1.5 mi west of SR 4.

This report satisfies the site-specific regulatory requirements contained in the Los Alamos National Laboratory (Laboratory) RCRA operating permit, specifically in Module VIII, which contains the Hazardous and Solid Waste Amendments (HSWA) corrective action requirements.

This document reports on field investigations carried out in 1995 for five aggregates of five potential release sites (PRS): Landfills, Firing Sites, Waste and Product Storage Areas, Septic Systems, and Outfalls. The objectives of these investigations were to determine the nature and extent of contamination; to determine the need for corrective action; and to satisfy regulatory requirements that pertain to OU 1100, if any, at those sites. Two other aggregates, the Underground Storage Tanks [PRSs 53-006(a - f)] and the Lagoons [PRSs 53-002 (a and b)] will not be addressed here. Investigation of the tanks has been deferred for budgetary reasons and proposed for 1997, and the lagoons are being addressed as a RCRA Closure.

Field activities at the remaining PRSs began in April 1995 and were mostly completed by July 1995. A few additional samples for semivolatile organic compounds analyses were collected in December 1995. Sampling results were evaluated to determine whether they provided enough information to make decisions regarding cleanup, no further action (NFA), or the need for a Phase II investigation. The analytical data received by the Laboratory underwent a quality assurance/quality control assessment, and the results showed that 100% of the data was acceptable and defensible. Data analysis for 13 of the sites showed no contamination of soil; these sites are recommended for NFA based on the Laboratory Environmental Restoration Project Consistency Team's NFA Policy Criterion 4 because no chemicals of potential concern (COPC) were present or retained. The following actions have been or will be taken for the remaining seven sites:

- PRS 20-003(c) and PRS 53-010 were cleaned up as Voluntary Corrective Actions (VCA) in 1995, and the reports were submitted to the US Department of Energy (DOE) on September 28, 1995.

- PRS 20-002(d) and PRS 53-008 will be cleaned up as VCAs in 1996, and the plans for this work will be submitted to DOE on November 23, 1996.

- PRS 20-001(c) and PRS 53-005 will be investigated further as a continuation of Phase I investigations. PRS 20-001(c) was not adequately sampled to determine the extent of the contamination, and PRS-53-005, the Waste Oil Pit was not located.

- PRS 72-001 is the small arms firing and training range currently used by the Laboratory security force. No evidence of lead migration was found resulting from this PRS, but the site is recommended for deferral until decommissioning because of its active status.

Table ES-1 presents a summary of the PRSs and the proposed actions.

TABLE ES-1
SUMMARY OF PROPOSED ACTIONS

PRS	HSWA	NFA Criteria*	Further Action	Rationale	Section
Landfills					
20-001(a)	A	4		Site has been characterized, and no COPCs are present.	5.1
20-001(b)	A	4		Site has been characterized, and no COPCs are present.	5.2
20-001(c)	A		Continuation of Phase I sampling	Site was not adequately characterized.	5.3
Firing Sites					
20-002(a)	A	4		Site has been characterized, and no COPCs are present.	5.4
20-002(b)	A	4		Site has been characterized, and no COPCs are present.	5.5
20-002(c)	A	4		Site has been characterized, and no COPCs are present.	5.6
20-002(d)	A		VCA	Plan will be submitted November 23, 1996.	5.7
20-003(b)		4		Site has been characterized, and no COPCs are present.	5.8
20-003(c)			VCA in 1995	Final report submitted September 30, 1995	5.9
72-001			Deferred	Site in use	5.10
Waste and Product Storage Areas					
53-001(a)	A	4		Site has been characterized, and no COPCs are present.	5.11
53-001(b)	A	4		Site has been characterized, and no COPCs are present.	5.12
53-001(e)		4		Site has been characterized, and no COPCs are present.	5.13
53-001(g)		4		Site has been characterized, and no COPCs are present.	5.14
53-005	A		Continuation of Phase I sampling	Waste Oil Pit was not located.	5.15
53-008			VCA for radiation	Radiation present; VCA Plan will be submitted November 23, 1996	5.16
		4	NFA RCRA	Site has been characterized, and no COPCs are present.	
53-010			VCA in 1995	Final report submitted September 30, 1995	5.17

* See Project Consistency Team Policy Number 015, "No Further Action Criteria" (PCT, 1210)

TABLE ES-1
SUMMARY OF PROPOSED ACTIONS
(Continued)

PRS	HSWA	NFA Criteria	Further Action	Rationale	Section
Underground Storage Tanks					
53-006(a)				Investigation deferred because of budget constraints in FY 1995	1.2.4
53-006(b)	A			Investigation deferred because of budget constraints in FY 1995	1.2.4
53-006(c)	A			Investigation deferred because of budget constraints in FY 1995	1.2.4
53-006(d)	A			Investigation deferred because of budget constraints in FY 1995	1.2.4
53-006(e)	A			Investigation deferred because of budget constraints in FY 1995	1.2.4
53-006(f)				Investigation deferred because of budget constraints in FY 1995	1.2.4
Septic Systems					
20-004		4		Site has been characterized, and no COPCs are present	5.18
20-005	A	4		Site has been characterized, and no COPCs are present	5.19
Outfall					
53-012 (e)		4		Site has been characterized, and no COPCs are present	5.20
Lagoons					
53-002(a)			Closure	Closure under RCRA	1.2.7

* See Project Consistency Team Policy Number 015, "No Further Action Criteria" (PCT, 1210)

RESOURCE CONSERVATION AND RECOVERY ACT
FACILITY INVESTIGATION REPORT

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1.0 INTRODUCTION

1.1 General Site History

Technical Area (TA) -20, TA-53, and TA-72 constitute the formerly designated Operable Unit (OU) 1100, which is located south and east of Los Alamos townsite (Figure 1.1-1). This site extends from the TA-53 entrance road eastward to New Mexico State Road (SR) 4. The boundary follows SR 4 to where it joins SR 502, and the site narrows to about the width of SR 502 as far as the boundary with San Ildefonso Pueblo. OU 1100 includes most of Sandia Canyon on the south, Mesita de Los Alamos in the center, and a portion of Los Alamos Canyon in the northeast. The northern boundary is broken (Figure 1.1-2), but it follows Los Alamos Creek eastward to the Santa Fe County line, then shifts northward up onto Los Alamos Mesa and continues eastward along SR 502 (commonly referred to as the Main Hill Road). The southern boundary follows the south rim of Sandia Canyon, and the eastern boundary curves along Bandelier National Monument property.

TA-20, no longer a designated TA, was located in Sandia Canyon south of TA-53, the Los Alamos Meson Physics Facility (LAMPF), which is located on Mesita de Los Alamos in the central portion of the OU. TA-72 is located in Sandia Canyon, approximately 1.5 mi west of SR 4. Los Alamos National Laboratory (Laboratory) never conducted activities either within the portion of Los Alamos Canyon that is included in OU 1100, or in the portion of Mesita de Los Alamos east of LAMPF (LANL 1994, 1157).

This report addresses 27 potential release sites (PRS) that have been taken from the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan (LANL 1994, 1157). The underground storage tanks and the lagoons will not be addressed here. Investigation for the tanks was deferred until 1997 for budgetary reasons, and the lagoons are being addressed as a RCRA closure. After the investigation for the underground storage tanks is completed, the results will be presented in an addendum to this report.

Thirteen of the sites addressed in this report have been proposed for no further action (NFA) under Criterion 4 of the Laboratory ER Project Consistency Team's No Further Action Criteria Policy (PCT, 1210). The remaining seven PRSs have undergone or will undergo the following actions:

- PRS 20-003(c) and PRS 53-010 were cleaned up as voluntary corrective actions (VCA) in 1995, and the reports were submitted to the US Department of Energy (DOE) on September 30, 1995.
- PRS 20-003(d) and PRS 53-008 will be cleaned up as VCAs in 1996, and the plans will be submitted to DOE on November 28, 1996.
- PRS 20-001(c) and PRS 53-005 will be investigated further as a continuation of Phase I. PRS 20-001(c) was not adequately sampled to determine the extent of the contamination, and PRS 53-005, the Waste Oil Pit, was not located.
- Phase I results for PRS 20-001(c) and PRS 53-005 will be presented as an addendum to this report.

1.1.1 TA-20

The first facilities were constructed at former TA-20 in 1944 to test initiators for nuclear explosions. Firing tests began in February 1945, and by March 1945 additional areas were being used for implosion or impaction tests. A number of buildings and areas gun firing sites, a firing pit, and magazines for munitions storage were developed in support of the testing program, (Figure 1.1-3).

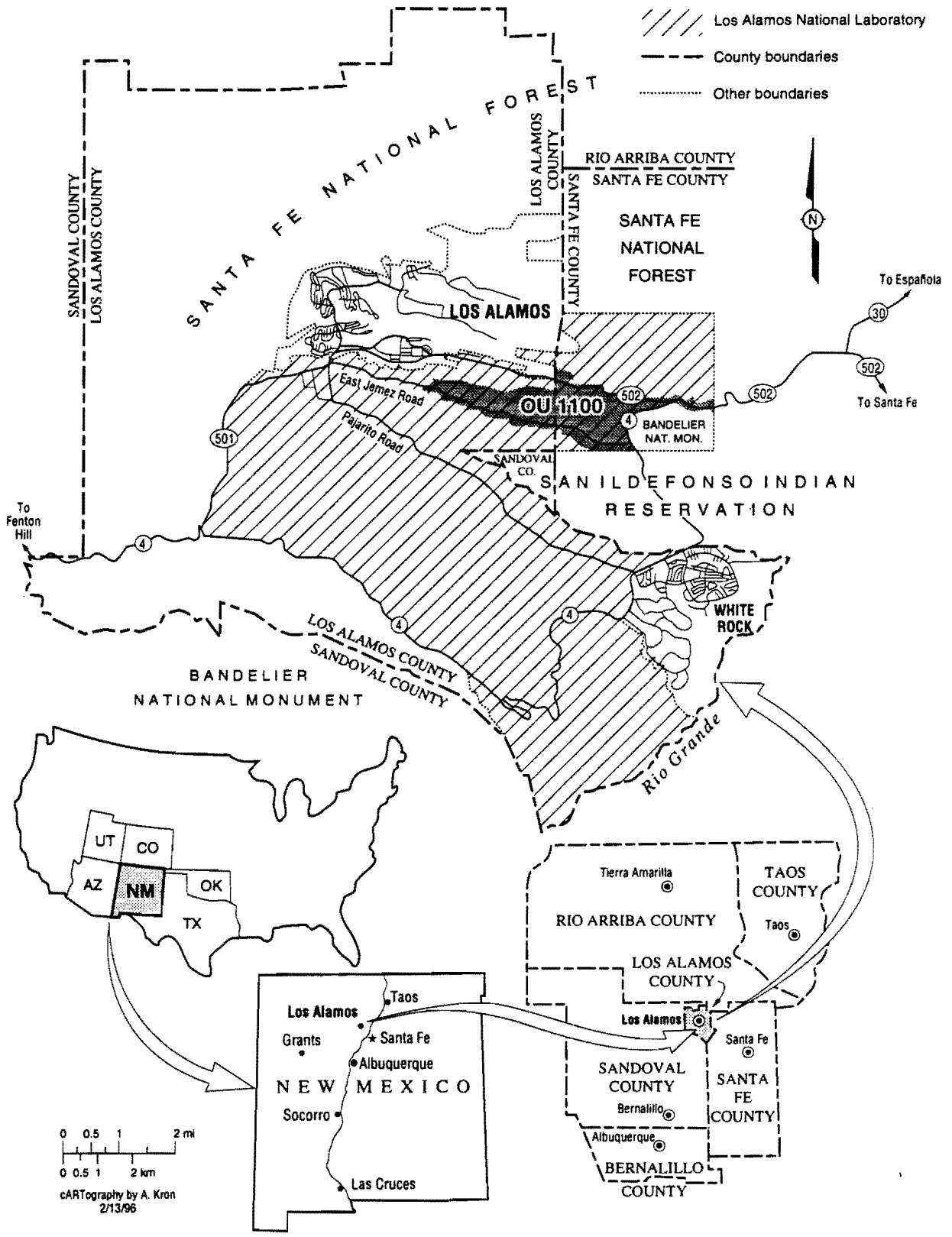

Figure 1.1-1 Location of OU 1100

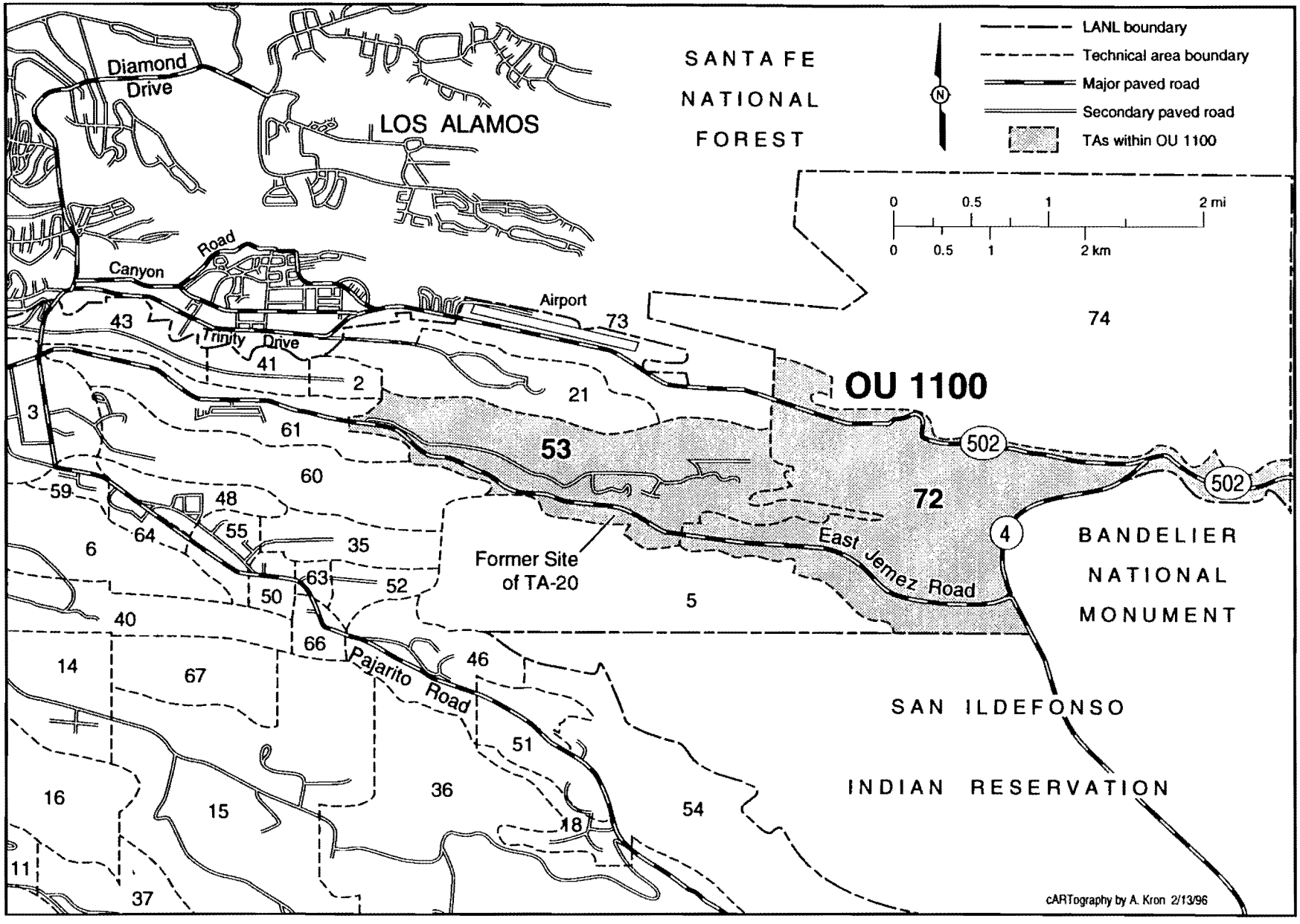

Figure 1.1-2 Location of OU 1100 with respect to some Laboratory technical areas and surrounding areas.

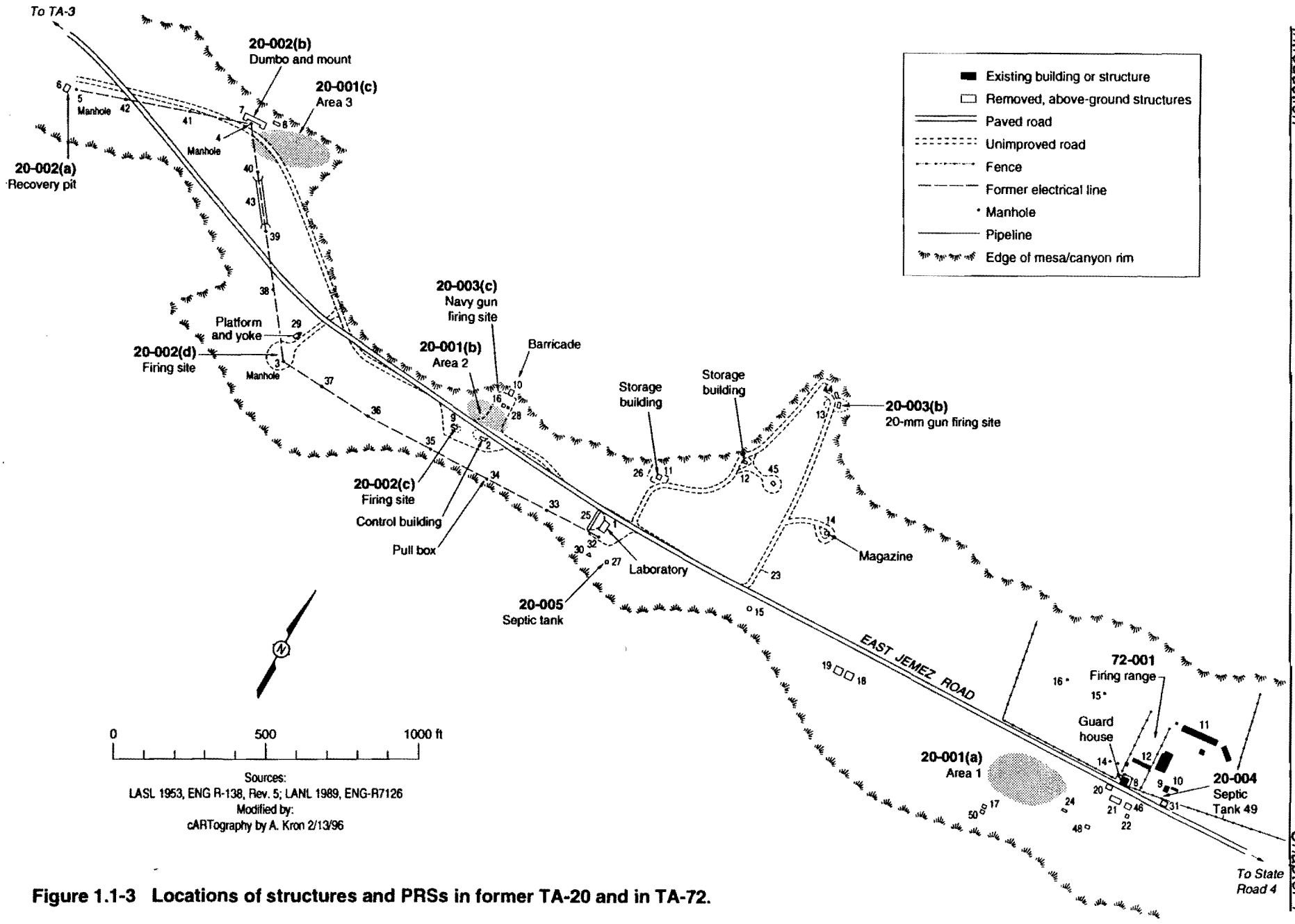

Figure 1.1-3 Locations of structures and PRSs in former TA-20 and in TA-72.

The former TA-20 underwent an intensive radiation monitoring and cleanup both in the spring of 1946 and in 1948, when TA-20 was decommissioned to make way for a new road through the canyon for access to South Mesa, in TA-3, and Los Alamos (LANL 1994, 1157). Many of the structures were dismantled and removed about that time, and two magazines were deactivated but were not destroyed until 1960. During the extensive cleanup during 1948, 60 to 70 lb of high explosives (HE) was removed (LANL 1984, 22-0015). Since then, the Laboratory conducted periodic searches for HE, and the area was declared safe in 1973 (LANL 1994, 1157).

1.1.2 TA-53

LAMPF consists of a 0.5-mi-long linear proton accelerator and associated research areas, offices, laboratories, and shops. Construction of LAMPF began in 1967, and the first proton beam, with an energy of 5 million electron volts (MeV), was produced in June 1970. In June 1972, the full design energy of 800 MeV was attained. Additional progressive improvements have been made over a number of years, and the routine operational current level is 1 milliampere (LANL 1987, 22-0017).

Building TA-53-1 houses administrative and technical offices, laboratories, shops, computer facilities, and a cafeteria. Building TA-53-2 contains a furnace shop, a test and assembly shop, development laboratories, and a staff shop. Special components and experimental apparatus are assembled in TA-53-2 in addition to repairs and tests conducted on klystrons and modulator assemblies. TA-53-3 houses the linear proton accelerator and associated experimental research areas, offices, laboratories, and shops.

The Ground Test Accelerator facility, TA-53-365, also located at TA-53, is a linear accelerator that was developed to test particle-beam weapons systems. This facility is located south of LAMPF and west of LANSCE.

Location of the PRSs at TA-53 are presented in Figure 1.1-4.

1.1.3 TA-72

TA-72 currently is used as a firing range by Protection Technology Los Alamos, the Laboratory's security force. This range has been operational since 1966. Structures on the site include some that were built as part of the firing range in addition to a guard house and associated structures from the former TA-20, which were abandoned in 1957 when access to East Jemez Road became unrestricted. Two Laboratory water supply wells, each with an associated chlorinator and pump station, are located within TA-72 (Figure 1.1-3).

1.2 RFI Phase I Work Plan Overview

The overall objectives of field investigations at OU 1100, as stated in the RFI Work Plan, were to determine the nature and extent of contamination, if any, from releases at the PRSs; to determine the need for corrective action; and to satisfy those regulatory requirements that pertain to OU 1100 contained in the Laboratory's permit to operate under RCRA (LANL 1994, 1157). This RFI Report discusses the 1995 field investigations of the 20 PRSs, which do not include the underground storage tanks or the lagoons.

These investigations also satisfy the site-specific regulatory requirements contained in the Los Alamos National Laboratory's (Laboratory) RCRA operating permit, specifically in Module VIII, which contains the Hazardous and Solid Waste Amendments (HSWA) corrective action requirements.

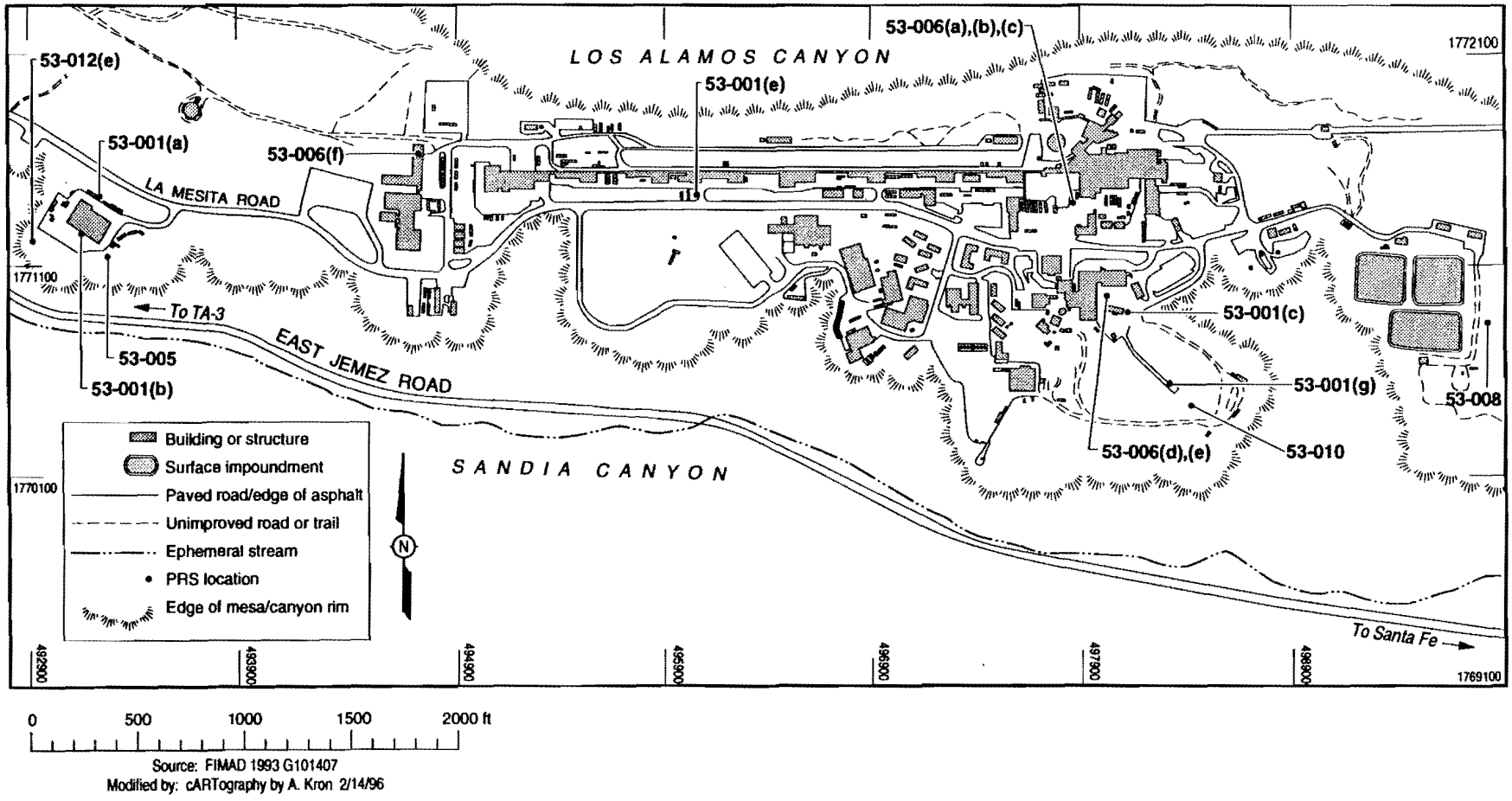

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Figure 1.1-4 Locations of PRSs in TA-53 that are addressed in this report.

A general conceptual model was developed for the RFI Work Plan, which identified potential contaminant pathways and potential human receptors (LANL 1994, 1157). The model identified historical sources of contamination and migration, current sources of contamination, and exposure routes. This information was used as a tool for making decisions regarding the sampling and analyses required to adequately characterize the PRS.

The conceptual exposure model is based on archival information only, and the pathway for exposure to the worker in that model can occur through ingestion, inhalation, dermal contact, or external radiation, both at the surface or during excavation, and would be expected to pose a minimum threat to workers.

For purposes of planning in the RFI Work Plan, the PRSs in OU 1100 were placed into aggregates based on similarity of function and other criteria. The aggregates are landfills, firing sites, waste and product storage areas, underground storage tanks, septic systems, and the lagoons. These same aggregate systems have been retained here in this report, although each PRS is described separately for clarity.

Additionally, a VCA may be proposed at any stage of the RFI to provide an obvious, feasible, and effective remedy for a site where conducting the VCA is more cost-effective than completing the RFI/Corrective Measures Study process. If the site meets the criteria for no further action (NFA) from the RFI Work Plan, Section 4.6.1 (LANL 1994, 1157) and PCT (Project Consistency Team) EM/ER:PCT-015, memorandum, "No Further Action Policy" (PCT, 1210), the site may be proposed for NFA.

1.2.1 Landfills

The landfills were aggregated based on the similarity of function and historical time frame. After the active sites were no longer in use, building rubble and possible contaminants from the site were buried. COPCs expected were HE, metals, strontium-90 and uranium. The sites were surveyed by geophysics techniques to help establish locations for trenching and removal of samples. Samples were taken in June 1995.

1.2.2 Firing Sites

The firing sites were aggregated based on the similarity of function and historical time frame. Guns were mounted and explosives tested at these locations. After the active sites were no longer in use, rubble and possible contaminants from the site were buried. Bullets, a source of lead, are known to be present at PRS 72-001 around the base of the berms and cliffs (LANL 1990, 0145), which were used as the backstop for the firing range. COPCs expected were HE, metals, and radionuclides. The sites were surveyed by geophysics techniques to help establish locations for trenching and removal of samples, and radiation surveys were conducted to establish bias for sampling locations. These sites were sampled in May and June of 1995.

1.2.3 Waste and Product Storage Area

The waste and product storage areas in various locations at TA-53 were aggregated based on the chemical storage function. COPCs at the sites included VOCs, PCBs, metals, and TPH. Radionuclides were additional COPCs at PRS 53-008, the Boneyard. These PRSs were sampled in May 1995. SVOCs samples were taken in December 1995 at PRS 53-001 sites to provide additional characterization of those sites that exhibited elevated levels of TPH.

1.2.4 Underground Storage Tanks

Site investigations for the underground storage tanks were deferred because of budget constraints during the fall of 1995. They are currently proposed for investigation in 1997, and the results of the investigation at that time will be prepared as an addendum to this report.

1.2.5 Septic Systems

These inactive septic systems were aggregated because of their use and suspected contaminants. COPCs included VOCs, SVOCs, cyanide and metals. Geophysics techniques were used in the presumed locations to determine the exact location of these systems, if possible. Samples were taken in June 1995.

1.2.6 Outfall

PRS 53-012(e) was the only outfall that was included in the Phase I investigations for OU 1100. COPCs at the outfall included VOCs, metals, PCBs, and TPH. SVOC samples were taken in December 1995 to provide additional compound-specific characterization of the outfall.

1.2.7 Lagoons

This aggregate consists of three surface impoundments [two inactive PRS 53-002(a) and one active PRS 53-002(b)] that are currently regulated as interim-status mixed-waste impoundments under RCRA. These impoundments are deferred actions, and they will undergo closure under RCRA.

1.3 Field Activities

The field work was conducted from May 9 to June 8, 1995, according to specifications in the RFI Work Plan. Sampling activities included surface and subsurfacing sampling using the spade and scoop and the hand auger methods. Approximately 190 samples were taken during the Phase I activities. Additional SVOC samples were collected in December 1995 to provide compound-specific information in locations where Phase I TPH results were positive.

Radiation, geomorphic, or geophysics surveys were performed as specified for the PRS before sampling began. Land surveys were performed to set grid points and sample locations using established Global Positioning System survey monuments with coordinates published in the LANL Survey Monument Network Manual (LANL 1994). A Sokkia Set IIIB Total Station with SDR Data Collector was used to conduct the survey. Data were downloaded from the survey equipment to Sokkia Link and DCA 12.0 PC-based civil and surveying software. The data control points were then adjusted as required by New Mexico state surveying regulations.

Geomorphic surveys were conducted at PRS 20-003(b), PRS 53-001(b), and PRS 72-001 to locate sediment traps for biased sampling. Geophysics surveys were performed at PRS 20-001(a), PRS 20-001(b), PRS 20-001(c), PRS 20-004 and PRS 20-005 to locate underground objects.

Field screening was performed at every sample location and on the collected sample material to determine potential hazards and to protect the health and safety of the on-site workers. Screening for radiation or HE was performed using the Laboratory Environmental Restoration (ER) procedures as specified in the RFI Work Plan or the Site-Specific Health and Safety Plan. A Ludlum 2221 alpha detector and an ESP-1 beta/gamma survey instrument were for screening for gross alpha, beta, and gamma. A photoionization detector was used to screen for VOCs and combustible gases, and the HE spot test was used to screen for explosives.

Samples collected during this field work were principally soil. Methods of sample collection included spade and scoop, hand auger, and trenching. Water samples of rinsate water were also collected for waste characterization purposes.

All applicable LANL-ER-SOPs (LANL, 0875) were followed unless otherwise noted in Chapter 5.0. Appendix E is a list of applicable SOPs and analytical methods used in this investigation.

2.0 ENVIRONMENTAL SETTING

The environmental setting of the Laboratory is described in Section 2.4 of the Installation Work Plan (IWP) for Environmental Restoration (LANL 1995, 1164). A discussion of the environmental setting, including climate, geology, hydrology, and a conceptual hydrogeologic model of OU 1100 and the surrounding area, is presented in the RFI Work Plan (LANL 1994, 1157). A summary is presented in the following sections. This description provides the information required to evaluate potential contaminant transport pathways and conceptual exposure models at OU 1100.

2.1 Climate

Los Alamos County, including the OU 1100 area, has a semiarid, temperate mountain climate. The high altitude, light winds, clear skies, and dry atmosphere allow summer temperatures to range from 45°F to 95°F. During the winter, the temperature typically ranges from 15°F to 50°F. Based on measurements at the East Gate meteorological station, the average summer precipitation is about 8 in., while the average annual precipitation is about 16 in. (LANL 1993, 0829). Stream flow in the canyons can occur as a result of summer storms or spring snowmelt runoff.

2.2 Geology

2.2.1 Geologic Setting

A detailed discussion of the geology of the Los Alamos area can be found in Section 2.5.1 of the IWP (LANL 1995, 1164).

The stratigraphy of the mesa was derived from numerous boreholes located on the mesa and in Sandia Canyon and water wells located in Sandia Canyon (LANL 1994, 1157). The depth of these drill holes ranged from 75 to 160 ft. Core recovery in all these boreholes was poor because the bedrock was fractured and nonwelded. Additional stratigraphy was inferred from geologic studies at TA-21, which provided a detailed description of exposed rocks along the north wall of Los Alamos Canyon directly northwest of TA-53 (LANL 1993, 1076).

The water wells in Sandia Canyon that went to a depth of about 800 ft provided geologic information (Purtymun, 22-0005), and a water well in Los Alamos Canyon directly north of Mesita de Los Alamos at the a depth of about 2,800 ft provided additional information that was inferred to affect the deeper areas under OU 1100 (Stoker et al. 1992, 0826 and Purtymun 1984, 0196). The main aquifer is about 1,000 ft below the surface of the TA-53 mesa top and about 700 ft from TA-20 in Sandia Canyon (LANL 1990, 0145).

The stratigraphic units important at OU 1100 consist of the following (in descending order): The Tshirege and Otowi members of the Bandelier Tuff; the Puye Formation; the basaltic rocks of the Cerros del Rio; the Totavi Formation; and the rocks of the Santa Fe group. The main aquifer is located in the Puye Formation at the east end of the OU. See Figure 2.2-1 for a representation of the stratigraphic units and approximate locations of TA-20 and TA-53.

2.2.2 Soils

Additional information regarding the soils in the Los Alamos area can be found in Section 2.5.1 of the IWP (LANL 1995, 1164) and in the RCRA Part B Permit Application for the TA-53 surface impoundments (LANL 1992, 1075).

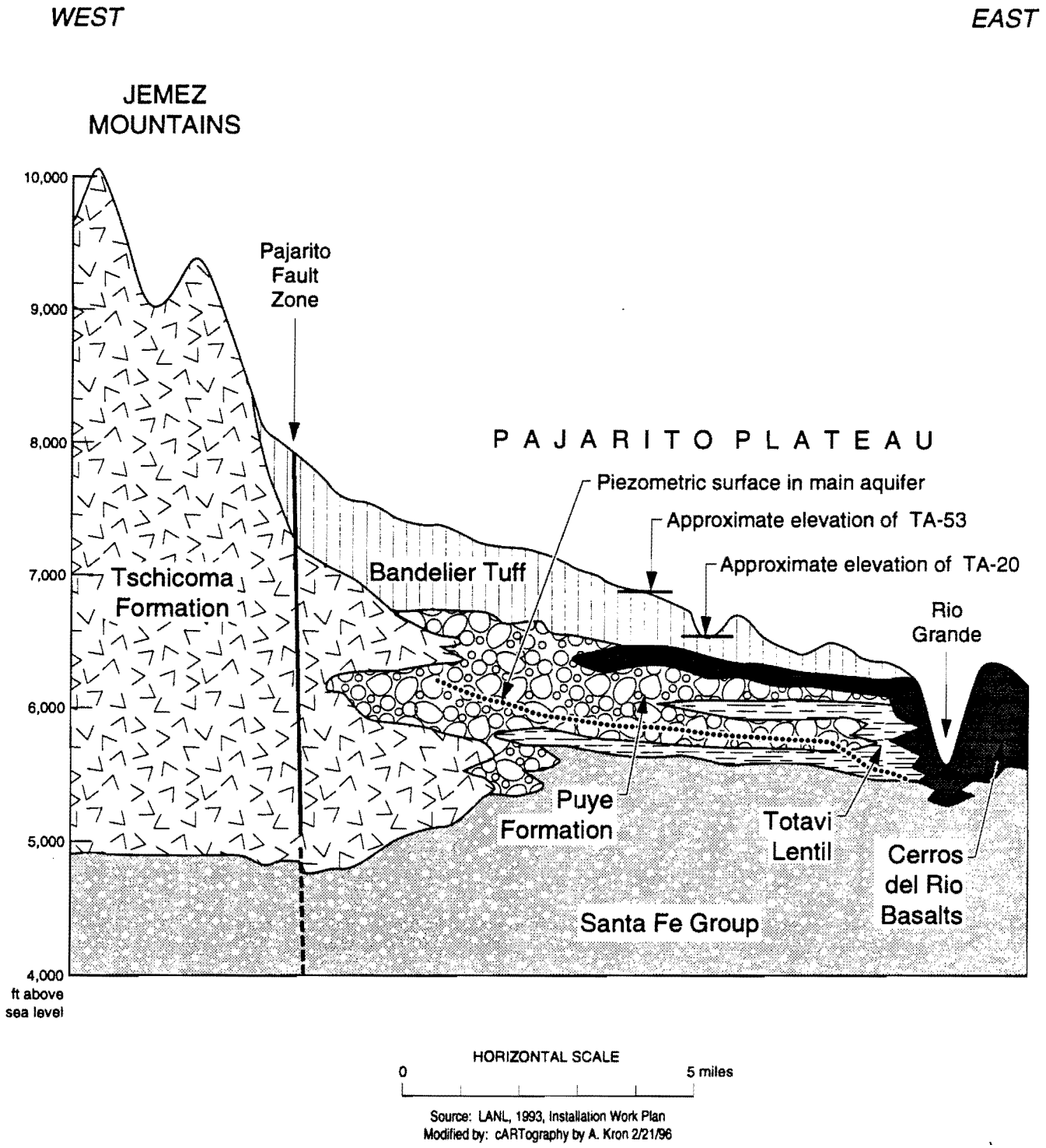

Figure 2.2-1. Geologic section showing stratigraphy from the Jemez Mountains to the Rio Grande and approximate elevations of TA-53 and TA-20.

The description of the soils at OU 1100 is based on the study by Nyhan et al. (1978, 0161). The soil in the western half of the mesa top consists of shallow, well-drained soils of the Hackroy series; a Hackroy rock outcrop complex; moderately deep, well-drained soils of the Nyjack series; and deep well-drained soils of the fine-loamy Typic Eutroboralfs. The soil in Sandia Canyon consists of well-drained soils of the Totavi series.

2.2.3 Sedimentation and Erosion

Active erosional processes in the Los Alamos area are addressed in Section 2.5.1.6 of the IWP (LANL 1995, 1164).

At OU 1100, sediment deposition and erosion by surface water occurs in response to snowmelt and storm-water runoff events. Periods of runoff can produce erosion, sediment transport, and deposition. In areas such as the Boneyard, where natural soils surface have been disturbed through use, erosion is generally accelerated (Graf 1975, 13-009; Nyhan and Lane 1986, 0159).

2.3 Hydrology

2.3.1 Surface Water

Surface water hydrology is addressed in detail in Section 2.5.2 of the IWP (LANL 1995, 1164).

Sandia Canyon has an ephemeral stream with a small drainage area that has its head at TA-3. (See Figure 2.3-1 for a topographical representation of the area.) Treated effluents from the TA-3 sanitary sewage treatment plant and cooling tower blowdown from the TA-3 power plant create continual flow in the upper portion of Sandia Canyon. Sandia Canyon receives additional flow from storm runoff and wastewater discharges from TA-53. During peak flow events, the stream may reach the Rio Grande. The stream is depleted by evaporation, transpiration, and possible some infiltration within a short distance downstream, near the firing site PRSs at the former TA-20 (LANL 1993, 0829).

2.3.2 Groundwater

Groundwater, including the vadose zone, alluvial groundwater, perched groundwater, and the main aquifer at Los Alamos is discussed in more detail in Section 2.5.2 of the IWP (LANL 1995, 1164).

Saturated groundwater occurs in three modes in the Los Alamos area: shallow, alluvial groundwater bodies in canyon bottoms; isolated perched horizons at depths between 120 and 200 ft; and the main aquifer underlying the entire plateau.

Fluid flow in the unsaturated zone (the area between the ground surface and groundwater) varies and results primarily from welding of the geologic formations and the number and size of fractures present. Generally, movement of fluids in the unsaturated zone is impeded by conditions in the Bandelier Tuff, which underlies the Los Alamos area (LANL 1995, 1164).

Saturated alluvial groundwater occurs in the narrow canyons of the Los Alamos area, but alluvial groundwater conditions have not been studied in Sandia Canyon. However, an alluvial groundwater body has been inferred to exist in the portions of Sandia Canyon stream flow. Sample results indicate that groundwater is present near PRS 20-001(c) (see Figure 2.3-1), but the groundwater ends near the active firing site at TA-72 (Purtymun and Stoker 1990, 22-0002).

Perched groundwater was encountered at a depth of about 450 ft when a well was being installed in 1965 near the intersection of East Jemez Road and SR 4. (LANL 1993, 0829). This perched groundwater was

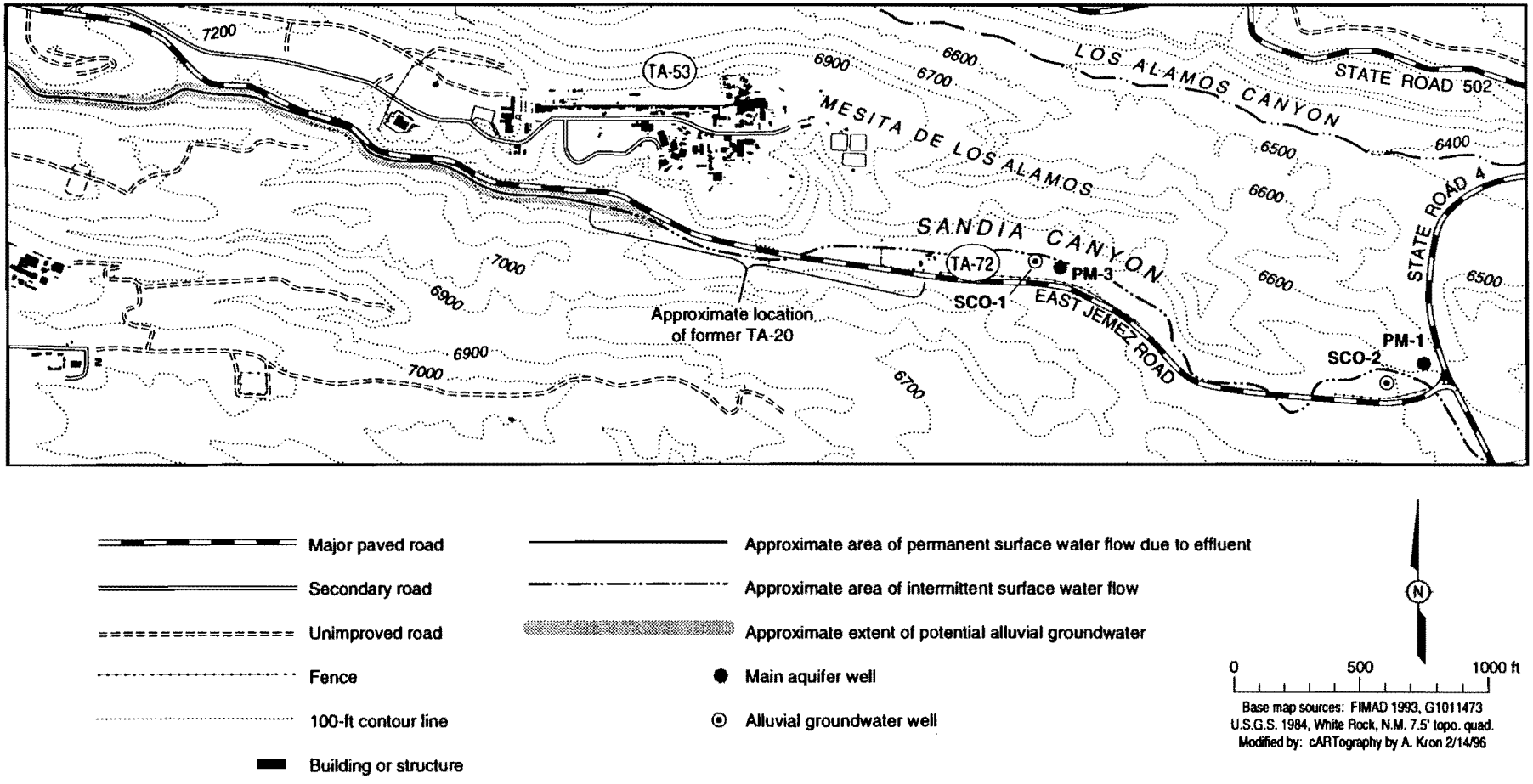

Figure 2.3-1 Topographic representation of Sandia Canyon and surroundings showing approximate surface and groundwater areas and wells.

located in the basaltic rocks of the Cerros del Rio and was separated from the top of the main aquifer by about 298 ft of basalt and conglomerate. Perched water was also found in another well that was installed, but it has not been determined if this perched water was the same as the zone near the 1965 water well (Stoker et al. 1992, 0826).

The only aquifer in Los Alamos capable of providing a municipal and industrial water supply is the main aquifer. The water in the main aquifer generally moves eastward across the entire plateau toward the Rio Grande, with some discharge into the Rio Grande through seeps and springs (Purtymun 1984, 0196). At OU 1100 the potentiometric surface in the aquifer lies about 1,000 ft below the mesa top, and at TA-20 in Sandia Canyon, at about 700 ft below ground level.

2.4 Biological and Cultural Surveys

2.4.1 Biological Survey

Biological resource field surveys were conducted at OU 1100 for compliance with the federal Endangered Species Act (as amended) (US Senate 1983); the New Mexico Wildlife Conservation Act (NM Game and Fish Department 1978); the New Mexico Endangered Plant Species Act (Kerr 1985); Executive Order 11990, "Protection of Wetlands" (The White House 1977, 0635); Executive Order 11988, "Floodplain Management" (The White House 1977, 0634); 10 CFR 1022; Compliance With Floodplain/Wetlands Environmental Review Requirements (DOE 1979, 0633); and DOE Order 5400.1, General Environmental Protection Program (DOE 1988, 0075).

The Environmental Protection Group conducted biological surveys during 1993 at TA-53 and TA-72 to determine whether precautions are needed to protect threatened, endangered or sensitive species (Haarmann 1995). The survey results also are assumed to apply to the site of former TA-20. The area was found to contain suitable habitat for protected species and wetlands. The protected species include the Jemez Mountains salamander, peregrine falcon, northern goshawk, spotted bat, and meadow jumping mouse. One wetland was classified as a wetland by the National Wetland Inventory. Eleven outfalls are within the OU, and at least three of the outfalls have jurisdictional wetlands. (Army Corps of Engineers 1987, 0871). A flood plain also exists in OU 1100 (McLin 1992, 0825).

Each PRS also was evaluated to determine the potential for ecological receptors to be exposed to any COPCs associated with the site. The assessment assigns scores that indicate overall landscape conditions at the site and site-specific conditions that influence the accessibility of any COPCs to ecological receptors. Results of the evaluation are provided in Table 2.4-1.

As stated in the RFI Work Plan (LANL 1994, 1157), the sampling team contacted the Laboratory Biological Resources Evaluation Team (BRET) 60 days before the commencement of sampling activities. BRET was then able to determine if they needed to be present during activities to prevent disturbance of species of concern. After review of their survey results, BRET did oversee operations at several PRSs.

2.4.2 Cultural Survey

A cultural resource survey was conducted during the summer of 1993 at OU 1100, as required by the National Historic Preservation Act (as amended) (USC 1992). The methods and techniques used for this survey conformed to those specified in the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (National Park Service 1983, 0632).

TABLE 2.4-1
SUMMARY OF SCREENING ASSESSMENT TO CATEGORIZE LANDSCAPE CONDITION AND RECEPTOR ACCESS POTENTIAL TO COPCs AT EACH PRS

PRS No.	Landscape Condition[a]	Receptor Access[b]	Description
20-001(a)	2	3	Landfill
20-001(b)	2	3	Landfill
20-001(c)	2	3	Landfill
20-002(a)	2	3	Firing Site
20-002(b)	2	3	Firing Site
20-002(c)	2	3	Firing Site
20-002(d)	2	3	Firing Site
20-003(b)	2	3	Gun Site
20-003(c)	2	3	Navy Gun Site
20-004	2	2	Septic System
20-005	2	2	Septic System
53-001(a)	2	2	Waste Area
53-001(b)	2	2	Waste Area
53-001(e)	1	1	Waste Area
53-001(g)	1	1	Waste Area
53-005	2	2	Waste Oil Pit
53-008	2	3	Boneyard Storage
53-010	2	3	Storage Area
53-012(e)	2	3	Outfall
72-001	2	3	Small Arms Range

[a] 1 = heavily disturbed/developed, 2 = moderately disturbed, 3 = lightly disturbed or not disturbed

[b] 0 = no potential for receptor access to COPCs or for COPC transport, 1 = low potential for access or transport, 2 = moderate potential for access or transport, 3 = high potential for access or transport

Twenty-three archaeological sites were located in the area surveyed, but they were determined to be unaffected by the RFI sampling activities proposed at OU 1100. The Laboratory archaeologists were notified 30 days before sampling was to begin to allow the archaeologists to determine if they needed to be present during sampling activities. A Laboratory archaeologist accompanied the field team leader on a field walk-over before sampling activities were begun.

3.0 APPROACH TO DATA ASSESSMENT AND ANALYSES

The decision approach used for data assessment and analysis involves a series of quantitative steps that occur after the field investigation, chemical analysis, and data reporting are complete. These steps begin with routine data validation and continue with more focused data validation, if necessary. Routine validation involves validating each data item against specific targets and adding qualifier flags to the data signifying a potential deficiency. Focused validation consists of analyzing quality assurance/quality control (QA/QC) data for their potential impact on the succeeding data assessment steps (i.e., comparing site data with background concentration data, verifying the identities of detected organic chemicals, comparing site data with screening action levels (SAL) for human health impacts, and performing human health or ecological risk assessments, when necessary). The following subsections provide overviews of the methods used to complete these quantitative steps.

3.1 Sample Analyses

All samples requiring chemical and radiological analysis and chain-of-custody documentation were submitted to the fixed analytic laboratory. Each soil sample was screened for radionuclides by mobile radiological laboratory. Analyses were conducted using the methods indicated in Appendix E of this report.

3.1.1 Analytical Methods

All samples were analyzed using EPA SW-846 methods or equivalent and/or radiological methods as described in Quality Control Data Use (document in preparation); unless otherwise noted.

The RFI Work Plan for OU 1100 (LANL 1994, 1157) stipulated that isotopic uranium be analyzed. However, following discussions with DOE and the ER Project Office, both total and isotopic uranium analyses were conducted in addition to the isotopic analysis.

3.1.2 Data Validation

Data verification and validation procedures are used to determine whether data packages have been generated according to specifications, are of known quality, and contain the information necessary to determine data sufficiency for decision making.

Data verification is a check of data deliverables against a set of stated requirements to ensure that what has been ordered has been delivered, thus indicating that the laboratories can be paid. All analytical data generated in support of the ER Project is verified.

Data validation is the process of determining whether individual results can be reliably used to support the decision-making process. During the process, validators determine whether data should be qualified or used with caution because of the potential impact of noted flaws or the failure to achieve precision or bias constraints.

Routine data validation is the comparison of quality indicators (such as surrogate recovery, measurements of method banks, holding times, differences between replicate measurements) with clearly defined limits to determine whether limitations may need to be placed on the use of the data. Routine validation is most suitable for routine analyses and for those nonroutine analyses for which clearly defined limits have been established.

The focused data validation process addresses those characteristics of the data (e.g., precision and bias) that directly affect the decision(s) to be based on the data. The same data set may undergo different focused validations for different decisions.

3.2 Background Comparisons

Once the data validation process is complete and the site data are finalized, the next step in the process is to compare site data with available background data. The results of a focused data validation should exclude from consideration for background comparison any contaminant that is identified as an artifact of analytical laboratory or field contamination, analytical interference, or improper analyte identification or quantitation. The purpose of this decision step is to determine whether chemicals that have natural or anthropogenic background distributions should be retained as COPCs or eliminated from further consideration. Background data are available from two sources: 1) soil samples collected throughout Los Alamos County for which chemical analyses were performed for certain inorganic (metal) chemicals and naturally occurring radioactive chemicals (Longmire et al. 1995, 1142 and 1266); and 2) background concentrations of radioactive chemicals associated with global fallout from atmospheric nuclear testing (e.g., plutonium, cesium, strontium, and tritium) reported in Laboratory environmental surveillance reports (most recently Environmental Protection Group 1994, 1179).

Comparisons between site data and background data are initially performed by comparing each observed concentration datum with an upper tolerance limit (UTL) estimated from background data. Details of statistical methods used to generate UTLs from the background data sets and suggestions for statistical methods of comparing site and background data sets and suggestions for statistical methods of comparing site and background concentration distributions are presented in the guidance document, Statistical Comparisons to Background, Part I (ER Project Assessments Council 1995, 1218). Distributional background comparisons are shown in Appendix D.

If a chemical has a reported concentration that exceeds its UTL or fails other statistical background comparison tests (i.e., the site data are statistically greater than background data), then that chemical is carried forward to the screening assessment process. If a chemical does not have a reported concentration that exceeds the UTL, then that chemical is removed from further consideration.

The ER Project has developed UTLs for the most commonly sampled chemicals and the most commonly analyzed media. For chemicals and/or media not included in the Longmire data or in other Laboratory databases), UTLs will be developed by the Decision Support Council as needed.

Where there were no background UTLs for radionuclides in soil, natural secular equilibrium established between radionuclides was taken into account. If the radionuclide of concern had no background UTL, it was compared with the radionuclide with which (under natural conditions) it would be in secular equilibrium. If the radionuclide of concern was found to be within secular equilibrium with its associated radionuclide, the radionuclide of concern was considered to be naturally occurring and not present as a result of Laboratory-related activities. Secular equilibrium is assumed for the following specific isotopes: thorium-232~thorium-228~radium-228; uranium-238~thorium-234; and uranium-234~thorium-230~radium-226.

In general, some of the inorganics analyzed as part of the analytical suite are not subjected to the data comparison because they are not considered to be COPCs at any the PRS investigated. These inorganics, which include aluminum, calcium, iron, magnesium, potassium, and sodium, occur naturally in soil.

3.3 Evaluation of Radionuclide Data

To determine whether the sample value represents a significant amount of radioactivity, a term called the Decision Amount (DA) is used. The DA is defined in ANSI N 13.30, Draft American National Standard for Performance Criteria for Radiobioassay (ANSI 1989) as the level at which only 5% of the background counts would erroneously be called positive (i.e., 95% of the background counts will be <DA). A widely accepted approximation of the ANSI standard is 3σ, which is derived by multiplying the uncertainty value

(σ) for an analyte by 3. If the reported sample value is less than or equal to the 3σ value, the analyte is considered to be undetected. Sample values greater than the 3σ value are considered to be positive and are compared with background UTLs and SALs.

Radionuclide data received from the analytical laboratory were evaluated for the presence of DOE-introduced radionuclides. The evaluation process examines each reported radionuclide based on its origin (i.e., whether it is naturally occurring or man-made). The natural radionuclides of cosmic or primordial origin (e.g., potassium-40) are identified first and are usually eliminated from further consideration unless their activity amounts are abnormally high.

Isotopes of the three existing natural radioactive decay series are compared with background and can be screened out unless their activity levels or isotopic ratios are significantly different from the isotopic ratio abundances found in naturally occurring radionuclides.

The environmental legacy of former atmospheric nuclear weapons' testing include the man-made radionuclides: tritium, cobalt-60, and isotopics of uranium, neptunium, plutonium, and americium. Depleted uranium (DU), which is 99.75% uranium-238, is also considered man-made, in that it has been depleted of most of its uranium-234 and uranium-235 in the gaseous diffusion process. In natural uranium, the activity ratio of uranium-238 to uranium-234 is ~1:1; for DU, the ratio is ~10:1 for the oldest (~50 years old) DU, and ~100:1 for DU that is ~3 years old. Thus, using the isotopic activities, the presence of DU can be ascertained. DU has been widely used in a variety of experiments at the Laboratory since 1945 and is an expected contaminant at the firing sites in former TA-20.

3.4 Evaluation of Organic Constituents

Background data are not available for organic chemicals. This preliminary evaluation of organic chemicals considers detected chemicals and chemicals that were analyzed for but not detected in any sample. The purpose of this decision step is to determine whether organic chemicals should be retained as COPCs or eliminated from further consideration based on detection status. Detection status is determined by the analytical laboratory on a sample-by-sample, analyte-by-analyte basis. Estimated quantitation limits (EQL) have been established for each analyte as reporting limits when the analyte is not detected. It should be noted that the EQLs reported for individual samples are dependent on a number of factors and can vary from sample to sample and from analysis to analysis. Therefore, the sample-specific EQL for a chemical must be used in this comparison.

If an organic chemical is reported as detected, then that chemical is generally carried forward through the screening assessment process. If a chemical is not reported as detected in any sample analyses, then that chemical is generally removed from further consideration. Exceptions to these general rules may be made if site-specific process knowledge so indicates. A chemical that is detected may be removed from further consideration if it can be determined that its presence is not a result of laboratory operations, and a chemical that is not detected in any sample may be carried through the decision process if the chemical can be expected to be present at the site based on historical operations.

3.5 Human Health Assessment

3.5.1 Screening Assessment

The screening assessment consists of sequential decisions that are used to determine whether chemicals have been released to the environment as a result of historical Laboratory operations at levels that may be hazardous to human health or the environment. The decisions include the following:

- Can reported concentrations be attributed solely to positive analytical laboratory or field bias?
- Are site data greater than background?

- Is the maximum site concentration greater than the SAL?

The purpose of this decision step is to determine whether chemicals should be retained as COPCs or eliminated from further consideration based on comparisons with SALs. This is the last step in the screening assessment process for human health concerns. If COPCs remain after this step, then further action may be proposed. If no COPCs remain after this step, then NFA may be proposed based on human health concerns. SALs are medium-specific concentrations that are calculated using chemical-specific toxicity information and conservative, default exposure assumptions. A complete description of the methods used to generate SALs is provided in "Risk-Based Corrective Action Process" (LANL/SNL 1996, 1277). For those chemicals for which SALs are available, each observed concentration datum is compared with the chemical's SAL. If a chemical has a reported concentration greater than its SAL, then that chemical is retained as a COPC pending further analysis. If a chemical does not have a reported concentration greater than its SAL, then that chemical is generally removed from further consideration. If more than one chemical is present at the site, this decision is deferred pending the results of the multiple chemical evaluation (described below). The decision to retain 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.

It is possible that COPCs should be retained because of the combined adverse health effects of several chemicals. This possibility is evaluated in the multiple chemical evaluation (MCE), in which the reported concentration for each chemical is divided by its respective SAL, and the resulting normalized values are incorporated into a simple additive model. If the sum of the normalized values (i.e., the total normalized value) is less than 1, then the chemicals are removed from further consideration. If the total normalized value is greater than 1, then chemicals having an individual normalized value greater than or equal to 0.1 are retained as COPCs pending further evaluation.

Only those chemicals that exceed background concentration thresholds (certain inorganics and radionuclides) or are detected (organics) in at least one sample are included in the MCE. These chemicals are divided into three classes: noncarcinogens, chemical carcinogens, and radionuclides. Additive effects are assumed within each class, but each class is evaluated separately. For further information on the calculation of MCEs see "Risk-Based Corrective Action Process" (LANL/SNL 1996, 1277).

The screening assessment described in "Technical Approach to RFI Reports" (LANL in preparation, 1281) was followed.

3.5.2 Risk Assessment

The human health risk assessment(s) presented in Chapter 5.0 follow the guidance document "Risk-Based Corrective Action Process" (LANL/SNL 1996, 1277). The human health risk assessment process consists of the following four steps:

- identification of chemicals of potential concern,
- exposure assessment,
- toxicity assessment, and
- risk characterization.

Human health risk assessments were performed for PRSs 53-001(a) and 53-012(e). Refer to Appendix D for calculations.

3.6 Ecological Assessment

An ecological risk assessment will be conducted when an approach has been approved by state and federal regulators. Threatened and endangered species and sensitive habitats have been identified based on field surveys (Section 2.4). A qualitative habitat screening model was applied to each PRS to evaluate the potential for exposure to ecological receptors. The model evaluates potential ecological risk by ranking general landscape condition (development and disturbance) and the potential for receptors to access COPCs, as described in LANL/SNL 1996 (1277).

4.0 RESULTS OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

Samples were collected, processed, and analyzed in accordance with the Environmental Restoration Quality Assurance/Quality Control (QA/QC) program documented in the Site-Specific Quality Assurance Project Plan (QAPjP), Annex II of the RFI Work Plan for OU 1100 (LANL 1994, 1157). The QA objectives for measured data are based on the Laboratory Quality Program Plan for ER Activities (LANL 1991, 0840).

A variety of QA/QC samples are used to determine the usability of the data generated from the various analyses. These samples included field and laboratory duplicates, performance evaluation samples, blind quality control samples, laboratory blanks, spikes, surrogates, and laboratory control samples (LCS). The assessment of QA/QC samples and the potential effect these results may have on data usability were evaluated for all samples.

The QA/QC data associated with this investigation indicated that of the more than 12,000 pieces of analytical data, approximately 100% are acceptable and defensible. None of the radiochemistry data are considered unusable; however, data that are less than 3σ are considered usable as nondetects (see Section 3.3). Similarly, approximately 2% of the organic data are qualified because of blank contamination and are usable as nondetects. Only 8% of the data are qualified as UJ or J. One organic datum for chrysene and one inorganic datum for manganese are considered unusable for screening assessment purposes because of QA/QC problems. The unusable data did not affect the sufficiency of the data for decision-making purposes. The QA/QC mechanisms were therefore generally effective in ensuring the reliability of measured data within expected limits of sampling and analytical error.

4.1 Analyses for PRS 20-001(a), Landfill Area 1

4.1.1 Inorganic Analyses

Eight samples were analyzed for inorganics; all inorganic data are considered usable as reported.

4.1.2 Organic Analyses

Eight samples were analyzed for HE; all organic data are considered usable as reported.

4.1.3 Radiochemistry Analyses

Eight samples were analyzed for radionuclides; those data that are less than 3-σ are usable as nondetects (Table B-1). All other radionuclide data are considered usable as reported.

4.2 Analyses for PRS 20-001(b), Landfill Area 2

4.2.1 Inorganic Analyses

Twenty-two samples, including one field duplicate sample, were analyzed for inorganics; all inorganic data are considered usable as reported.

4.2.2 Organic Analyses

Twenty-two samples, including one field duplicate sample, were analyzed for HE; all organic data are considered usable as reported.

4.2.3 Radiochemistry Analyses

Twenty-two samples, including one field duplicate sample, were analyzed for radionuclides. The uranium-235 data for eight samples are qualified as J because the LCS results are outside of the contractual requirement (±20%) by 69% and 58.3% for uranium-235 (Table B-1). The data are usable because the recoveries are biased high. Those data that are less than the 3σ are usable as nondetects. All other data are considered usable as reported.

4.3 Analyses for PRS 20-002(a), Recovery Pit

4.3.1 Inorganic Analyses

Twenty-three samples, including one field duplicate sample, were analyzed for inorganics. Four barium samples and one thallium sample are qualified as J and undetected estimated (UJ), respectively, because recoveries in the LCS are outside of acceptable limits (Table B-1). Data are usable because the recoveries are biased high. All other inorganic data for are considered usable as reported.

4.3.2 Organic Analyses

Twenty-three samples, including one field duplicate sample, were analyzed for HE; all organic data are considered usable as reported.

4.3.3 Radiochemistry Analyses

Twenty -three samples, including one field duplicate sample, were analyzed for radionuclides. The method blank contained uranium-234 and uranium-238. The uranium-234 and uranium-238 data for sample 0220-95-071 are less than five times the blank concentration and, therefore, are usable as nondetects only (Table B-1). In addition, those data that are less than the 3σ are usable as nondetects. All other radionuclide data are considered usable as reported.

4.4 Analyses for PRS 20-002(b), Dumbo and Mount

4.4.1 Inorganic Analyses

Twenty-three samples, including one field duplicate sample, were analyzed for inorganics. All antimony and mercury data are qualified as either UJ or J because matrix spike and LCS recoveries, respectively, are outside of acceptable limits (Table B-1). The antimony data are usable because the matrix spike recovery is less than 1% below the limit, and antimony would have been detected if present. The mercury data are usable because the recovery in the LCS is within reasonable limits and the matrix spike recovery is acceptable. All other inorganic data are considered usable as reported.

4.4.2 Organic Analyses

Twenty-three samples were analyzed for HE; all organic data are considered usable as reported.

4.4.3 Radiochemistry Analyses

Twenty-three samples, including one field duplicate sample, were analyzed for radionuclides. Those data that are less than the 3σ are usable as nondetects (Table B-1). All other radionuclide data are considered usable as reported.

4.5 Analyses for PRS 20-002(c), Firing Site

4.5.1 Inorganic Analyses

Twenty-five samples, including one field duplicate sample, were analyzed for inorganics. All mercury data are qualified either as UJ or J because recovery in the LCS is below acceptable limits (Table B-1). The mercury data are usable because the recovery in the LCS is within reasonable limits and the matrix spike recovery is acceptable, so the analyte can be accurately quantified. In addition, the calculated relative percent difference (RPD) between chromium concentrations in sample 0220-95-0256 and its field duplicate, sample 0220-95-0257, is about 43%. The calculated RPD between zinc concentrations in sample 0220-95-0256 and its field duplicate, sample 0220-95-0257, is about 41%. For these sample results, the chromium and zinc RPDs indicate the variability inherent in sampling the soil matrix; therefore, the results are usable as individual analyses (Table B-1). All other inorganic data are considered usable as reported.

4.5.2 Organic Analyses

Twenty-five samples, including one duplicate sample, were analyzed for HE; all organic data are considered usable as reported.

4.5.3 Radiochemistry Analyses

Twenty-five samples, including one field duplicate sample, were analyzed for radionuclides. Those data that are less than the 3σ are usable as nondetects (Table B-1). All other radionuclide data are considered usable as reported.

4.6 Analyses for PRS 20-003(b), 20-mm Gun Firing Site

4.6.1 Inorganic Analyses

Ten samples, including one field duplicate sample, were analyzed for inorganics. Manganese data in all samples and arsenic, cobalt, and selenium in one sample are qualified as either UJ or J. The data are qualified because the matrix spike recovery for manganese and the correlation coefficients for arsenic and selenium are less than EPA-established limits, and cobalt recovery in the LCS is greater than the EPA-established limits. The manganese data are usable because the percent recovery in the matrix spike is within reasonable limits and the LCS recovery is acceptable. The arsenic and selenium data are usable because the analytes can still be quantified. The cobalt data are usable because the recovery is biased high. In addition, the calculated RPD between manganese concentrations in sample number 0220-95-176 and its field duplicate, sample 0220-95-177 is 151%. The manganese concentrations in all other samples are within the range of sample 0220-95-176 but not its duplicate, which is one order of magnitude greater than the other samples. Therefore, the manganese data for sample 0220-5-177 is considered an outlier and, therefore, is unusable. The high RPD for this pair of samples is most likely a result of soil matrix heterogeneity. All other inorganic data are considered usable as reported.

4.6.2 Organic Analyses

PRS 20-003(b) was not sampled for organics.

4.6.3 Radiochemistry Analyses

Ten samples, including one field duplicate sample, were analyzed for radionuclides. Those data that are less than the 3σ are usable as nondetects (Table B-1). All other radionuclide data are considered usable as reported.

4.7 Analyses for PRS 72-001, Small Arms Firing Range

4.7.1 Inorganic Analyses

Eight samples, including one field duplicate sample, were analyzed for inorganics; all inorganic data are considered usable as reported.

4.7.2 Organic Analyses

PRS 72-001 was not sampled for organics.

4.7.3 Radiochemistry Analyses

PRS 72-001 was not sampled for radionuclides.

4.8 Analyses for PRS 53-001(a), Waste Accumulation at Building TA-53-2

4.8.1 Inorganic Analyses

Four samples were analyzed for inorganics; all inorganic data are considered usable as reported.

4.8.2 Organic Analyses

Four samples were analyzed for PCBs and pesticides. Two results were obtained for one of the PCB samples. The undiluted result was not usable as the value was estimated (E) because the level was above the calibration range. The diluted analysis is usable because it is accurately quantified (Table B-2). For the pesticide data, the quantitative value for endosulfan II and endrin aldehyde in two analytical columns differed by more than the QC criteria in one sample and are usable as nondetects only (Table B-2). All other PCB and pesticide data are considered usable as reported.

Four samples were analyzed for semivolatiles. Six semivolatile analytes associated with all samples were qualified as UJ because the recoveries in the LCS are outside of acceptable limits (Table B-2). The data are usable because the recoveries are within reasonable limits so the analytes would have been detected if present. All other semivolatile data are considered usable as reported.

Four samples were analyzed for volatiles; all volatile data are usable as reported.

4.8.3 Radiochemistry Analyses

PRS 53-001(a) was not sampled for radionuclides.

4.9 Analyses for PRS 53-001(b), Waste Accumulation at Building TA-53-2

4.9.1 Inorganic Analyses

Three samples, including one duplicate sample, were analyzed for inorganics; all inorganic data are considered usable as reported.

4.9.2 Organic Analyses

Three samples were analyzed for PCBs and pesticides; all PCB and pesticides data are considered usable as reported.

Four samples were analyzed for semivolatiles. Six chemicals associated with all semivolatile samples were qualified as UJ because the recoveries in the LCS are outside of acceptable limits (Table B-2). The data are usable because the recoveries are within reasonable limits, so the analytes would have been detected if present. All of the data for two semivolatile samples are qualified as UJ because surrogate recoveries are outside of acceptable limits (Table B-2). Data are usable because only one base-neutral extractable and one acid-extractable surrogate are affected and the surrogate recoveries from the other surrogates are sufficient to quantify the analytes so that they would have been detected if present. All of the data for one semivolatile sample are qualified as UJ because matrix spike recoveries are outside of acceptable limits (Table B-2). Data are usable because the surrogate recoveries are acceptable. All other semivolatile data for PRS 53-001(b) are considered usable as reported.

Three samples were analyzed for volatiles. The method blank contained methylene chloride, and all associated samples contained methylene chloride at less than 10 times blank concentration, indicating that methylene chloride may have been present because of contamination. Therefore, all methylene chloride data are usable as nondetects only. All other volatile data are usable as reported.

4.9.3 Radiochemistry Analyses

PRS 53-001(b) was not sampled for radionuclides.

4.10 Analyses for PRS 53-001(e), Waste Accumulation at Building TA-53-25

4.10.1 Inorganic Analyses

PRS 53-001(e) was not sampled for inorganics.

4.10.2 Organic Analyses

Four samples were analyzed for semivolatiles. Six chemicals associated with all semivolatile samples are qualified as UJ because the recoveries in the LCS are outside of acceptable limits (Table B-2). The data are usable because the recoveries are within reasonable limits, and the analytes would have been detected if present. All of the data associated with one semivolatile sample are qualified as UJ because surrogate recovery is outside of acceptable limits (Table B-2). Data are usable because the other surrogate recoveries are sufficient to the quantify the analytes so that the analytes would have been detected if present. All other semivolatile data are considered usable as reported.

Four samples were analyzed for volatiles. The method blank contained methylene chloride, and all associated samples contained methylene chloride at less than 10 times blank concentration, indicating that the presence of this analyte is a result of contamination. Therefore, all methylene chloride data are usable as nondetects only. In addition, 17 analytes associated with two samples are qualified as UJ because of low internal standard responses. The data are usable because the responses are sufficient to detect and quantify the target compounds. All other volatile data are usable as reported.

4.10.3 Radiochemistry Analyses

PRS 53-001(e) was not sampled for radionuclides.

4.11 Analyses for PRS 53-001(g), Waste Storage Shed, TA-53-1031

4.11.1 Inorganic Analyses

Five samples were analyzed for inorganics. Arsenic and thallium in one sample and selenium in two samples are qualified as J or UJ because recoveries in the analytical spike are outside of acceptable limits (Table B-2). The data are usable because the recoveries are either biased high or are within reasonable limits, and the analyte would have been detected if present. All cobalt data are qualified as J because it is detected in the blank (Table B-2). The cobalt data are usable because the sample values are more than five times the blank value, indicating the presence is a result of detectable levels in the soil. All lead data are qualified as J because the RPD between duplicate data are greater than EPA-established limits. All manganese data are qualified as J because matrix spike recovery is less than EPA-established limits (Table B-2). The lead data are usable because the high RPD is an indication of the variability of the soil matrix, while the manganese data are usable because the recoveries are within reasonable limits (>50<75%) and the analytical spike recovery is acceptable. All other inorganic data are considered usable as reported.

4.11.2 Organic Analyses

Four samples were analyzed for semivolatiles. Six semivolatile analytes associated with all samples are qualified UJ because the recoveries in the LCS are outside of acceptable limits (Table B-2). The data are usable because the recoveries are within reasonable limits, and the analytes would have been detected if present. Chrysene in sample 0253-95-0385 is detected above the EQL but below the MDL and is usable as a nondetect only. All other semivolatile data are usable as reported.

Five samples were analyzed for volatiles. The method blank contained methylene chloride, and the methylene chloride in all samples is less than 10 times blank concentration, indicating that the presence of this analyte may be a result of contamination (Table B-2). Therefore, all methylene chloride data are usable as nondetects. In addition, five volatile chemicals associated with all samples are qualified as UJ because the relative standard deviations in the initial or continuing calibrations are greater than EPA-established limits (Table B-2). Data usability is unaffected because the data are biased high. All other volatile data are considered usable as reported.

4.11.3 Radiochemistry Analyses

PRS 53-001(g) was not sampled for radionuclides.

4.12 Analyses for PRS 20-004, Septic Tank TA-20-49 and Drain Line

4.12.1 Inorganic Analyses

Nine samples were analyzed for inorganics; all inorganic data are considered usable as reported.

4.12.2 Organic Analyses

Nine samples were analyzed for volatile and semivolatile organics; all organic data are considered usable as reported.

4.12.3 Radiochemistry Analyses

PRS 20-004 was not sampled for radionuclides.

4.13 Analyses for PRS 20-005, Septic Tank TA-20-27

4.13.1 Inorganic Analyses

Ten samples, including one field duplicate sample, were analyzed for inorganics; all inorganic data are considered usable as reported.

4.13.2 Organic Analyses

PRS 20-005 was not sampled for organics.

4.13.3 Radiochemistry Analyses

PRS 20-005 was not sampled for radionuclides.

4.14 Analyses for PRS 53-012(e), Outfall

4.14.1 Inorganic Analyses

Three samples were analyzed for inorganics; all inorganic data are considered usable as reported.

4.14.2 Organic Analyses

Three samples were analyzed for PCBs and pesticides. The PCB data are considered usable as reported. For the pesticide data, the quantitative value for dieldrin, endosulfan II, endrin aldehyde, and gamma-chlordane in two analytical columns differed by more than the QC limit; therefore, these data are usable as nondetects (Table B-2). All other pesticide data are considered usable as reported.

Three samples were analyzed for semivolatiles. Six chemicals associated with all semivolatile samples are qualified as UJ because the recoveries in the LCS are outside of acceptable limits (Table B-2). The data are usable because the recoveries are within reasonable limits, and the analytes would have been detected if present. All of the data associated with these semivolatile samples are qualified as UJ because surrogate recoveries are outside of acceptable limits (Table B-2). Data are usable because only one base-neutral extractable and one acid-extractable surrogate are affected and the surrogate recoveries from the other surrogates are sufficient to quantify the analytes so that they would have been detected if present. All other semivolatile data are considered usable as reported.

Three samples were analyzed for volatiles. Twenty-seven analytes in one sample and 17 analytes in the other two samples are qualified as UJ because of low internal standard responses (Table B-2). Data are usable because the responses are sufficient to detect and quantify the target compounds. All other volatile data are considered usable as reported.

4.14.3 Radiochemistry Analyses

PRS 53-012(e) was not sampled for radionuclides.

5.0 SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 PRS 20-001(a), Landfill Area 1

PRS 20-001(a) was a small landfill site used to bury metal scrap. Based on the sampling results and screening assessment, we recommend NFA for the site under NFA Policy Criterion 4: The site has been characterized, and no COPCs are retained from the screening assessment. Figure 5.1-1 shows the site with the sample locations and results posted.

5.1.1 History

PRS 20-001(a) is discussed in detail in Section 5.1 of the RFI Work Plan (LANL 1994, 1157). The landfill was used from 1945 to 1948 and was subsequently excavated. Its primary use was to bury metal scrap, some of it contaminated. Records (Courtwright 1962, 22-0031; Reider 1962, 22-0068; Drake and Courtwright 1966, 22-0039; Ahiquist 1985, 22-0025) indicate that the landfill was excavated and its contents removed during a 1948 cleanup.

5.1.2 Description

PRS 20-001(a), located south of East Jemez Road and slightly west of the active firing range (Figure 5.1-1), was a small landfill site used primarily to bury metal scrap. The landfill was relatively small and shallow (probably not more than 5 ft deep). The site is now sparsely forested, with no visible evidence of the landfill.

5.1.3 Previous Investigation(s)

In August and September of 1986, a geophysics survey (Weston 1986, 22-0069) was conducted using magnetometry (MAG), in an attempt to find evidence of the former landfill sites. Neither the presence of metal nor the location of the landfill site were established.

The landfill was investigated in 1987 as part of a DOE environmental survey (DOE 1987, 22-0113). The report noted that the landfill was believed to be located across from the active firing range. A depression, approximately 5 ft deep, was observed at the end of an unpaved road.

5.1.4 Field Investigation

Before any analytical sample locations were chosen, a thorough geophysical survey was conducted at the landfill. Historical data indicate that the landfill was used for the disposal of metal objects, so MAG surveys were chosen to assess the possible location of large (at least 1 ft in diameter) buried ferrous metal objects. Because the landfill may have been excavated, electromagnetic induction (EM) was also used to detect disturbed areas containing fill material that could represent the previous burial site or pit. Surface structures and debris can generate similar anomalies as those caused by buried objects, so the locations of all EM and MAG anomalies were correlated with field notes that indicated the locations of surface features, debris, and structures in an effort to eliminate from consideration those anomalies that are not related to subsurface disturbance.

The landfill was surveyed and a grid was laid out using traditional cadastral survey techniques. The geophysical surveys were then conducted by taking both EM measurements and MAG readings at 5-ft increments over the grid area. Grid point markers presented in the associated figures identify the location as a point of field measurement. The data was recorded electronically and later uploaded into a commercially available software package for contouring. Terrain conductivity (quadrature) maps were

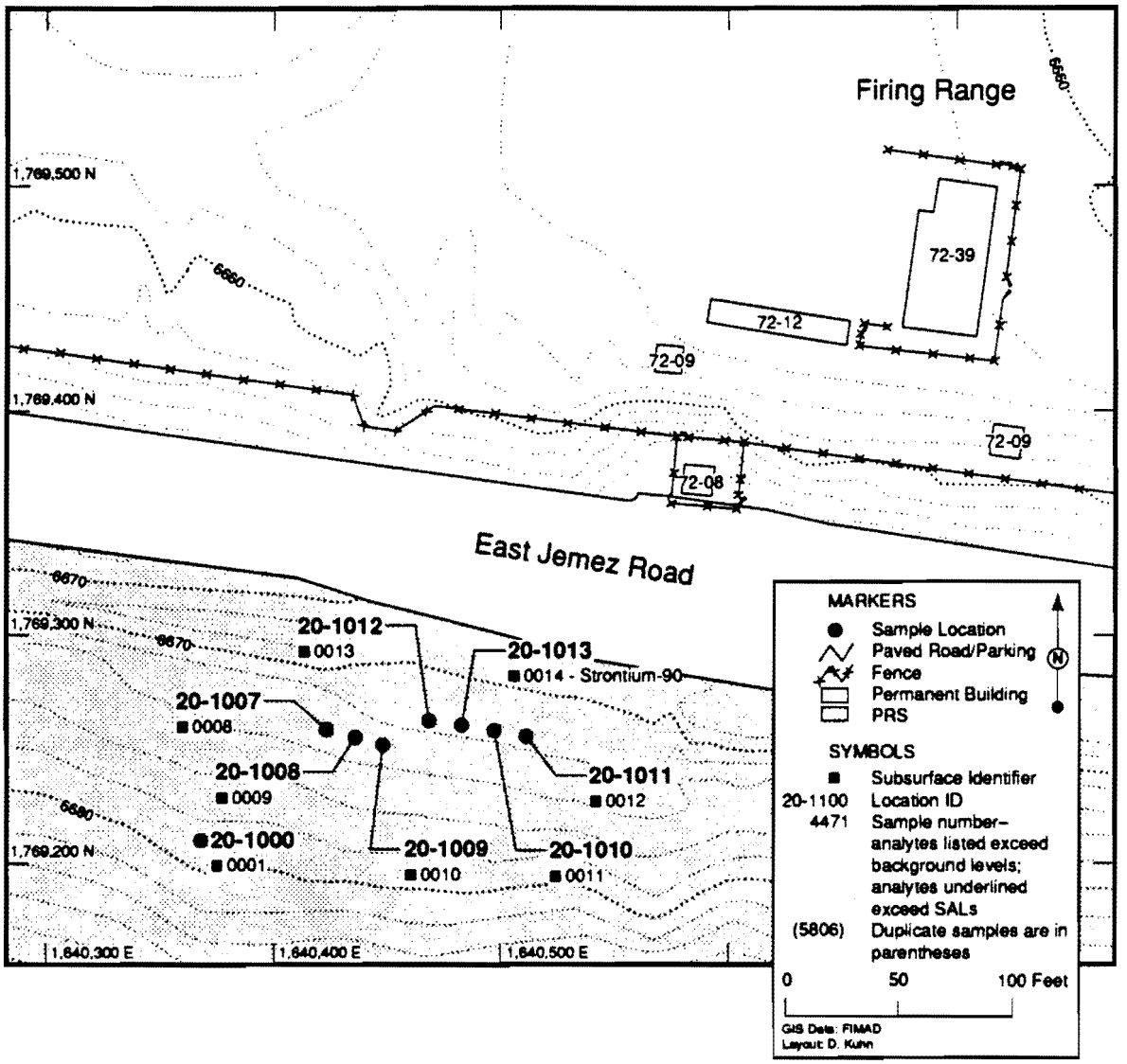

Figure 5.1-1 PRS 20-001(a), Landfill Area 1, showing sample locations and results.

generated from the EM data, and vertical magnetic gradient contour maps were generated from the MAG field data. These maps target anomalies that are typical of buried pits, trenches, and debris and were used to bias the selection of areas to be trenched within the suspected landfill site.

5.1.4.1 Results of Field Surveys

A 200-ft by 300-ft grid was established over this area prior to the geophysical survey, as indicated in Figure 5.1-2 and Figure 5.1-3. Numerous sources of interference are reflected in the geophysical maps for this area, particularly along the northern and eastern boundaries of the investigation area. Along the northern boundary, the interference was caused by overhead powerlines, metal surface debris, and parked cars. The interference along the eastern boundary is most likely caused by subsurface utilities, as evidenced by a manhole located along that boundary.

On Figure 5.1-2, the magnetic gradient map, the high-magnitude anomalies located in the southern section of the investigation area correspond to the locations of tuff boulders and are interpreted to be caused by the local magnetic tuff, which has a high magnetite content. These anomalies do not occur on Figure 5.1-3, the terrain conductivity map, because the two geophysical methods measure different properties of subsurface materials. Figure 5.1-3 does indicate high-magnitude anomalies in the northeastern portion of the site. These anomalies are not associated with known surface structures or objects and are typical of buried metal objects. Another anomaly is possible in the central portion of the site (Figure 5.1-3). This small accumulation of low-magnitude closed hatched contours possibly represents a backfilled area; however, this interpretation is inconclusive because of the subtle nature of the data collected in this area.

5.1.4.2 Results of Field Screening

Samples were field screened for radioactivity and HE to identify gross concentrations of COPCs. Surface radiological screening was performed before the start of intrusive activities. The screening showed no radioactivity above background. HE spot tests were performed on each soil sample to be submitted for laboratory analysis. No positive results were obtained.

5.1.4.3 Results of Mobile Laboratory Screening

Eight soil samples were analyzed by an on-site mobile laboratory for gross alpha, beta, and gamma radioactivity. No results were encountered at this PRS that require special labeling or packaging of samples being sent offsite for analysis.

5.1.4.4 Trenching and Sample Collection and Submittal for Analysis

The objective of the Phase I sampling was to determine whether COPCs are present at the landfill sites. Figure 5.1-1 shows all sample locations at this PRS, and Table 5.1-1 shows a summary of samples taken.

A Case 580 Super K Construction King backhoe with a 18-in.-wide bucket was used to excavate the two trenches. Trench locations were selected based on anomalies that were not associated with known surface structures or objects detected during the geophysical investigation.

The north trench location was centered around anomalies associated with buried objects. Excavation of the north trench exposed small pieces of wood debris, a 3-ft-long section of a pole, and a metal power pole anchor. Excavation of the south trench produced no evidence of a previous excavation. Seven soil samples were taken from the north trench at a depth of 10 ft to 11 ft in accordance with the RFI Work Plan.

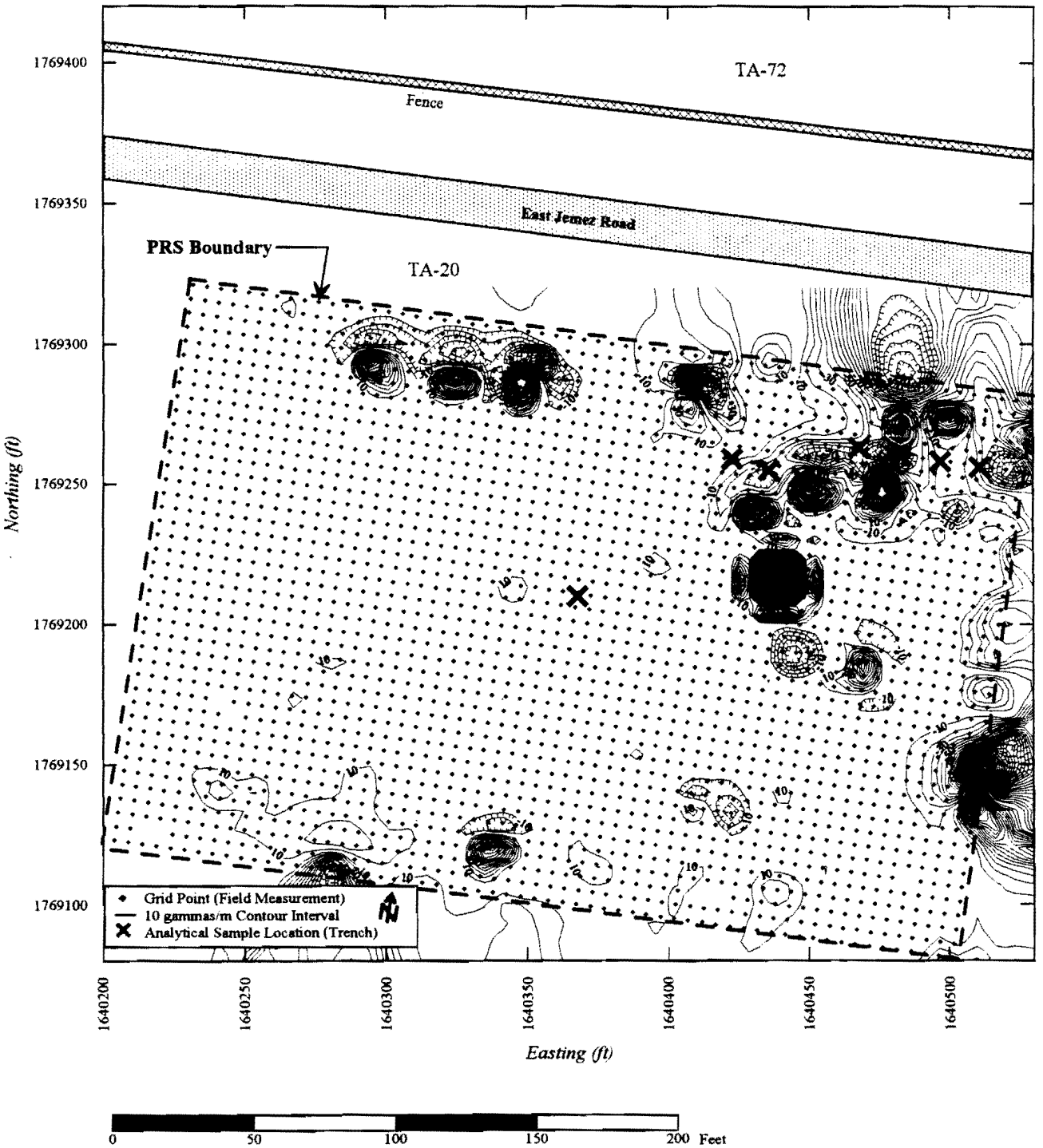

Figure 5.1-2 PRS 20-001(a), Landfill Area 1, magnetic gradient map

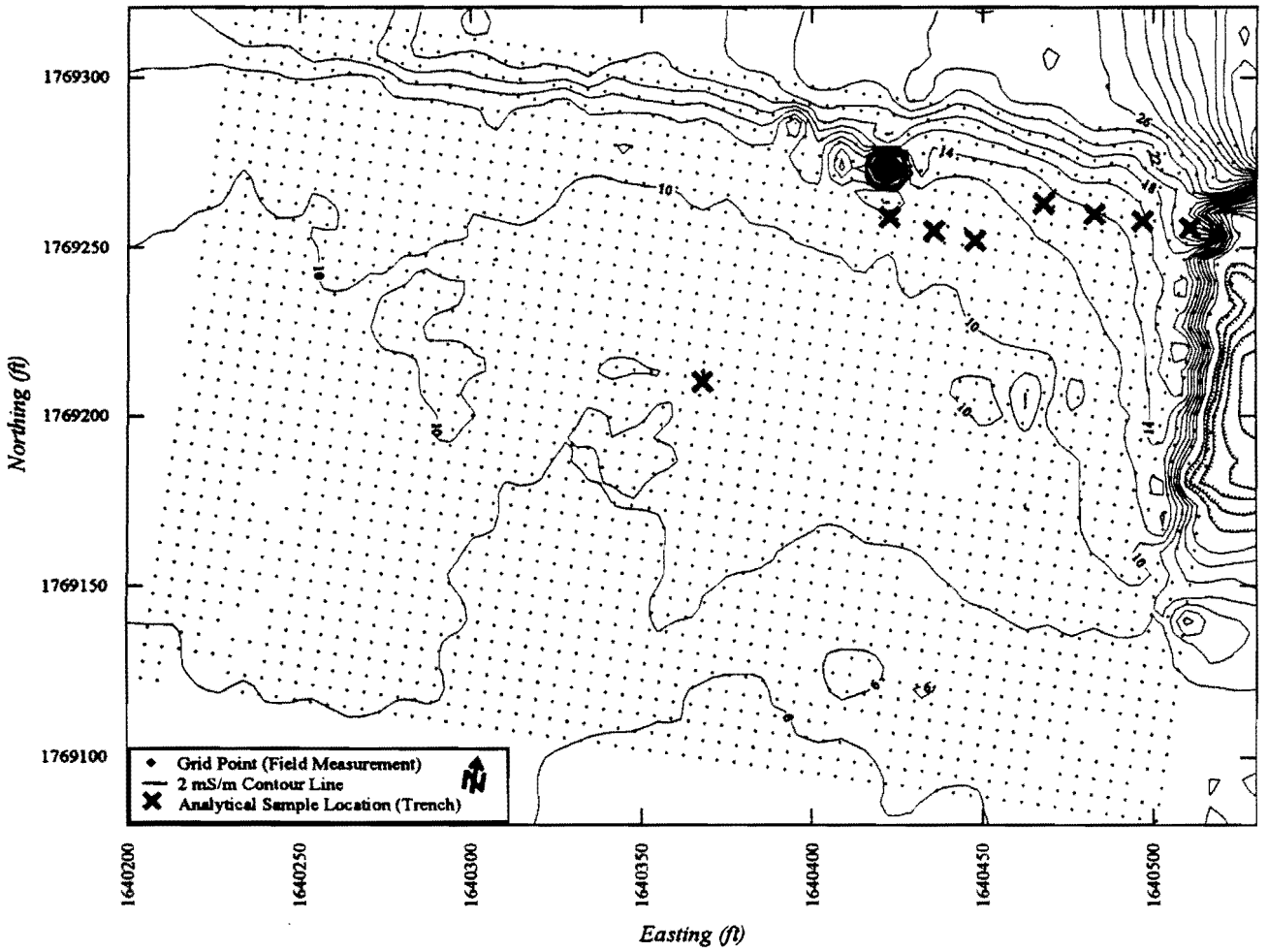

Figure 5.1-3 PRS 20-001(a), Landfill Area 1, terrain conductivity map

TABLE 5.1-1
SAMPLE SUMMARY - LANDFILLS

Location ID	Sample ID		Depth (ft)	Matrix	Sample Methods*					
					HE	Metals	Sr-90	U (iso)	U (tot)	Gamma-Spec
PRS 20-001(a)										
20-1000	0220-95-	0001	10-11	Soil		296	NA	NA	NA	297
20-1007		0008	10-11	Soil	295	296	NA	NA	NA	297
20-1008		0009	10-11	Soil	295	296	NA	NA	NA	297
20-1009		0010	10-11	Soil	295	296	NA	NA	NA	297
20-1010		0011	10-11	Soil	295	296	NA	NA	NA	297
20-1011		0012	10-11	Soil	295	296	NA	NA	NA	297
20-1012		0013	10-11	Soil	295	296	NA	NA	NA	297
20-1013		0014	10-11	Soil	295	296	NA	NA	NA	297
PRS 20-001(b)										
20-1014	0220-95-	0015	8-9	Soil	358	359	NA	NA	NA	360
20-1015		0016	8-9	Soil	358	359	NA	NA	NA	360
20-1016		0017	9-10	Soil	358	359	NA	NA	NA	360
20-1017		0018	9-10	Soil	358	359	NA	NA	NA	360
20-1018		0019	6-7	Soil	358	359	NA	NA	NA	360
20-1018		0020D	6-7	Soil	358	359	NA	NA	NA	360
20-1019		0023	1-2	Soil	358	359	NA	NA	NA	360
20-1020		0024	10-11	Soil	358	NA	NA	NA	NA	360
20-1021		0025	10-11	Soil	312	318/21804	319	319	NA	319
20-1022		0026	10-11	Soil	312	318/21804	319	319	NA	319
20-1023		0027	10-11	Soil	312	318/21804	319	319	NA	319
20-1024		0028	10-11	Soil	312	318/21804	319	319	NA	319
20-1025		0029	10-11	Soil	312	318/21804	319	319	NA	319
20-1026		0030	10-11	Soil	312	318/21804	319	319	NA	319
20-1027		0031	10-11	Soil	312	318/21804	319	319	NA	319
20-1028		0032	10-11	Soil	312	318/21804	319	319	NA	319
20-1029		0033	10-11	Soil	312	318/21804	319	319	NA	319
20-1030		0034	10-11	Soil	312	318/21804	319	319	NA	319
20-1031		0035	10-11	Soil	312	318/21804	319	319	NA	319
20-1032		0036	10-11	Soil	312	NA	319	319	NA	319
20-1033		0037	10-11	Soil	312	318/21804	319	319	NA	319
20-1034		0038	10-11	Soil	312	318/21804	319	319	NA	319

D: duplicate sample *batch numbers

The south trench location was centered around anomalies associated with disturbed material. The excavation produced no evidence of a previous excavation. One sample was taken from the south trench at a depth of 10 ft to 11 ft. Although the RFI Work Plan called for seven samples to be taken from each trench, no evidence of backfill material was discovered in the trenching. Because of the lack of backfill evidence and the small size of the sample hole, only one sample was taken.

The north and south excavations produced no evidence of the metal scrap reportedly associated with this PRS.

Eight samples were submitted for analysis to an off-site laboratory for HE, metals, strontium-90, isotopic uranium, and gamma spectrometry.

5.1.5 Background Comparisons

Inorganics

No inorganics were detected either at concentrations above background UTLs or without a background value. Therefore, inorganics were eliminated as COPCs at this PRS.

Radionuclides

One subsurface soil sample had a detected concentration of strontium-90 (1.52 pCi/g) that exceeded the maximum background concentration (1 pCi/g) and was carried forward to the SAL comparison stage.

5.1.6 Evaluation of Organic Constituents

HE was not detected. Therefore, organics were eliminated as COPCs.

5.1.7 Human Health Assessment

5.1.7.1 Screening Assessment

The strontium-90 concentration (1.52 pCi/g) in one sample was below its SAL (4.4 pCi/g) and is eliminated as a COPC.

5.1.7.2 Risk Assessment

No human health risk assessment was performed for PRS 20-001(a) because no COPCs were retained as a result of the screening assessment.

5.1.8 Ecological Assessment

No inorganics were detected above background UTLs and no organics were detected, so these constituents are eliminated as contaminant sources for ecological risk. The detected concentration of strontium-90 did not exceed its SAL, so it also is eliminated as a source. No further ecological evaluation is required for this PRS.

5.1.9 Extent of Contamination

No COPCs were retained; therefore, this section is not applicable.

5.1.10 Conclusions and Recommendations

PRS 20-001(a) has been characterized, and no COPCs are retained based on the sample results and screening assessment. No further action is recommended, and based on NFA Policy Criterion 4, a Class III permit modification will be submitted requesting removal of this site from the HSWA module of the Laboratory's RCRA operating permit.

5.2 PRS 20-001(b), Landfill Area 2

PRS 20-001(b) was a trench used to bury gun barrels. Based on the sampling results and screening assessment, we recommend NFA for the site under NFA Policy Criterion 4: The site has been characterized, and no COPCs are retained from the screening assessment. Figure 5.2-1 shows the site with sample locations and results posted.

5.2.1 History

PRS 20-001(b) is described in detail in Section 5.1 of the RFI Work Plan (LANL 1994, 1157).

The landfill was used from 1945 to 1948 and was subsequently excavated by bulldozer. Its primary use was to bury gun barrels. Records (Courtwright 1962, 22-0031; Reider 1962, 22-0068; Drake and Courtwright 1966, 22-0039; Ahiquist 1985, 22-0025) indicate that the landfill was excavated and its contents removed during a 1948 cleanup.

5.2.2 Description

PRS-20-001(b), located adjacent to an old gun-mount base (TA-20-16), was described as a trench that was used to bury gun barrels. The site is now partly covered on the south side by the embankment for East Jemez Road, and there is no visible evidence of the landfill.

5.2.3 Previous Investigation(s)

In August and September of 1986, a geophysical survey (Weston 1986, 22-0069) was conducted using MAG, in an attempt to find evidence of the former landfill sites. Neither the presence of metal nor the location of the landfill site were established.

In 1989, a surface radiation survey (Scholl 1989, 0485), using both phoswich and laboratory analytical techniques, was conducted in the vicinity of TA-20-16, which is adjacent to PRS 20-001(b). The results of the survey revealed only background levels of radiation.

5.2.4 Field Investigation

A geophysical survey similar to the one conducted at Landfill Area 1 was also completed for this PRS. For a complete description of the survey, see Section 5.1.4.

5.2.4.1 Results of Field Surveys

A 150-ft by 200-ft grid was established over this area prior to the geophysical survey, as indicated in the Figure 5.2-2 and Figure 5.2-3. There were numerous tuff boulders and outcrops of tuff in the northeast and northwest section of the investigation area. The anomalies located in these areas on Figure 5.2-2, the magnetic gradient map, are interpreted to be a result of these tuff boulders and, as would be expected, do not occur on Figure 5.2-3, the terrain conductivity map. The anomalies located in the

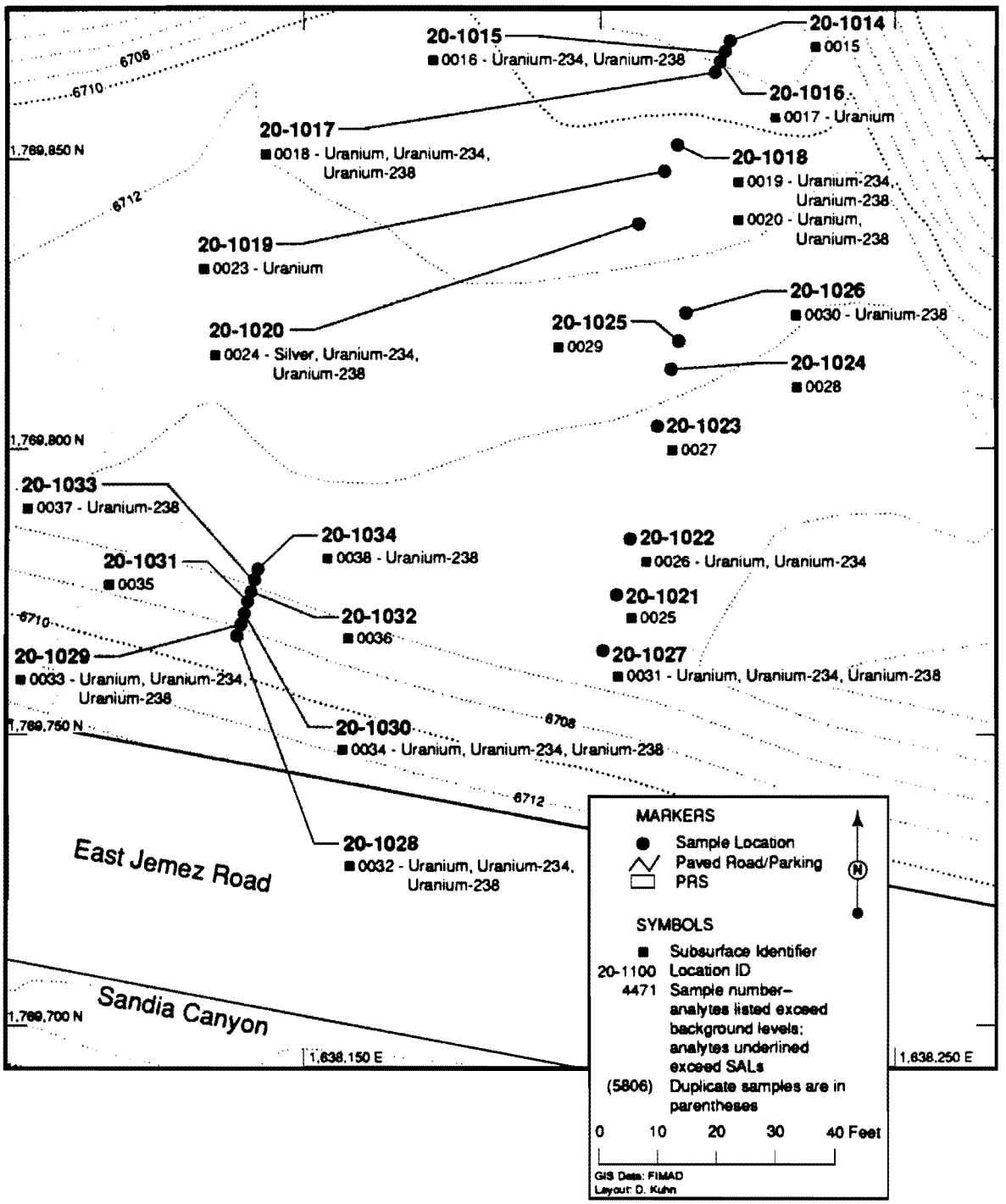

Figure 5.2-1 PRS 20-001(b), Landfill Area 2, showing sample locations and results

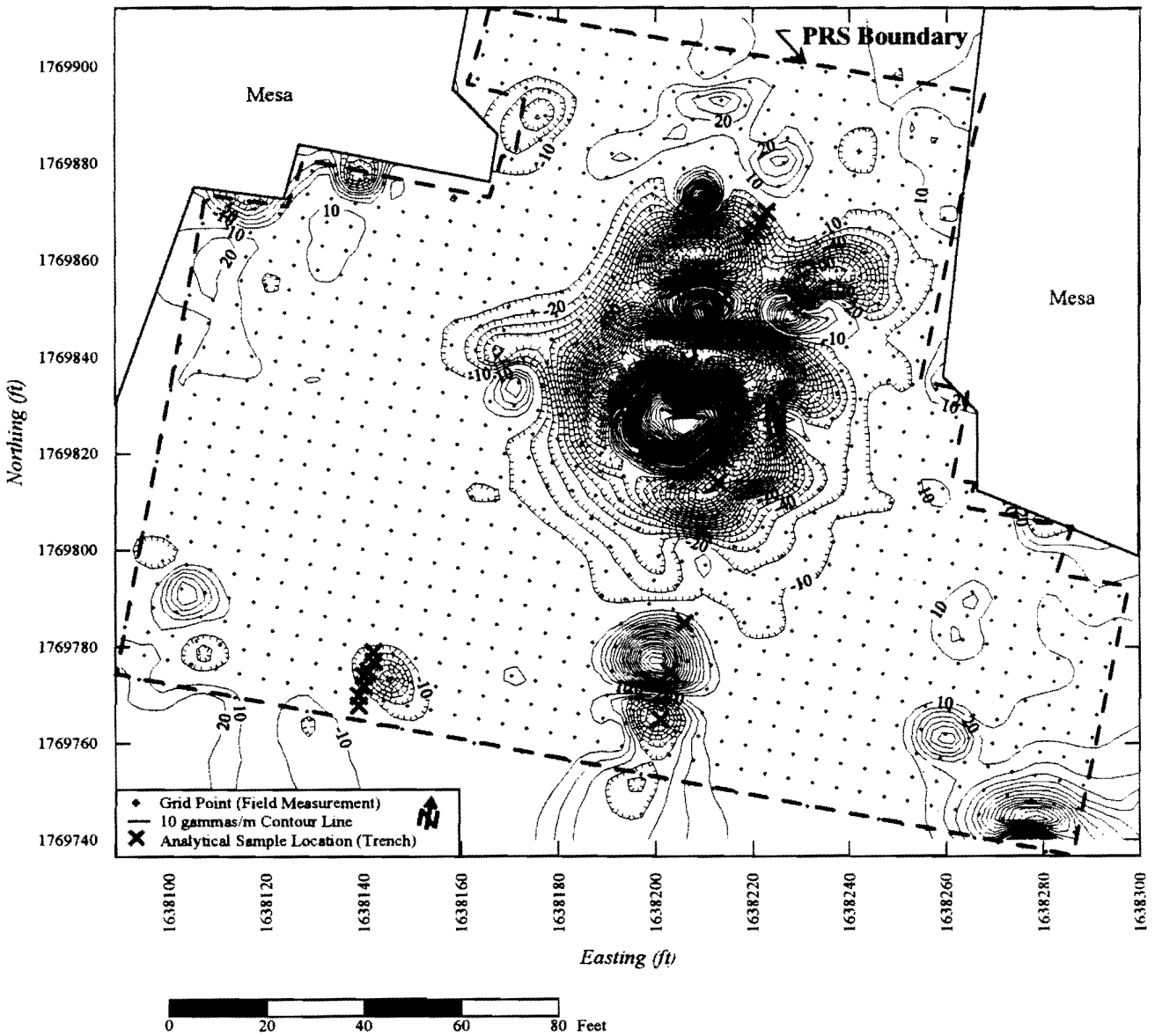

Figure 5.2-2 PRS 20-001(b), Landfill Area 2, magnetic gradient map

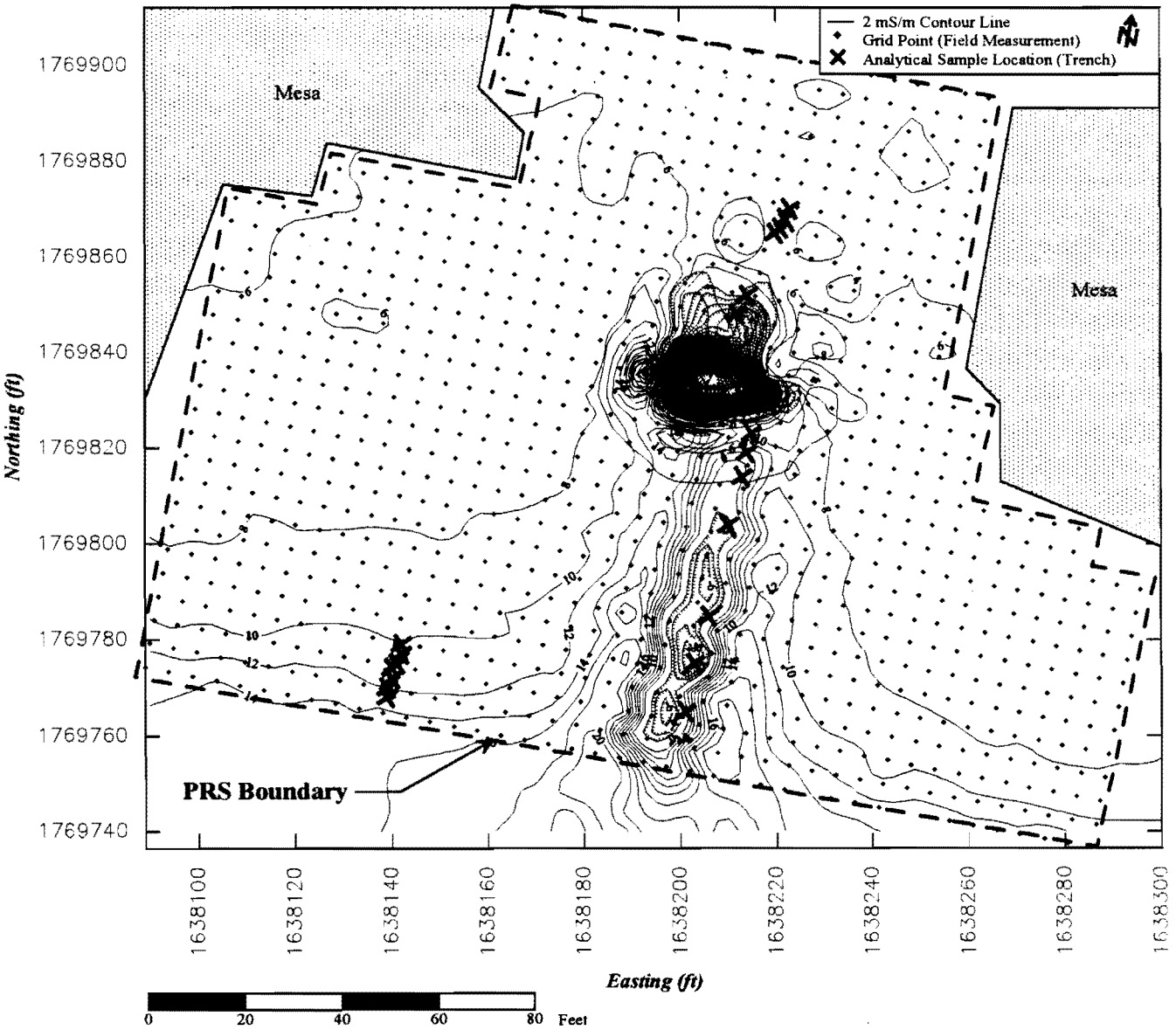

Figure 5.2-3.PRS 20-001(b), Landfill Area 2, terrain conductivity map

extreme southeast and southwest sections of Figure 5.2-2 are associated with surface structures and debris. The high-magnitude anomalies located in the center of both figures could indicate a subsurface disturbance associated with the old gun site. A small metal stake marking the gun site is located approximately in the center of the anomaly. The lineation of high-magnitude anomalies trending due north (Figure 5.2-3) is typical of a buried utility corridor or possibly a buried trench with appreciable amounts of metal present. Another anomaly occurs on Figure 5.2-2 that does not correspond to any known surface interference. This anomaly is typical of a buried metal object. The last anomaly observed occurs in the northern-central portion of Figure 5.2-3. This observance is possibly caused by a backfilled area; however, the data for this area is subtle at best.

5.2.4.2 Results of Field Screening

Samples were field screened for radioactivity and HE to identify gross concentrations of COPCs. Surface radiological screening was performed before the start of intrusive activities. The screening showed no radioactivity above background. HE spot tests were performed on each soil sample to be submitted for fixed laboratory analysis. No positive results were obtained.

5.2.4.3 Results of Mobile Laboratory Screening

Twenty-two soil samples were analyzed at an on-site mobile laboratory for gross alpha, beta, and gamma radioactivity. No results were encountered at this PRS that required special labeling or packaging of samples being sent offsite for analysis.

5.2.4.4 Trenching and Sample Location and Submittal for Analysis

The objective of the Phase I sampling was to determine whether COPCs are present at the landfill sites. Figure 5.2-1 shows all sample locations at this PRS, and Table 5.1-1 shows a summary of samples taken.

A Case 580 Super K Construction King backhoe with a 18-in.-wide bucket was used to excavate the three trenches. Trench locations were selected based on anomalies not associated with known surface structures or objects that were detected during the geophysical investigation.

Three trenches were excavated at PRS 20-001(b). The trench locations centered around anomalies associated with buried objects. Excavation of the east trench exposed a 4-ft-long section of 2-in.-diameter steel electrical conduit and some wire rope. Excavation of the north trench exposed structural steel shapes (channels and angles), the foundation for the navy gun (an 8-ft-thick concrete pad with 2-in. steel plate cover), and wooden debris. Excavation of the south trench exposed abandoned utility lines and a 6-ft-long chain-type pipe wrench. Seven samples were taken from each trench at depths varying from 1 ft to 11 ft, with one duplicate sample taken in accordance with the RFI Work Plan.

The excavations produced no evidence of the gun barrels reportedly associated with this PRS. The north excavation extended into PRS 20-002(d) and was cleaned up as part of the VCA for that PRS.

Twenty-two samples were submitted for analysis to an off-site laboratory for HE, metals, strontium-90, isotopic uranium, and gamma spectrometry.

5.2.5 Background Comparisons

Inorganics

One subsurface soil sample (10 - 11 ft) had a detected concentration of silver (4.2 mg/kg), for which there was no background concentration. Concentrations of total uranium (natural) were detected above the

background UTL, and distributional tests also show that the concentrations of uranium at this site differ from background (Table 5.2-1) and were carried forward to the SAL comparison stage.

Figure 5.2-1 presents the distribution, including depth samples, of inorganic COPCs detected at PRS 20-001(b).

TABLE 5.2-1
INORGANICS WITH CONCENTRATIONS GREATER THAN BACKGROUND UTL FOR PRS 20-001(b)

Sample ID	Depth (ft)	Silver (mg/kg)	Uranium (mg/kg)
LANL UTL	N/A	na	5.45
SAL	N/A	380	230
0220-95-0017	9 - 10	ND	5.5
0220-95-0018	9 - 10	ND	5.6
0220-95-0020*	6 - 7	ND	5.8
0220-95-0023	1 - 2	ND	5.5
0220-95-0024	10 - 11	4.2	5.2
0220-95-0026	10 - 11	ND	5.5
0220-95-0031	10 - 11	ND	6
0220-95-0032	10 - 11	ND	5.8
0220-95-0033	10 - 11	ND	6.1
0220-95-0034	10 - 11	ND	5.7

N/A: Not Applicable na: Not Available ND: Not Detected *: field duplicate

Radionuclides

Uranium and its isotopes uranium-234 and uranium-238 were detected at concentrations above background UTLs (Table 5.2-2) and were carried forward to the SAL comparison stage.

Figure 5.2-1 presents the spatial distribution of radionuclides detected at PRS 20-001(b) above background (all horizon data).

5.2.6 Evaluation of Organic Constituents

No organics were detected, and therefore they were eliminated as COPCs.

5.2.7 Human Health Assessment

5.2.7.1 Screening Assessment

Silver and uranium were detected at concentrations above background and submitted to an MCE for noncarcinogens. The sum of their maximum normalized concentrations was 0.04, which is less than the decision value of 1.0 (Table 5.2-3). These analytes were eliminated as COPCs.

TABLE 5.2-2
PRS 20-001(b) RADIONUCLIDES WITH CONCENTRATIONS GREATER THAN BACKGROUND UTL

Sample ID	Location ID	Depth (ft)	Uranium (mg/kg)	Uranium-234 (pCi/g)	Uranium-238 (pCi/g)
LANL UTL	N/A	N/A	5.45	1.94	1.82
SAL	N/A	N/A	29	13	67
0220-95-0016	20-1015	8 - 9	5.3	1.99	1.83
0220-95-0017	20-1016	9 - 10	5.5	1.77	1.77
0220-95-0018	20-1017	9 - 10	5.6	2.05	1.89
0220-95-0019	20-1018	6 - 7	5.3	2.07	1.99
0220-95-0020**	20-1018	6 - 7	5.8	1.74	1.91
0220-95-0023	20-1019	1 - 2	5.5	1.8	1.8
0220-95-0024	20-1020	10 - 11	5.2	1.95	1.86
0220-95-0026	20-1022	10 - 11	5.5	1.97	1.79
0220-95-0030	20-1026	10 - 11	5.4	1.86	1.99
0220-95-0031	20-1027	10 - 11	6	2.03	2.07
0220-95-0032	20-1028	10 - 11	5.8	1.91	2.15
0220-95-0033	20-1029	10 - 11	6.1	1.97	2.33
0220-95-0034	20-1030	10 - 11	5.7	2	2.06
0220-95-0037	20-1032	10 - 11	5	1.86	1.87
0220-95-0038	20-1014	10 - 11	5.4	1.8	2

**: field duplicate N/A: Not Applicable

TABLE 5.2-3
MULTIPLE CHEMICAL EVALUATION FOR NONCARCINOGEN CHEMICALS AT PRS 20-001(b)

Chemical	Maximum Normalized Concentrations
Silver	0.01
Total Uranium (Natural)	0.03
TOTAL	0.04

Uranium and its isotopes were detected below their respective SALs (Table 5.2-1) and are not retained as COPCs. An MCE for radionuclides was not conducted because the only radionuclides detected above background were uranium and its isotopes uranium-234 and uranium-238, which do not have additive effects.

No chemicals at PRS 20-001(b) were present above SAL. Therefore, no chemicals are retained as COPCs.

5.2.7.2 Risk Assessment

No human health risk assessment was performed for PRS 20-001(b) because no COPCs were retained as a result of the screening assessment.

5.2.8 Ecological Assessment

The general landscape condition around this PRS is moderately developed and disturbed, and the potential for receptors to come in contact with COPCs at the site is high (Table 2.4-1). Therefore, this PRS will be included in the ecological risk assessment that will be conducted when an approach has been approved by state and federal regulators. The completed ecological risk assessment will be submitted to the EPA. Threatened and endangered species and/or sensitive habitat listed in Chapter 2 will be evaluated in the ecological risk assessment.

5.2.9 Extent of Contamination

No COPCs were retained; therefore, this section is not applicable.

5.2.10 Conclusions and Recommendations

PRS 20-001(b) has been characterized and no COPCs are retained based on the sample results and screening assessment. No further action is recommended, and based on NFA Policy Criterion 4, a Class III permit modification will be submitted requesting removal of this site from the HSWA module of the Laboratory's RCRA operating permit.

5.3 PRS 20-001(c), Landfill Area 3

Sampling for PRS 20-001(c), Landfill Area 3, was not conducted at the proper location during field operations. An addendum to the RFI Report for this PRS will be submitted after further sampling is conducted on September 30, 1996. All specific results, conclusions, and recommendations will be included in the report.

5.4 PRS 20-002(a), Recovery Pit

PRS 20-002(a) was a steel-lined pit (TA-20-6) that was used to contain initiator test shots and facilitate the recovery of the initiators. Based on the sampling results and screening assessment, we recommend NFA for the site under NFA Policy Criterion 4: The site has been characterized, and no COPCs are retained from the screening assessment. Figure 5.4-1 shows the site with sample locations and results posted.

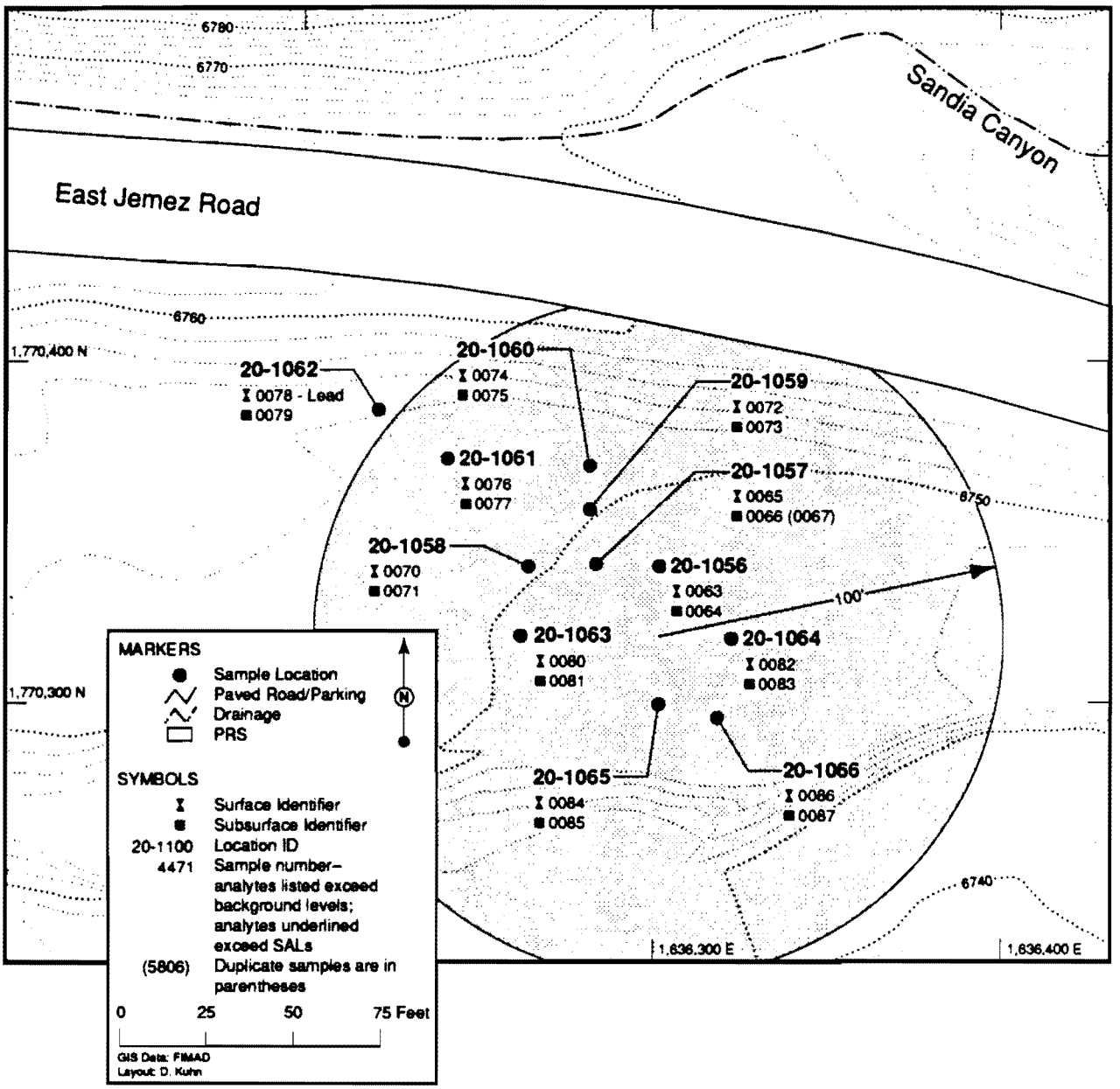

Figure 5.4-1 PRS 20-002(a), Recovery Pit, showing sample location and results

5.4.1 History

PRS 20-002(a) is discussed in detail in Section 5.2 of the RFI Work Plan (LANL 1994, 1157).

The pit was completed in April 1945 and removed in April 1948 (LANL undated, 22-0051). The initiator development tests were reported to have used HE, strontium-90, beryllium, and nickel. Uranium may have also been used in some of the tests. Because the tests were to be contained within the vessel, contamination also should have been contained. However, because the framework and mat covering the containment area failed, some contamination may have been released in the area.

5.4.2 Description

The pit was located south of East Jemez Road at the far west end of TA-20. The inside dimensions were 14 ft 8 in. by 14 ft 8 in. by 12 ft deep. The walls and floor consisted of 0.75 in.-thick steel plate backed by 12-in. by 12-in. timbers drawing (LASL 1951, 22-0052). A steel framework covered the pit, overlain by a mat of 0.25-in.-diameter steel rods spaced 1 in. apart (LASL 1951, 22-0053). According to a 1947 memo (Bradbury 1947, 22-0027), the framework and mat, presumably installed to contain debris from the shots, failed after the first few shots.

Currently, the area that includes the reported location of TA-20-6 is a gentle sloping grassy area with patches of badly weathered asphalt that may be remnants of the original TA-20 access road (Figure 5.4-1). A 4-ft by 4-ft concrete box with a hinged steel lid is on the site and could be a manhole, perhaps TA-20-4, that was used for electrical wiring. An orange angle-iron stake marks the probable location of TA-20-7 [PRS 20-002(b)]. However, there is no evidence of TA-20-6 (LANL 1994, 1157).

5.4.3 Previous Investigations

In the past 45 years, Sandia Canyon has been surveyed a number of times for HE. Any material found has been removed from the area. Large pieces of HE were not expected during this activity. COPCs are expected to be within the soil matrix (LANL 1994, 1157).

Environmental samples were taken at this site in 1985 for the Los Alamos Site Characterization Program and analyzed for HE, uranium, beryllium, and gross alpha and beta radioactivity. One sample indicated the presence of uranium at 10.16 mg/kg. The reported background range for uranium in soils at the Laboratory is 3 mg/kg to 7 mg/kg (Scholl 1989, 0485).

5.4.4 Field Investigations

Prior to the start of field investigations, all firing site locations, including PRS 20-002(a), were surveyed and a grid was laid out using traditional cadastral survey techniques. Radiological field surveys were then conducted by taking gamma radiation measurements near the soil surface at intersecting points on the established grid. These radiation data points were then plotted as "activity rate contours" to help clarify the radioactivity distribution and activity levels in relation to topographic, geologic, and historical site usage.

To assist in the analysis, a background value was recorded at each site by taking a measurement at an area adjacent to the site. Contour lines above these survey-specific background values were then plotted and used as a tool to select analytical sample locations.

The surveys were conducted to aid in the selection of analytical sample locations and to represent a snapshot of the radioactivity trends specific to the local area. The field readings are sensitive to environmental conditions and, as such, are relative only to the local area at that particular moment in time.

The background values established at each site serve only to clarify the contouring by reducing the "noise" in the figure.

The radiological surface activities presented in Figure 5.4-2 are a graphical depiction of the results of the field data collected. The actual numerical values of the field surveys are not necessarily statistically significant; however, the figures do depict a general trend for each area and were evaluated on that basis.

5.4.4.1 Results of Field Surveys

A 200-ft by 200-ft grid was established over the site, and surface radiation readings were measured and recorded at 20-ft intervals, as indicated by the grid point markers in Figure 5.4-2. The surface activity for this PRS was elevated in the center and northern portions of the site, with the higher readings being generally twice the measured ambient surface activity. The horizontal definition of the contour lines in the northern portion of the site are indicative of the increased gravel and rock that occurs as one moves closer to the embankment of East Jemez Road.

5.4.4.2 Results of Field Screening

All samples were field screened for radioactivity and HE to identify gross concentrations of COPCs. Surface radiological screening was performed before the start of intrusive activities. The screening showed no radioactivity above background. The HE spot test was performed on each sample to be sent offsite for laboratory analysis. No positive results were obtained from the HE spot test on any sample.

5.4.4.3 Results of Mobile Laboratory Screening

Twenty-three samples were analyzed by an on-site mobile laboratory for gross alpha, beta, and gamma radioactivity. No results were encountered at this PRS that required special labeling or packaging of samples being sent offsite for analysis.

5.4.4.4 Sample Collection and Request for Analysis

The objective of Phase 1 sampling was to determine whether COPCs are present at the site. Figure 5.4-1 shows all sample locations at this PRS, and Table 5.4-1 shows a summary of samples taken.

At PRS 20-002(a), 23 samples were collected, both surface and subsurface, at 11 different sample locations. Analysis was requested for uranium, isotopic uranium, gamma spectrometry, strontium-90, HE, and total analyte list (TAL) metals.

5.4.5 Background Comparisons

Inorganics

One surface soil sample (0 - 0.5 ft) had a detected concentration of lead (37.9 mg/kg) that exceeded the background UTL (23.3 mg/kg). Further analysis for the lead concentrations observed at this site show that they are not statistically different from LANL background lead concentrations (Gehan p-value = 0.9990, Quantile test p-value = 0.9728, Slippage test p-value = 0.1218. See Appendix D for a discussion of these tests). Therefore, all inorganics are eliminated as COPCs for this PRS.

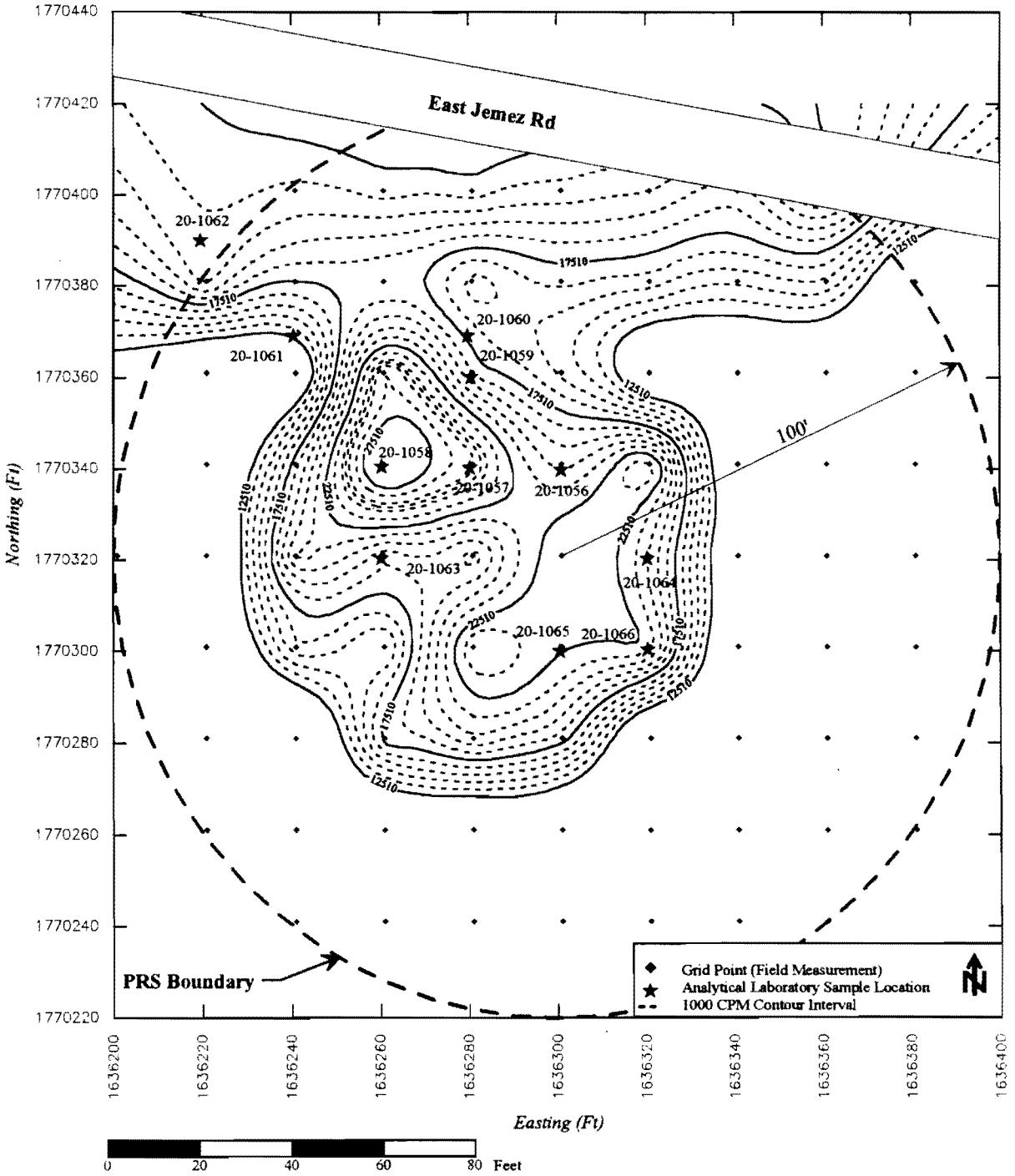

Figure 5.4-2 PRS 20-002(a) radiological field screening results

TABLE 5.4-1
SAMPLE SUMMARY - FIRING SITES

Location ID	Sample ID		Depth (ft)	Matrix	Sample Methods*					
					HE	Metals	Sr-90	U (iso)	U (tot)	Gamma-Spec
PRS 20-002(a)										
20-1056	0220-95-	0063	0-0.5	Soil	264	NA	283	NA	NA	283
20-1056		0064	2.5-3.0	Soil	264	NA	283	NA	NA	283
20-1057		0065	0-0.5	Soil	264	NA	283	NA	NA	283
20-1057		0066	2.5-3.0	Soil	264	NA	283	NA	NA	283
20-1057		0067D	2.5-3.0	Soil	264	NA	283	NA	NA	283
20-1058		0070	0-0.5	Soil	264	NA	283	NA	NA	283
20-1058		0071	2.5-3.0	Soil	264	NA	283	NA	NA	283
20-1059		0072	0-0.5	Soil	264	NA	283	NA	NA	283
20-1059		0073	2.5-3.0	Soil	264	NA	283	NA	NA	283
20-1060		0074	0-0.5	Soil	264	NA	283	NA	NA	283
20-1060		0075	2.5-3.0	Soil	264	NA	283	NA	NA	283
20-1061		0076	0-0.5	Soil	264	NA	283	NA	NA	283
20-1061		0077	2.5-3.0	Soil	264	NA	283	NA	NA	283
20-1062		0078	0-0.5	Soil	264	NA	283	NA	NA	283
20-1062		0079	2.5-3.0	Soil	264	NA	283	NA	NA	283
20-1063		0080	0-0.5	Soil	264	NA	283	NA	NA	283
20-1063		0081	2.5-3.0	Soil	264	NA	283	NA	NA	283
20-1064		0082	0-0.5	Soil	264	NA	283	NA	NA	283
20-1064		0083	2.5-3.0	Soil	264	NA	283	NA	NA	283
20-1065		0084	0-0.5	Soil	264	265	283	NA	NA	283
20-1065		0085	2.5-3.0	Soil	264	265	283	NA	NA	283
20-1066		0086	0-0.5	Soil	264	265	283	NA	NA	283
20-1066		0087	2.5-3.0	Soil	264	265	283	NA	NA	283
PRS 20-002(b)										
20-1067	0220-95-	0088	0-0.5	Soil	423	NA	427	NA	NA	427
20-1067		0089D	0-0.5	Soil	423	NA	427	NA	NA	427
20-1067		0092	2.5-3.0	Soil	423	NA	427	NA	NA	427
20-1068		0093	0-0.5	Soil	423	NA	427	NA	NA	427
20-1068		0094	2.5-3.0	Soil	423	NA	427	NA	NA	427
20-1069		0095	0-0.5	Soil	423	NA	427	NA	NA	427
20-1069		0096	2.5-3.0	Soil	423	NA	427	NA	NA	427
20-1070		0097	0-0.5	Soil	423	NA	427	NA	NA	427
20-1070		0098	2.5-3.0	Soil	423	NA	427	NA	NA	427
20-1071		0099	0-0.5	Soil	423	NA	427	NA	NA	427

D: duplicate sample *batch numbers

TABLE 5.4-1
SAMPLE SUMMARY - FIRING SITES
(continued)

Location ID	Sample ID		Depth (ft)	Matrix	Sample Methods*					
					HE	Metals	Sr-90	U (iso)	U (tot)	Gamma-Spec
PRS 20-002(b) (continued)										
20-1071	0220-95-	0100	2.5-3.0	Soil	423	NA	427	NA	NA	427
20-1072		0101	0-0.5	Soil	423	NA	427	NA	NA	427
20-1072		0102	2.5-3.0	Soil	423	NA	427	NA	NA	427
20-1073		0103	0-0.5	Soil	423	NA	427	NA	NA	427
20-1073		0104	2.5-3.0	Soil	423	NA	427	NA	NA	427
20-1074		0105	0-0.5	Soil	423	NA	427	NA	NA	427
20-1074		0106	2.5-3.0	Soil	423	NA	427	NA	NA	427
20-1075		0107	0-0.5	Soil	423	NA	427	NA	NA	427
20-1075		0108	2.5-3.0	Soil	423	425	427	NA	NA	427
20-1076		0109	0-0.5	Soil	423	425	427	NA	NA	427
20-1076		0110	0-0.5	Soil	423	425	427	NA	NA	427
20-1077		0114	0-0.5	Soil	423	425	427	NA	NA	427
20-1077		0115	2.5-3.0	Soil	423	425	427	NA	NA	427
PRS 20-002(c)										
20-1144	0220-95	0240	0-0.5	Soil	444	445	443	NA	NA	443
20-1144		0241	2.5-3.0	Soil	444	445	443	NA	NA	443
20-1144		0242	4.5-5.0	Soil	444	445	443	NA	NA	443
20-1145		0243	0-0.5	Soil	444	445	443	NA	NA	443
20-1145		0244	2.5-3.0	Soil	444	445	443	NA	NA	443
20-1145		0245	4.5-5.0	Soil	444	445	443	NA	NA	443
20-1146		0246	0-0.5	Soil	444	445	443	NA	NA	443
20-1146		0247	2.5-3.0	Soil	444	445	443	NA	NA	443
20-1146		0248	4.5-5.0	Soil	444	445	443	NA	NA	443
20-1147		0249	0-0.5	Soil	444	445	443	NA	NA	443
20-1147		0250	2.5-3.0	Soil	444	445	443	NA	NA	443
20-1147		0251	4.5-5.0	Soil	444	445	443	NA	NA	443
20-1148		0252	0-0.5	Soil	444	445	443	443	NA	443
20-1148		0253	2.5-3.0	Soil	444	445	443	443	NA	443
20-1148		0254	4.5-5.0	Soil	444	445	443	NA	NA	443
20-1149		0255	0-0.5	Soil	444	445	443	NA	NA	443
20-1149		0256	2.5-3.0	Soil	444	445	443	NA	NA	443
20-1149		0257	2.5-3.0	Soil	444	445	443	NA	NA	443
20-1149		0260	4.5-5.0	Soil	444	445	443	443	NA	443
20-1150		0261	0-0.5	Soil	444	445	443	443	NA	443

D: duplicate sample *batch numbers

TABLE 5.4-1
SAMPLE SUMMARY - FIRING SITES
(continued)

Location ID	Sample ID		Depth (ft)	Matrix	Sample Methods*					
					HE	Metals	Sr-90	U (iso)	U (tot)	Gamma-Spec
PRS 20-002(c) (continued)										
20-1150	0220-95-	0262	2.5-3.0	Soil	444	445	443	443	NA	443
20-1150		0263	4.5-5.0	Soil	444	445	443	443	NA	443
20-1151		0264	0-0.5	Soil	444	445	443	443	NA	443
20-1151		0265	2.5-3.0	Soil	444	445	443	443	NA	443
20-1151		0266	4.5-5.0	Soil	444	445	443	443	NA	443
PRS 20-003(b)										
20-1094	0220-95-	0170	0-1.0	Soil	NA	NA	NA	NA	NA	463
20-1094		0171	1.0-5.0	Soil	NA	NA	NA	NA	NA	463
20-1095		0172	2.0-3.0	Soil	NA	NA	NA	NA	NA	463
20-1096		0173	0-1.0	Soil	NA	NA	NA	NA	NA	463
20-1096		0174	1.0-5.0	Soil	NA	NA	NA	NA	NA	463
20-1097		0175	2.0-3.0	Soil	NA	NA	NA	NA	NA	463
20-1098		0176	0-1.0	Soil	NA	NA	NA	NA	NA	463
20-1098		0177D	0-1.0	Soil	NA	NA	NA	NA	NA	463
20-1098		0180	1.0-5.0	Soil	NA	NA	NA	NA	NA	463
20-1099		0181	2.0-3.0	Soil	NA	NA	NA	NA	NA	463
PRS 72-001										
72-1000	0272-95-	0001	0-1.0	Soil	NA	265	NA	NA	NA	NA
72-1001		0002	0-1.0	Soil	NA	265	NA	NA	NA	NA
72-1002		0003	0-1.0	Soil	NA	265	NA	NA	NA	NA
72-1003		0004	0-1.0	Soil	NA	265	NA	NA	NA	NA
72-1004		0005	0-1.0	Soil	NA	265	NA	NA	NA	NA
72-1004		0006D	0-1.0	Soil	NA	265	NA	NA	NA	NA
72-1005		0009	0-1.0	Soil	NA	265	NA	NA	NA	NA
72-1006		0010	0-1.0	Soil	NA	265	NA	NA	NA	NA

D: duplicate sample *batch numbers

Radionuclides

No radionuclides were detected either at concentrations above background UTLs or that did not have background values. Therefore, radionuclides were eliminated as COPCs.

5.4.6 Evaluation of Organic Constituents

No organics were detected, and therefore they were eliminated as COPCs.

5.4.7 Human Health Assessment

5.4.7.1 Screening Assessment

No organics or radionuclides were detected and all inorganics were within background levels. Therefore, no COPCs are retained.

5.4.7.2 Risk Assessment

No human health risk assessment was performed for PRS 20-002(a) because no COPCs were retained as a result of the screening assessment.

5.4.8 Ecological Assessment

This PRS will be included in the ecological risk assessment that will be conducted when an approach has been approved by state and federal regulators. The completed ecological risk assessment will be submitted to EPA. Threatened and endangered species and/or sensitive habitat listed in Chapter 2 will be evaluated in the ecological risk assessment.

5.4.9 Extent of Contamination

No COPCs were retained; therefore, this section is not applicable.

5.4.10 Conclusions and Recommendations

PRS 20-002(a) has been characterized, and no COPCs are retained based on the sample results and screening assessment. No further action is recommended, and based on NFA Policy Criterion 4, a Class III permit modification will be submitted requesting removal of this site from the HSWA module of the Laboratory's RCRA operating permit.

5.5 PRS 20-002(b), Dumbo and Mount

PRS 20-002(b) was a cylindrical steel tank, known as "Dumbo," that was used to contain an explosive test so that shot fragments could be recovered. Based on the sampling results and screening assessment, we recommend NFA for the site under NFA Policy Criterion 4: The site has been characterized, and no COPCs are retained from the screening assessment. Figure 5.5-1 shows the site with sample locations and results posted.

5.5.1 History

PRS 20-002(b) is discussed in detail in Section 5.2 of the RFI Work Plan (LANL 1994, 1157).

Dumbo, the steel tank, was mounted on a firing pad at one end of a platform near the west end of TA-20 (Figure 5.5-1). Dumbo was used only once because of the difficulty of opening the tank after the shot was fired within the tank (DOE 1987, 0264). A second Dumbo, built and installed on the firing pad at the other end of the concrete platform (Bradbury 1947, 22-0027), was never used. The two Dumbos were constructed in 1945 and were removed in 1948 (LANL undated, 22-00521). Contamination is expected to be minor because of the containment of the shot. Historical explosives use at the firing sites included metals and uranium in addition to HE.

5.5.2 Description

Dumbo was a 5-ft-diameter cylindrical tank at TA-20 that was used to contain an explosive test and recover shot fragments. The tank was mounted on a firing pad at one end of a 91-ft by 14-ft concrete platform (TA-20-7) near the west end of TA-20. TA-20-7 was equipped with rail tracks, which allowed a work platform to be moved to provide access to Dumbo (LASL 1951, 22-0054). Currently, the area is a grassy sloped area with patches of badly weathered asphalt that may be remnants of the original TA-20 access road. An August 1993 site visit revealed no surface evidence of TA-20-7 (LANL 1994, 1157).

5.5.3 Previous Investigations

In the past 45 years, Sandia Canyon has been surveyed a number of times for HE. Material found has been removed from the area. Large pieces of HE were not expected during this activity. COPCs are expected to be within the soil matrix (LANL 1994, 1157).

The two Dumbos were surveyed for radioactivity, as reported in a Laboratory memo of 1946 (Littlejohn 1946, 22-0066). The survey showed no contamination on the unused Dumbo. The other Dumbo showed 3,000 to 5,000 cpm at the rim and more than 20,000 cpm in the interior. Soil samples taken in 1985 did not indicate concentrations of uranium above background even though the surface readings conducted with a phoswich indicated readings higher than background (Scholl 1989, 0485). Later, the higher readings were attributed to internal equipment readings or external disturbances.

5.5.4 Field Investigations

Field investigations for this site consisted of a field radiological survey. For a description of the survey, refer to Section 5.1.4.

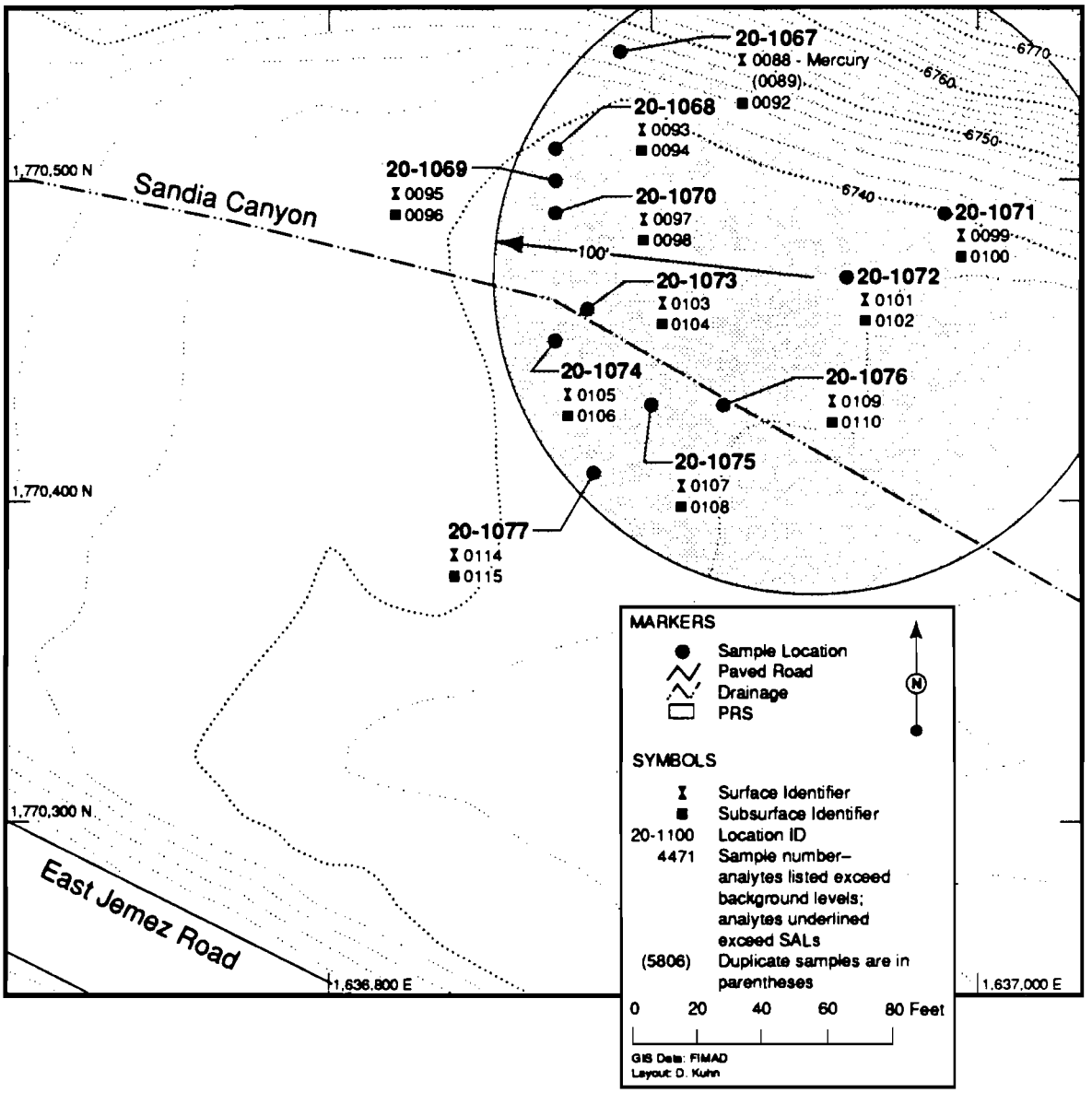

Figure 5.5-1. PRS 20-002(b), Dumbo and Mount, showing sample locations and results

5.5.4.1 Results of Field Surveys

A 200-ft by 200-ft grid was established over the site, and surface radiation readings were measured and recorded at 10-ft intervals, as indicated by the grid point markers in Figure 5.5-2. Generally, surface radiation for this site was higher at the center and western edges, with some readings on the western edge as much as six times the measured ambient radiation levels. In contrast, the surface radiation readings towards the center of the site are three to four times ambient levels. Analytical sample locations were concentrated on the western edge of the site because of the higher field readings in this portion of the site.

5.5.4.2 Results of Field Screening

All samples were field screened for radioactivity and HE to identify gross concentrations of COPCs. Surface radiological screening was performed before the start of intrusive activities. The screening showed no radioactivity above background. The HE spot test was performed on each sample to be sent offsite for laboratory analysis. No positive results were obtained from the HE spot test on any sample.

5.5.4.3 Results of Mobile Laboratory Screening

Twenty-three samples were analyzed by an on-site mobile laboratory for gross alpha, beta, and gamma radioactivity. No results were encountered at this PRS that required special labeling or packaging of samples being sent offsite for analysis.

5.5.4.4 Sample Collection and Request for Analysis

The objective of Phase 1 sampling was to determine whether COPCs are present at the site. Figure 5.5-1 shows all sample locations at this PRS, and Table 5.4-1 shows a summary of the samples taken.

At PRS 20-002(b), 23 samples were collected, both surface and subsurface, at 11 different sample locations. Analysis was requested for uranium, isotopic uranium, gamma spectrometry, strontium-90, HE, and TAL metals.

5.5.5 Background Comparisons

Inorganics

One surface soil sample (0-0.5 ft) had a reported concentration of mercury (0.14 [J] mg/kg) that exceeded the background UTL (0.1 mg/kg) (Figure 5.5-1).

Radionuclides

No radionuclides were detected either at concentrations above background UTLs or that did not have background values. Therefore, radionuclides were eliminated as COPCs.

5.5.6 Evaluation of Organic Constituents

No HE COPCs were detected; therefore, organics were eliminated as COPCs.

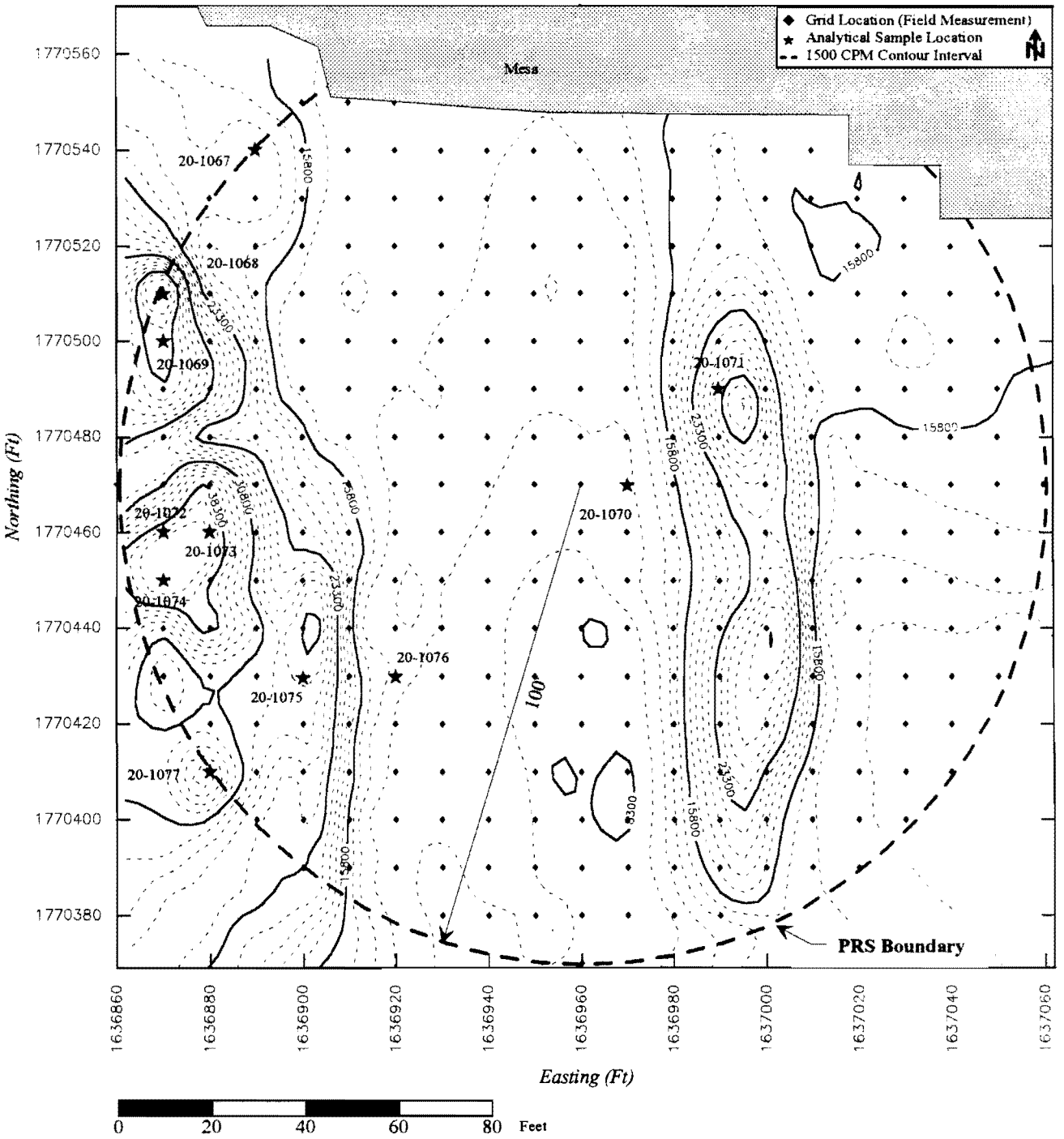

Figure 5.5-2 PRS 20-002(b) radiological field screening results

5.5.7 Human Health Assessment

5.5.7.1 Screening Assessment

The mercury concentration (0.14 mg/kg) was below its SAL (23 mg/kg). An MCE was not conducted because no other analytes were detected or were detected at concentrations above background UTLs.

No chemicals were detected above SALs. Therefore, no COPCs are retained.

5.5.7.2 Risk Assessment

No human health risk assessment was performed for PRS 20-002(b) because no COPCs were retained as a result of the screening assessment.

5.5.8 Ecological Assessment

The general landscape condition around PRS 20-002(a) is moderately developed and disturbed, and the potential for receptors to come in contact with mercury at the site is high (Table 2.4-1). Therefore, this PRS will be included in the ecological risk assessment that will be conducted when an approach has been approved by state and federal regulators. The completed ecological risk assessment will be submitted to EPA. Threatened and endangered species and/or sensitive habitat listed in Chapter 2 will be evaluated in the ecological risk assessment.

5.5.9 Extent of Contamination

No COPCs were retained; therefore, this section is not applicable.

5.5.10 Conclusions and Recommendations

PRS 20-002(b) has been characterized, and no COPCs are retained based on the sample results and screening assessment. No further action is recommended, and based on NFA Policy Criterion 4, a Class III permit modification will be submitted requesting removal of this site from the HSWA module of the Laboratory's RCRA operating permit.

5.6 PRS 20-002(c), Firing Site

PRS 20-002(c) was a firing site identified in an engineering drawing as a firing point near the center of TA-20 (LASL 1951, 22-0055). Based on the sampling results and screening assessment, the site is recommended for a NFA under NFA Policy Criterion 4: The site has been characterized, and no COPCs are retained from the screening assessment. Figure 5.6-1 shows the site with sample locations and results posted.

5.6.1 History

PRS 20-002(c) is discussed in detail in Section 5.2 of the RFI Work Plan (LANL 1994, 1157).

Historical explosives use at the firing sites included metals and uranium in addition to HE as COPCs.

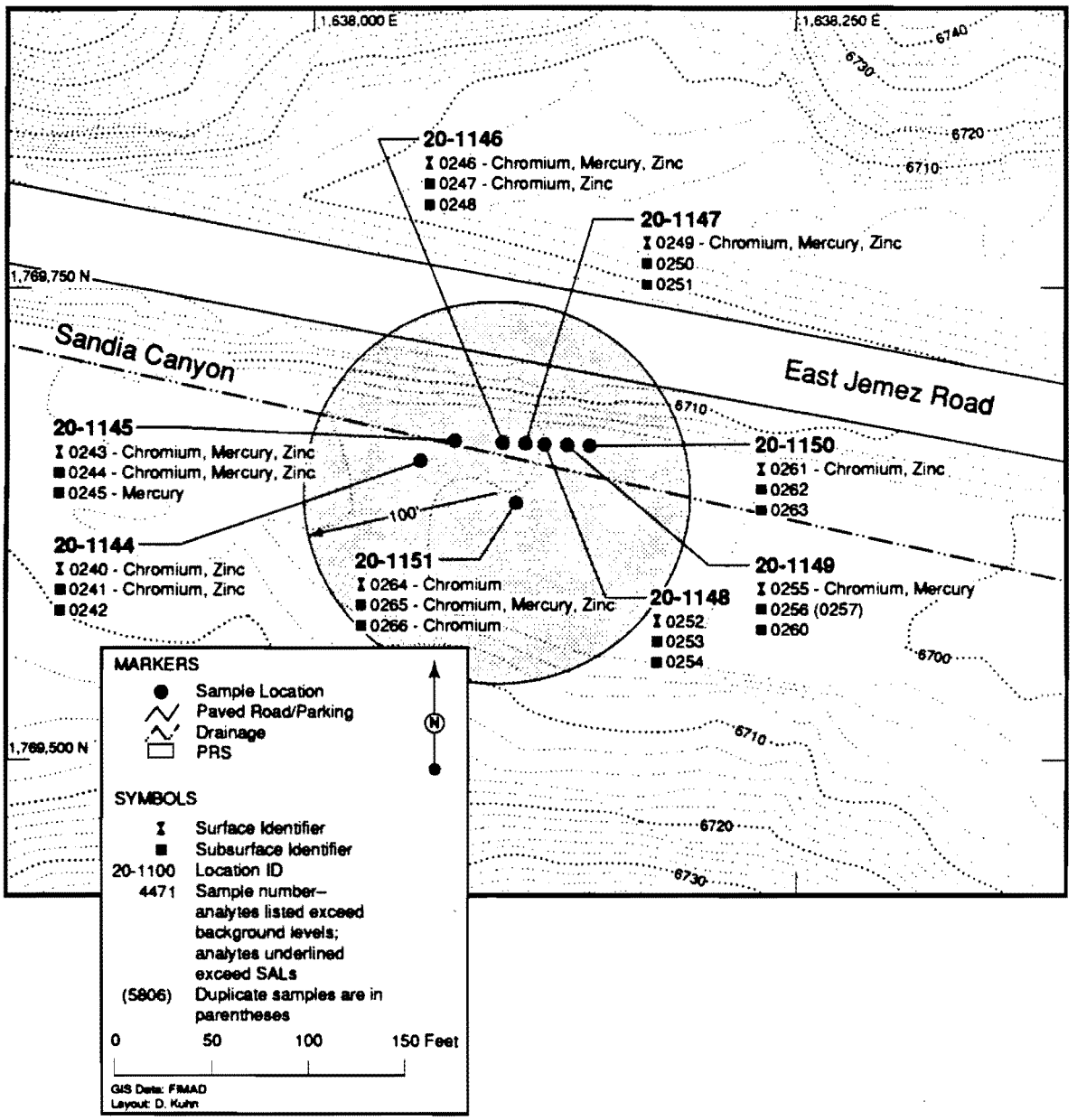

Figure 5.6-1 PRS 20-002(c), Firing Site, showing sample locations and results

5.6.2 Description

A 1947 Laboratory memo (Bradbury 1947, 22-0027) describes a firing point located adjacent to the control building (TA-20-2) that was used for charges of up to 50 lb. An engineering drawing (LASL 1951, 22-0055) shows electrical conduit running from TA-20-2 to TA-20-9, a foundation ramp and bin (Figure 5.6-1). A second drawing (LASL 1951, 22-0056) shows TA-20-9 bordered on three sides by an earth berm.

The south side of the area is now covered by the embankment for East Jemez Road, and the northern portion has a gentle slope. An August 1993 site visit revealed no evidence of past activities or structures associated with this firing site (LANL 1994, 1157).

5.6.3 Previous Investigations

In the past 45 years, Sandia Canyon has been surveyed a number of times for HE. Material found has been removed from the area. Large pieces of HE were not expected during this activity. COPCs are expected to be within the soil matrix (LANL 1994, 1157).

No site-specific information regarding previous investigations is available. Visible contamination would have been removed during the cleanups conducted in the general area over the years (LANL 1994, 1157).

5.6.4 Field Investigations

Field investigations for this site consisted of a field radiological survey. For a description of the survey, refer to Section 5.1.4.

5.6.4.1 Results of Field Surveys

A 200-ft by 200-ft grid was established over the site, and surface radiation readings were measured and recorded at 20-ft intervals, as indicated by the grid point markers in Figure 5.6-2. The horizontal definition of the contour lines in the northern portion of the site are indicative of the increased gravel and rock as one approaches the embankment of East Jemez Road. The radiation levels recorded in the field show very little variation across the site except for the somewhat higher readings along a drainage that cuts across the PRS. Analytical samples were primarily located along the drainage.

5.6.4.2 Results of Field Screening

Samples were field screened for radioactivity and HE to identify gross concentrations of COPCs. Surface radiological screening was performed before the start of intrusive activities. The screening showed no radioactivity above background. The HE spot test was performed on each sample to be sent offsite for laboratory analysis. No positive results were obtained from the HE spot test on any sample.

5.6.4.3 Results of Mobile Laboratory Screening

Twenty-five samples were analyzed by an on-site mobile laboratory for gross alpha, beta, and gamma radioactivity. No results were encountered at this PRS that required special labeling or packaging of samples being sent offsite for analysis.

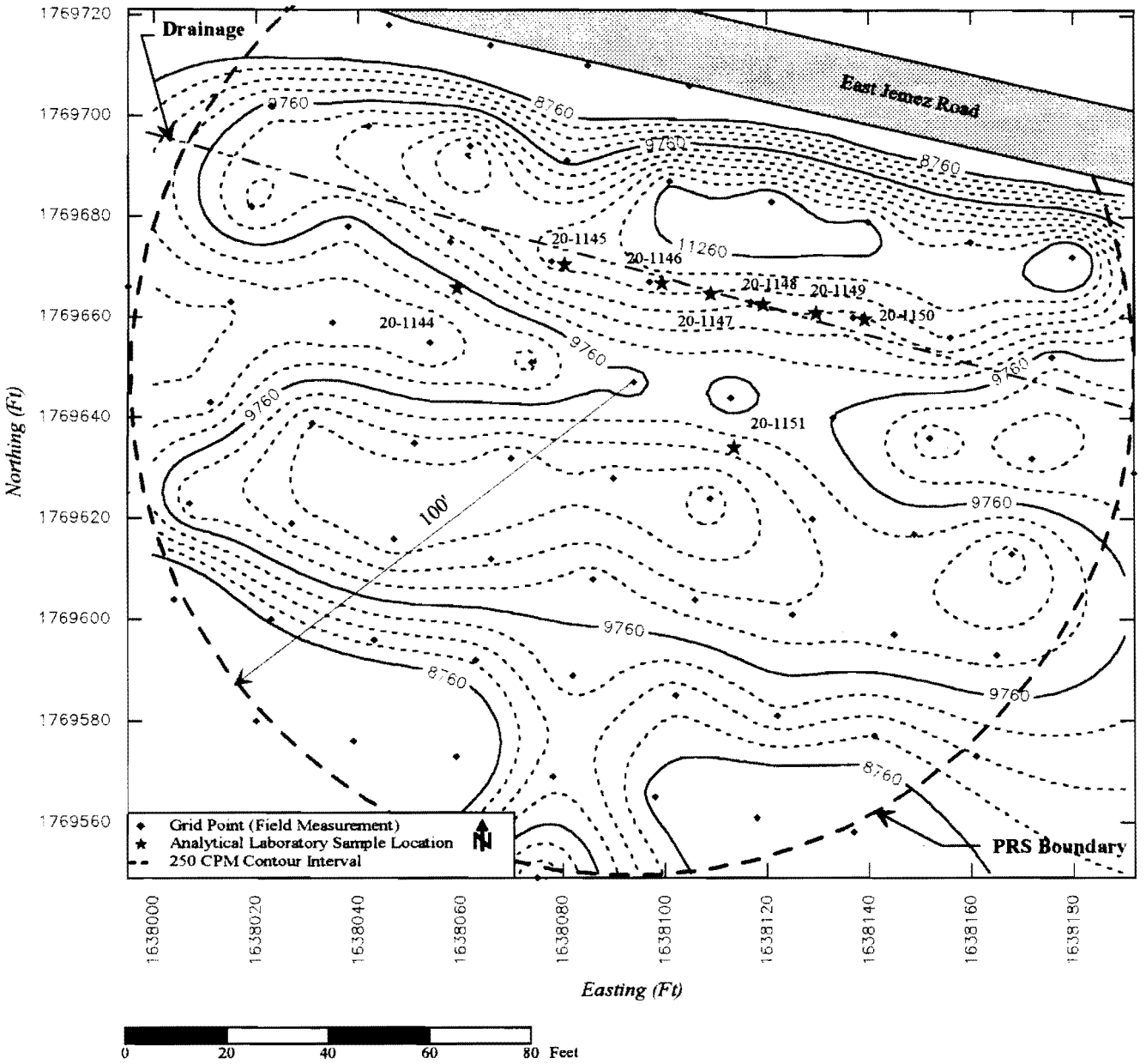

Figure 5.6-2 PRS 20-002(c) radiological field screening results

5.6.4.4 Sample Collection and Request for Analysis

The objective of Phase 1 sampling was to determine whether COPCs are present at the site. Figure 5.4-1 shows all sample locations at this PRS, and Table 5.4-1 shows a summary of the samples taken.

At PRS 20-002(c), 25 samples were collected, both surface and subsurface, at 11 different sample locations. Analysis was requested for uranium, isotopic uranium, gamma spectrometry, strontium-90, HE, and TAL metals.

5.6.5 Background Comparisons

Inorganics

Chromium, mercury, and zinc were detected at concentrations greater than the background UTLs (Table 5.6.-1) and were carried forward to the SAL comparison. Further analysis of chromium and zinc showed the distribution of site data concentrations to be statistically different from background (chromium: Gehan test p-value = 0.0016, Quantile test p-value = 0.0001, slippage test p-value = 0.0000; zinc: Gehan test p-value = 0.0111, Quantile test p-value = 0.0001, slippage test = 1.000. See Appendix D for a discussion of these tests.) Comparison of the mercury data with the Laboratory background distribution of mercury is not possible because of the preponderance of nondetects in the background data set.

Figure 5.6-1 presents the spatial distribution of inorganic COPCs at PRS 20-001(c) that are above background.

TABLE 5.6-1
INORGANICS WITH CONCENTRATIONS GREATER THAN BACKGROUND UTL FOR PRS 20-002(c)

Sample ID	Depth (ft)	Chromium (mg/kg)	Mercury (mg/kg)	Zinc (mg/kg)
LANL UTL	N/A	19.3	0.1	50.8
SAL	N/A	210	23	23000
0220-95-0240	0 - 0.5	44.7	ND (UJ)	60
0220-95-0241	2.5 - 3	37.8	ND (UJ)	52.6
0220-95-0243	0 - 0.5	50	0.12 (J)	63.5
0220-95-0244	2.5 - 3	88.4	0.17 (J)	63.9
0220-95-0245	4.5 - 5	10.5	0.31 (J)	27.2
0220-95-0246	0 - 0.5	57.9	0.13 (J)	69.3
0220-95-0247	2.5 - 3	46.7	ND (UJ)	52.6
0220-95-0249	0 - 0.5	48	0.12 (J)	60.2
0220-95-0255	0 - 0.5	29	0.11 (J)	45.5
0220-95-0261	0 - 0.5	40.1	ND (UJ)	62
0220-95-0264	0 - 0.5	29.9	ND (UJ)	46.9
0220-95-0265	2.5 - 3	115	0.16 (J)	69.9
0220-95-0266	4.5 - 5	32.9	ND (UJ)	42.4

J: value estimated N/A: Not Applicable ND: Not Detected UJ: value undetected at estimated concentration

Radionuclides

No radionuclides were detected either at concentrations above background UTLs or that did not have background values. Therefore, radionuclides were eliminated as COPCs.

5.6.6 Evaluation of Organic Constituents

No HE was detected. Therefore, organics are eliminated as COPCs.

5.6.7 Human Health Assessment

5.6.7.1 Screening Assessment

Chromium, mercury, and zinc were detected below their SALs (Table 5.6.-1).

Chromium was the only carcinogen detected at PRS 20-002(c). Therefore, an MCE was not conducted for carcinogens, and chromium is eliminated as a COPC.

An MCE conducted for noncarcinogens (mercury and zinc) resulted in a sum of maximum normalized concentrations of 0.01 (Table 5.6-2), which is less than the decision value of 1.0. Therefore, mercury and zinc are eliminated as COPCs.

5.6.7.2 Risk Assessment

No human health risk assessment was performed for PRS 20-002(c) because no COPCs were retained as a result of the screening assessment.

TABLE 5.6-2
MULTIPLE CHEMICAL EVALUATION FOR NONCARCINOGEN CHEMICALS AT PRS 20-002(c)

Chemical	Maximum Normalized Concentrations
Mercury	0.013
Zinc	0.003
TOTAL	0.02

5.6.8 Ecological Assessment

The general landscape condition around this PRS is moderately developed and disturbed, and the potential for receptors to come in contact with COPCs at the site is high (Table 2.4-1). Therefore, this PRS will be included in the ecological risk assessment that will be conducted when an approach has been approved by state and federal regulators. The completed ecological risk assessment will be submitted to EPA. Threatened and endangered species and/or sensitive habitat listed in Chapter 2 will be evaluated in the ecological risk assessment.

5.6.9 Extent of Contamination

No COPCs were retained; therefore, this section is not applicable.

5.6.10 Conclusions and Recommendations

PRS 20-002(c) has been characterized, and no COPCs are retained based on the sample results and screening assessment. No further action is recommended, and based on NFA Policy Criterion 4, a Class III permit modification will be submitted requesting removal of this site from the HSWA module of the Laboratory's RCRA operating permit.

5.7 PRS 20-002(d), Firing Site

PRS 20-002(d) was a firing site used by Group M-4 for implosion testing. Inorganics (beryllium) and radionuclides (cadmium-109; radium-226; strontium-85 and strontium-90; and uranium-234, uranium-235, and uranium-238) were detected above SALs. Based on sample results and the screening assessment, this PRS is proposed for a VCA to address the COPCs above SALs. A VCA Plan for this PRS will be submitted to DOE on November 23, 1996. All specific results, conclusions, and recommendations are included in the VCA Plan.

5.8 PRS 20-003(b), 20-mm Gun Firing Site

PRS 20-003(b), 20-mm Gun Firing Site, consisted of two structures, TA-20-13 and the adjacent TA-20-44, located in a canyon on the north side of TA-20. Based on the sampling results and screening assessment, we recommend NFA for the site under NFA Policy Criterion 4: The site has been characterized, and no COPCs are retained from the screening assessment. Figure 5.8-1 shows the site with sample locations and results posted.

5.8.1 History

PRS 20-003(b) is described in detail in Section 5.2 of the RFI Work Plan (LANL 1994, 1157).

The firing sites in TA-20 were used for neutron timing and initiator tests. TA-20-13 appears to be the control building from which the 20-mm gun in TA-20-44 were fired. TA-20-44, built in February 1945, was a 20-mm gun mount, and TA-20-13 was described in a 1947 memo (Bradbury 1947, 22-0027) as a workshop. A support building and magazine (TA-20-45) were built about the same time.

TA-20 was largely decommissioned to make way for the new road in 1948 and many structures were dismantled and removed. The magazine was not destroyed until February 1960, when it was burned after having been monitored for HE, radiation, and toxic materials. The CEARP report (DOE 1987, 0164) indicates that the guns were fired at steel plates set against the cliffs, and earlier reports indicated guns were fired directly into the side canyon wall (LASL 1951, 22-0058).

5.8.2 Description

PRS 20-003(b) consisted of two structures, TA-20-44 and TA-20-13 (Figure 5.8-1). TA-20-44 was a wood frame building with dimensions of about 16 ft by 16 ft by 8 ft high and equipped with concrete gun mounts (LASL 1951, 22-0058). TA-20-13 was an adjacent control building with approximately the same dimensions; the walls facing the gun mount were covered with 0.5-in.-thick steel plate. The two buildings were connected by electrical conduit laid in a trench (LASL 1951, 22-0058 and LASL 1951, 22-0059). The magazine was approximately 450 ft south of these buildings.

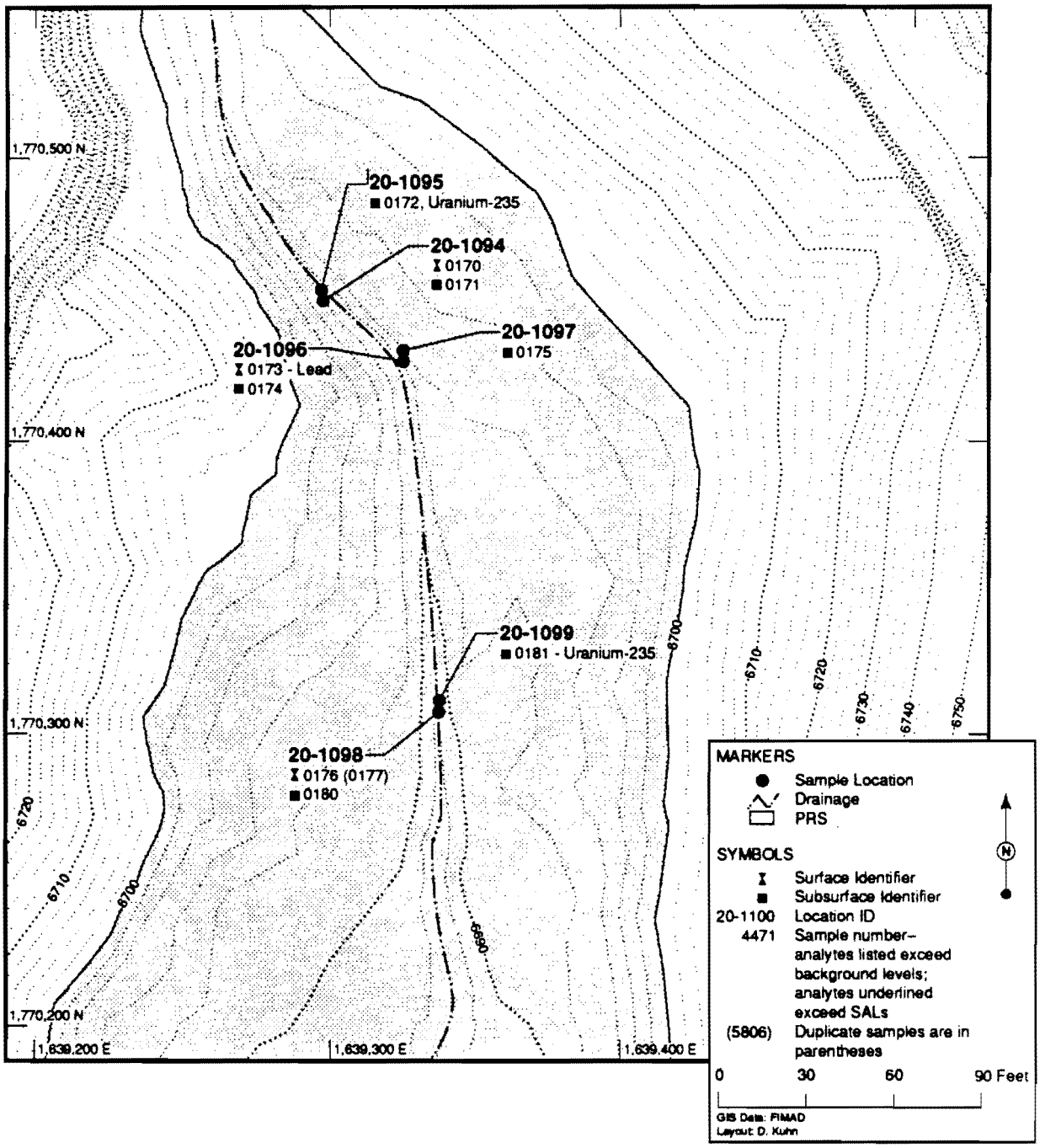

Figure 5.8-1.PRS 20-003(b), 20-mm Gun Firing Site showing sample locations.

An August 1993 visit to the site revealed that the surface structures had been removed, although several concrete foundations remained. The rock faces in the canyon walls were pitted with various-sized cavities. Because this is the typical geomorphology and weathering of the tuff, it is difficult to determine, without testing, if this pattern is from a modern source or if it is a results of the natural aging process. The valley floor is higher next to the cliffs and ends in flat grassland. Dense brush and trees are located along the north end and canyon walls.

5.8.3 Previous Investigations

In the past 45 years, Sandia Canyon has been surveyed a number of times for HE. Material found has been removed from the area. Large pieces of HE were neither expected nor found during the current activity. COPCs are expected to be within the soil matrix (LANL 1994, 1157).

In the spring of 1946, cleanup and radiation monitoring activities took place at TA-20; presumably this cleanup included PRS 20-003(b). Contaminated soil and other items were removed from the area (LANL 1984, 22-0015). The area around the 20-mm gun site was investigated in 1985. A radiation survey by a phoswich (Scholl 1985, 0485) revealed no readings above background, and soil samples showed uranium levels within the normal background range. Samples were not taken in the projectile impact area.

5.8.4 Field Investigation

Field investigations for this site consisted of a field radiological survey. For a description of the survey, refer to Section 5.1.4.

5.8.4.1 Results of Field Surveys

An 80-ft by 140-ft grid was established over the site, and surface radiation readings were measured and recorded at 20-ft intervals, as indicated by the grid point markers in Figure 5.8-2. Radiological COPCs were not expected at the site; however, in conformance with the RFI Work Plan, both radiological and geomorphic field surveys were conducted in this area. As expected, radiological field readings produced very little variation across the site. Analytical samples were collected from the drainage that cuts across the PRS.

Because of the small area of this PRS, a detailed geomorphic survey was not conducted. Instead, sample locations were chosen at sediment catchments in the drainage channel at the PRS.

5.8.4.2 Results of Field Screening

Samples were field screened for radioactivity and HE to identify gross concentrations of COPCs. Surface radiological screening was performed before the start of intrusive activities. The screening showed no radioactivity above background at the site. The HE spot test was performed on each sample to be sent offsite for laboratory analysis. No positive results were obtained from the HE spot test on any sample.

5.8.4.3 Results of Mobile Laboratory Screening

Ten soil samples were analyzed by an on-site mobile laboratory for gross alpha, beta, and gamma radioactivity. No results were encountered at this PRS that required special labeling or packaging of samples being sent offsite for analysis.

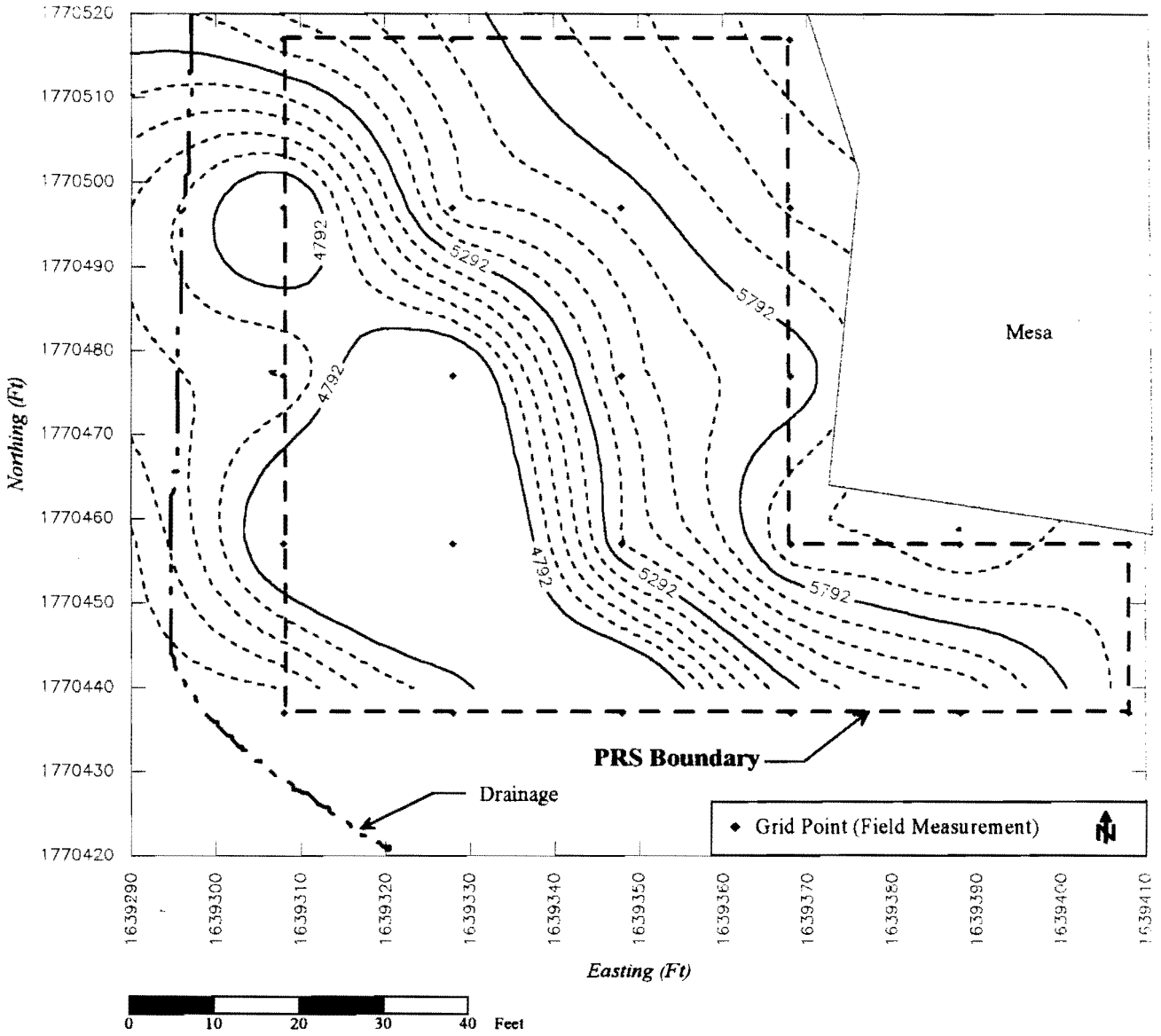

Figure 5.8.2 PRS 20-003(b) radiological field screening

5.8.4.4 Sample Collection and Request for Analysis

The objective of Phase 1 sampling was to determine whether COPCs from the impact area had migrated via the drainage channel to downstream locations. Figure 5.8-1 shows all sample locations at this PRS, and Table 5.4-1 shows a summary of samples taken.

At PRS 20-003(b), 10 samples were collected, both surface and subsurface, at three different sample locations. Analysis was requested for gamma spectrometry, strontium-90, and TAL metals.

5.8.5 Background Comparisons

Inorganics

One surface soil sample (0 - 1 ft) had a detected concentration of lead (65.1 mg/kg) that exceeded the background UTL (23 mg/kg). Further analysis of the lead concentrations observed at this site show that they are not statistically different from LANL background lead concentrations. (Gehan p-value = 0.9990, Quantile test p-value = 0.9218, Slippage test p-value = 0.0598. See Appendix D for a discussion of these tests.) Therefore, all inorganics are eliminated as COPCs for this PRS.

Radionuclides

Two subsurface samples had concentrations of uranium-235 (0.55 pCi/g and 0.46 pCi/g, respectively) that exceeded the background UTL (0.084 pCi/g) (Figure 5.8-1). The uranium-235 data were obtained from the gamma spectroscopy analysis; uranium and isotopic uranium analyses were not requested for this PRS. Uranium -238 is not detectable by gamma spectroscopy because it does not emit gamma-rays. Uranium-234 emits a very weak gamma-ray and is not normally detectable by gamma spectroscopy. Therefore, no data for uranium-234 and uranium-238 are available for this site.

Figure 5.8-1 presents the location of uranium-235 concentrations above background at PRS 20-003(b).

5.8.6 Evaluation of Organic Constituents

PRS 20-003(b) was not sampled for organics.

5.8.7 Human Health Assessment

5.8.7.1 Screening Assessment

The uranium-235 concentrations were below the SAL (10 pCi/g). An MCE was not conducted because only one radionuclide was detected above the background UTL. No chemicals were detected at concentrations above their SALs. Therefore, uranium -235 is eliminated as a COPC.

5.8.7.2 Risk Assessment

No human health risk assessment was performed for PRS 20-003(b) because no COPCs were retained as a result of the screening assessment.

5.8.8 Ecological Assessment

The general landscape condition around this PRS is moderately developed and disturbed, and the potential for receptors to come in contact with COPCs at the site is high (Table 2.4-1). Therefore, this PRS will be included in the ecological risk assessment that will be conducted when an approach has been

approved by state and federal regulators. The completed ecological risk assessment will be submitted to EPA. Threatened and endangered species and/or sensitive habitat listed in Chapter 2 will be evaluated in the ecological risk assessment.

5.8.9 Extent of Contamination

No COPCs were retained; therefore this section is not applicable.

5.8.10 Conclusions and Recommendations

PRS 20-003(b) has been characterized, and no COPCs are retained based on the sample results and screening assessment. No further action is recommended, and based on NFA Policy Criterion 4, this PRS will not be added to the HSWA module of the Laboratory's RCRA operating permit and will be submitted requesting the removal of this site from the ER Project List of PRSs.

5.9 PRS 20-003(c), Navy Gun Site

PRS 20-003(c) was the site of a Navy gun and associated structures. During the Phase I RFI, the Navy gun mount was located. Based on the sampling results and screening assessment, the site was cleaned up in a VCA as a housekeeping measure. A VCA final report for this PRS was submitted to DOE on September 30, 1995. Eight samples were collected at different sample locations. All specific results, conclusions, and recommendations are included in the VCA Final Report.

5.10 PRS 72-001, Small Arms Firing Range

TA-72, the site of PRS 72-001, has been operational since 1966 as a small-arms firing range for the Laboratory's security force. Sampling was conducted in site drainage downgradient from the site to determine whether migration of lead had occurred. No COPCs were present, indicating that contamination from the firing range has not migrated. Based on the sampling results and screening assessment, and because the site itself is still active, we recommend that any corrective action be deferred until after the site is decommissioned. Figure 5.10-1 shows the site with sample locations and results posted.

5.10.1 History

TA-72 has been used as a small-arms firing range for the Laboratory's security force since 1966.

5.10.2 Description

The firing range includes a 175-ft by 250-ft firing range surrounded by earth berms, an adjacent skeet shooting range, and some administrative buildings. PRS 72-001 is located at the west end of TA-72 in Sandia Canyon (Figure 5.10-1). Lead is known to be present in the firing range; bullets are scattered around the base of the berms and cliffs. Lead shot from skeet shooting is visible on the ground surface.

5.10.3 Previous Investigation(s)

No site-specific information is available regarding previous investigations.

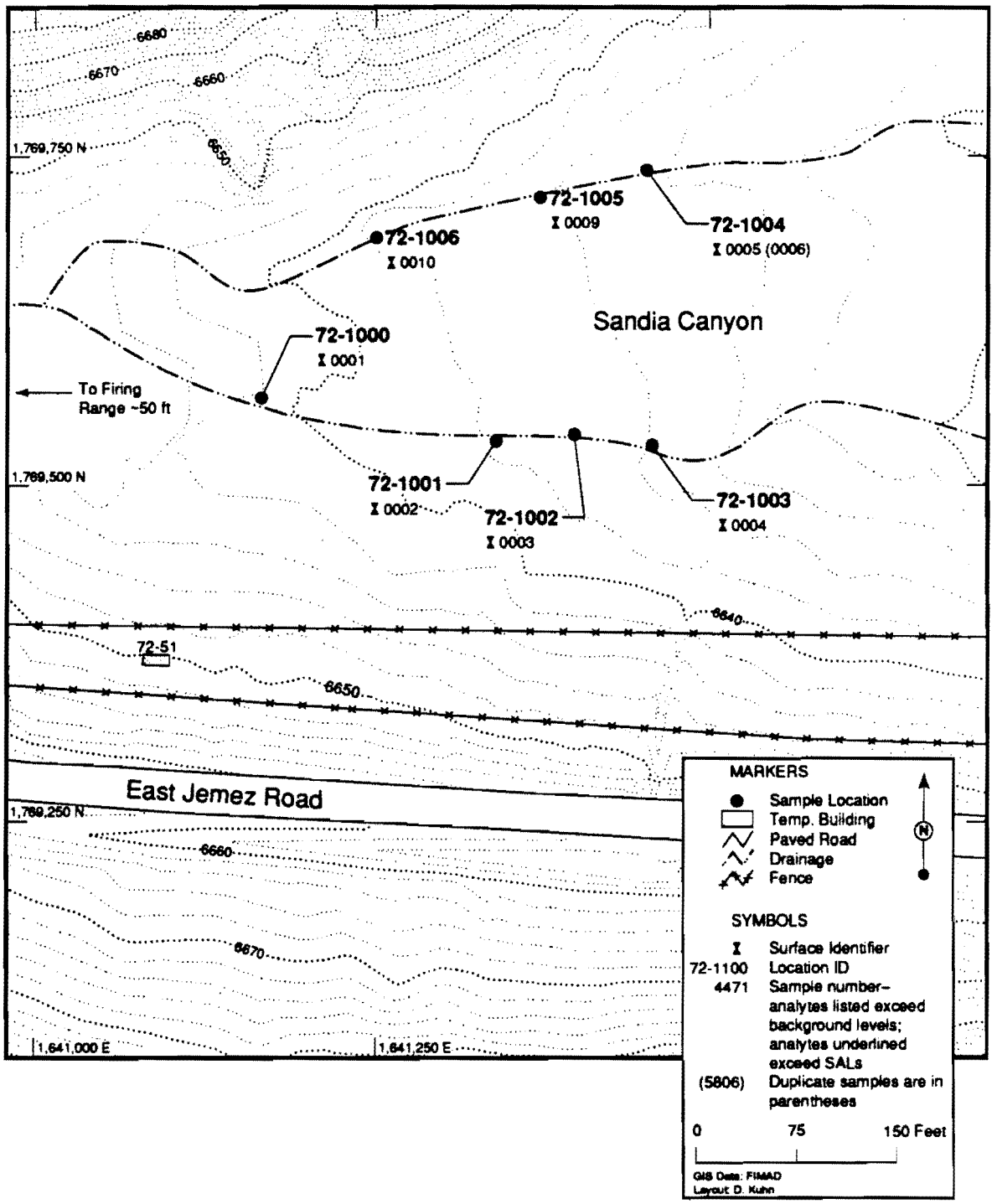

Figure 5.10-1. PRS 72-001, Small Arms Range, showing sample locations and results

5.10.4 Field Investigation

Before any analytical sample locations were chosen, a geomorphic survey was conducted to locate sediment catchments in the downstream drainage.

5.10.4.1 Results of Field Investigation

Because the drainage runs through the site, a detailed geomorphic survey was not conducted. The sample locations were chosen at sediment catchments downstream of the site and in the drainage channel that passes through the site.

5.10.4.2 Results of Field Screening

Samples were field screened for radioactivity and HE to identify gross concentrations of COPCs. Surface radiological screening was performed before the start of intrusive activities. The screening showed no radioactivity above background. HE spot tests were performed on each soil sample to be submitted for laboratory analysis. No positive results were obtained.

5.10.4.3 Results of Mobile Laboratory Screening

Eight soil samples were analyzed by an on-site mobile laboratory for gross alpha, beta, and gamma radioactivity. No results were encountered at this PRS that required special labeling or packaging of samples being sent offsite for analysis.

5.10.4.4 Sample Collection and Request for Analysis

The objective of Phase 1 sampling was to determine whether COPCs from the small-arms firing range had migrated via the drainage channel to downstream locations. Figure 5.10-1 shows all sample locations at this PRS, and Table 5.4-1 shows a summary of samples taken.

At PRS 72-001, eight surface samples were collected at different sample locations. Analysis was requested for TAL metals.

5.10.5 Background Comparisons

Inorganics

No inorganics were detected either at concentrations above background UTLs or that did not have background values. Therefore, inorganics were eliminated as COPCs.

Radionuclides

PRS 72-001 was not sampled for radionuclides.

5.10.6 Evaluation of Organic Constituents

PRS 72-001 was not sampled for organics.

5.10.7 Human Health Assessment

5.10.7.1 Screening Assessment

No inorganics were detected either at concentrations above background or that did not have background values. PRS 72-001 was not sampled for radionuclides or organics. Therefore, a screening assessment was not conducted.

5.10.7.2 Risk Assessment

No human health risk assessment was performed for PRS 72-001 because no COPCs were retained in either the inorganic background comparison or the organic constituent evaluation.

5.10.8 Ecological Assessment

This PRS will be included in the ecological risk assessment that will be conducted when an approach has been approved by state and federal regulators. The completed ecological risk assessment will be submitted to EPA. Threatened and endangered species and /or sensitive habitat listed in Chapter 2 will be evaluated in the ecological risk assessment.

5.10.9 Extent of Contamination

No COPCs were retained in the sediment catchment areas.

5.10.10 Conclusions and Recommendations

The sediment catchments of PRS 72-001 have been characterized, and no COPCs are present based on the sample results and screening assessment. This indicates that the contamination from the firing site has not migrated. A deferred action for assessment and remediation after the decommissioning of the site is recommended. Based on NFA Policy Criterion 4, the PRS will not be added to the HSWA module of the RCRA operating permit and will be submitted requesting removal from the ER Project List of PRSs.

5.11 PRS 53-001(a), Waste Accumulation at Building TA-53-2

PRS 53-001(a) is an active product storage area that consists of a covered concrete pad with drum-storage racks and product drums. The site was formerly used as a hazardous waste accumulation area. This site is an active product storage area. Based on the sample results and screening assessment, we recommend NFA for this site under NFA Policy Criterion 4: The site has been characterized, and no COPCs are retained from the screening assessment. Figure 5.11-1 shows the site with sample locations and results posted.

5.11.1 History

PRS 53-001(a) is discussed in detail in Section 5.3 of the RFI Work Plan (LANL 1994, 1157).

This area has been used for both waste and product accumulation since 1968, when operations at TA-53-02 began, until 1992. A 1989 photograph shows a sign identifying the area as a satellite waste accumulation area (LANL 1989, 22-0048). The site now is used exclusively for nonhazardous waste storage (LANL 1993, 22-0050). The current site has a sign that states: New, Used (non-PCB) Oil.

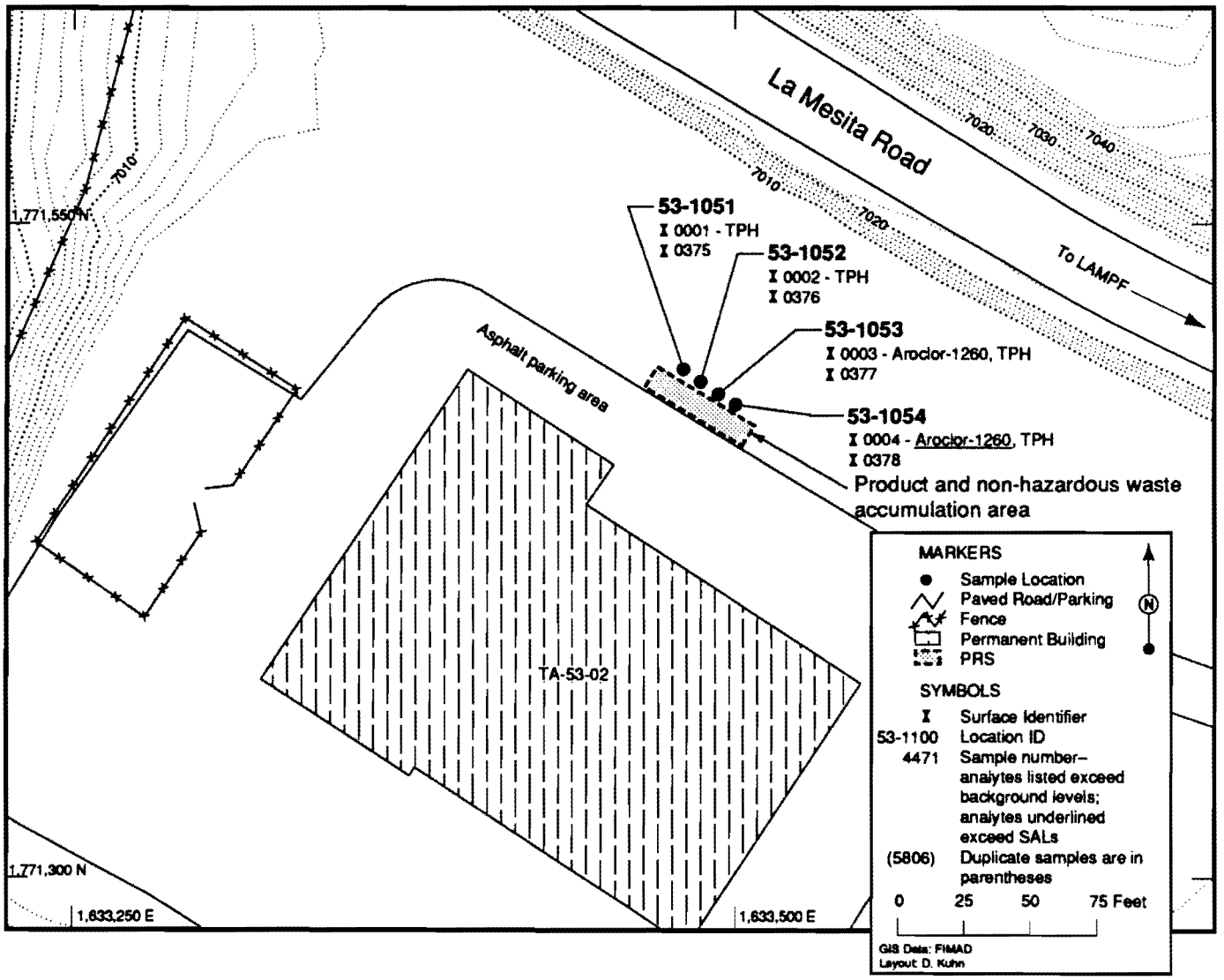

Figure 5.11-1 PRS 53-001(a), product and non-hazardous waste accumulation at Building TA-53-2, showing sample locations and results

5.11.2 Description

PRS 53-001(a) consists of a covered concrete pad with drum-storage racks and product drums located north of TA-53-2. No releases are evident.

5.11.3 Previous Investigation(s)

No previous environmental sampling has been conducted at this site.

5.11.4 Field Investigations

5.11.4.1 Results of Field Surveys

A field survey was not conducted at PRS 53-001(a).

5.11.4.2 Results of Field Screening

Samples were field screened for radioactivity and organic vapors to identify gross concentrations of COPCs. Surface radiological screening was performed before the start of intrusive activities. The screening showed no radioactivity above background. Field screening of the soils with a portable photoionization detector was performed prior to collection of samples. The field screening showed no organic vapors above background.

5.11.4.3 Results of Mobile Laboratory Screening

Four samples were analyzed by an on-site mobile laboratory for gross alpha, beta, and gamma radioactivity. No results were encountered at this PRS that required special labeling or packaging of samples being sent off-site for analysis.

5.11.4.4 Sample Collection and Submittal for Analysis

The objective of Phase 1 sampling was to determine whether COPCs are present at the site. Figure 5.11-1 shows all sample locations at this PRS, and Table 5.11-1 shows a summary of samples taken.

At PRS 53-001(a), four surface samples were collected at different sample locations. Analysis was requested for TAL metals, PCBs, TPH, VOCs, and SVOCs.

5.11.5 Background Comparisons

Inorganics

No inorganics were detected either at concentrations above background or that did not have background values. Therefore, inorganics were eliminated as COPCs.

Radionuclides

PRS 53-001(a) was not sampled for radionuclides.

TABLE 5.11-1
SAMPLE SUMMARY - WASTE AND PRODUCT STORAGE AREAS

Location ID	Sample No.		Depth (in.)	Matrix	Sample Methods*					
					Metals	PCB	TPH	SVOC	Gamma-Spec	VOC
PRS 53-001(a)										
53-1051	0253-95-	0001	0-6	Soil	185/5195	184	184	NA	NA	184
53-1052		0002	0-6	Soil	185/5195	184	184	NA	NA	184
53-1053		0003	0-6	Soil	185/5195	184	184	NA	NA	184
53-1054		0004	0-6	Soil	185/5195	184	184	NA	NA	184
53-1051		0375	0-6	Soil	NA	NA	NA	DS	NA	NA
53-1052		0376	0-6	Soil	NA	NA	NA	DS	NA	NA
53-1053		0377	0-6	Soil	NA	NA	NA	DS	NA	NA
53-1054		0378	0-6	Soil	NA	NA	NA	DS	NA	NA
PRS 53-001(b)										
53-1055	0253-95-	0005	0-12	Soil	211	210	210	NA	NA	210
53-1055		0007	0-12	Soil	211	210	210	NA	NA	210
53-1056		0008	0-8	Soil	211	210	210	NA	NA	210
53-1055		0390	0-12	Soil	NA	NA	NA	DS	NA	NA
53-1055		0391	12-18	Soil	NA	NA	NA	DS	NA	NA
53-1056		0392	0-4	Soil	NA	NA	NA	DS	NA	NA
53-1056		0393	4-8	Soil	NA	NA	NA	DS	NA	NA
PRS 53-001(e)										
53-1057	0253-95-	0011	0-6	Soil	NA	NA	210	NA	NA	210
53-1058		0012	0-6	Soil	NA	NA	210	NA	NA	210
53-1059		0013	0-6	Soil	NA	NA	210	NA	NA	210
53-1060		0014	0-6	Soil	NA	NA	210	NA	NA	210
53-1057		0379	0-6	Soil	NA	NA	NA	DS	NA	NA
53-1058		0380	0-6	Soil	NA	NA	NA	DS	NA	NA
53-1059		0381	0-6	Soil	NA	NA	NA	DS	NA	NA
53-1060		0382	0-6	Soil	NA	NA	NA	DS	NA	NA
PRS 53-001(g)										
53-1061	0253-95-	0015	0-6	Soil	220	NA	219	NA	NA	219
53-1062		0016	0-6	Soil	220	NA	219	NA	NA	219
53-1063		0017	0-6	Soil	220	NA	219	NA	NA	219
53-1063		0018D	0-6	Soil	220	NA	219	NA	NA	219
53-1064		0021	0-6	Soil	220	NA	219	NA	NA	219
53-1061		0383	0-6	Soil	NA	NA	NA	DS	NA	NA
53-1062		0384	0-6	Soil	NA	NA	NA	DS	NA	NA
53-1063		0385	0-6	Soil	NA	NA	NA	DS	NA	NA
53-1064		0386	0-6	Soil	NA	NA	NA	DS	NA	NA

D: duplicate sample DS: Direct Ship sample *batch numbers

5.11.6 Evaluation of Organic Constituents

Alpha-chlordane, aroclor-1260, and trichloroethene were detected (Table 5.11-2) and carried forward to the SAL comparison.

Total petroleum hydrocarbon (TPH) was detected in four soil samples (Table 5.11-2). However, VOC and SVOC analyses of the soil resulted in no detected concentrations of any individual organic compounds. Therefore, TPH is not considered a COPC and will not be evaluated further.

TABLE 5.11-2
PRS 53-001(a) SOIL CONCENTRATIONS FOR ORGANIC ANALYTES DETECTED

Sample ID	Depth (ft)	Alpha-chlordane (mg/kg)	Aroclor-1260 (mg/kg)	TPH (mg/kg)	Trichloroethene (mg/kg)
SAL	N/A	0.34	1*	No SAL	7.1
EQL	N/A	0.002	0.038	N/A	0.006
0253-95-0001	0 - 0.5	ND	ND	458	0.022
0253-95-0002	0 - 0.5	ND	ND	249	ND
0253-95-0003	0 - 0.5	ND	0.07	180	ND
0253-95-0004	0 - 0.5	0.003	3.25 (D)	222	ND

D: Diluted sample N/A: Not Applicable ND: Not Detected. *: SAL is for mixed aroclors (total PCBs)

5.11.7 Human Health Assessment

5.11.7.1 Screening Assessment

One sample had a detected concentration of aroclor-1260 (3.25 mg/kg) that exceeded the SAL (1 mg/kg) for total PCBs (Table 5.11-2); therefore aroclor-1260 is carried forward to a risk assessment.

An MCE conducted for carcinogens (alpha-chlordane and trichloroethene) resulted in a sum of maximum normalized concentrations of 0.01 (Table 5.11.-3) which is less than the decision value of 1.0. Therefore, these analytes are eliminated as COPCs.

TABLE 5.11-3
MULTIPLE CHEMICAL EVALUATION FOR CARCINOGENIC CHEMICALS AT PRS 53-001(a)

Chemical	Maximum Normalized Concentrations
Alpha-chlordane	0.008
Trichloroethene	0.003
TOTAL	0.01

5.11.7.2 Risk Assessment

It is current Laboratory policy that OU 1100, and specifically the TA-53 complex, will remain under continued Laboratory land use. Because of the continued Laboratory land use and the nature of the site, which makes it highly unlikely that intrusive work would be conducted, the potential risk for aroclor-1260 is calculated using a nonintrusive industrial exposure scenario. Under this exposure scenario, the receptors of concern are workers that may be on site for no more than 8 hours a day, 250 days a year, for 25 years. The potential exposure pathways include inhalation of dust and incidental ingestion of soil.

The lifetime average daily doses and the average daily doses for cancer and noncancer doses, respectively, are calculated for exposure through the oral route (ingestion) and through inhalation. EPA standard default parameters were used to calculate the daily doses.

It is conservatively assumed that health effects resulting from exposure to a particular aroclor are representative of health effects that may be produced by other aroclors. For aroclor-1260 (PCB), carcinogenic doses were calculated to be 2.05×10^{-8} mg/kg for inhalation and 5.68×10^{-7} mg/kg for ingestion. Noncarcinogenic doses were calculated to be 5.73×10^{-8} mg/kg for inhalation and 1.59×10^{-6} mg/kg for ingestion.

Carcinogenic and noncarcinogenic doses were used to calculate a lifetime cancer risk of 4.53×10^{-6} mg/kg and a hazard index 0.08 for aroclor-1260, respectively. The calculated potential risk is well within the EPA-established acceptable cancer risk range of 10^{-6} to 10^{-4}. The calculated potential risk and hazard values are more than one order of magnitude below the decision values of 10^{-4} cancer risk and a hazard index of 1, respectively. Therefore, no further work is necessary to limit exposure to aroclor-1260 at this PRS.

A detailed discussion of the components of the risk assessment conducted at this PRS for aroclor-1260 (i.e., exposure assessment, toxicity characterization, and risk/dose characterization) is presented in Appendix C, along with, the equations and calculations used to derive the potential risk values.

5.11.8 Ecological Assessment

The general landscape condition around this PRS is moderately developed and disturbed, and the potential for receptors to come in contact with COPCs at the site is moderate (Table 2.4-1). Therefore, this PRS will be included in the ecological risk assessment that will be conducted when an approach has been approved by state and federal regulators. The completed ecological risk assessment will be submitted to EPA. Threatened and endangered species and/or sensitive habitat listed in Chapter 2 will be evaluated in the ecological risk assessment.

5.11.9 Extent of Contamination

The calculated potential risk and health hazard are more than one order of magnitude below decision values (i.e., the upper bound of cancer risk of 10^{-4} at undisturbed sites and hazard index of 1).

5.11.10 Conclusions and Recommendations

PRS 53-001(a) has been characterized, and no COPCs are retained based on the sample results and screening assessment. This site, an active storage area, is recommended for NFA at this time. Based on NFA Policy Criterion 4, a Class III permit modification will be submitted requesting removal of this site from the HSWA Module of the Laboratory's RCRA operating permit.

5.12 PRS 53-001(b), Waste Accumulation at Building TA-53-2

PRS 53-001(b), a less-than-90-day storage area for drums before 1990, currently consists of four locked cabinets for storage of hazardous products and waste. This site is managed as a waste accumulation area under 40 CFR 262. Based on the sample results and screening assessment, we recommend deferred action for this site. Figure 5.12-1 shows the site with sample locations and results posted.

5.12.1 History

PRS 52-001(b) is discussed in detail in Section 5.3 of the RFI Work Plan (LANL 1994, 1179).

This waste accumulation area was shown in an engineering drawing dated April 1971 (LASL 1971, 22-0064). A photograph taken in 1989 shows the south side of TA-53-2, with the site visible and marked by signs required for less-than-90-day storage. Materials reportedly stored at this site were spent solvents and acids. The photograph also identified a drum rack with six product drums and three waste drums. No evidence of leakage is visible, and the asphalt beneath the pad appears clean (LANL 1989, 22-0048). According to records, the drums were removed from the site in 1990.

The site was inspected in September 1993, and the drum rack was no longer in place. Four locked cabinets were used for storage of hazardous products and waste. No staining was visible on either the concrete pad or the underlying asphalt. An engineering drawing from 1971 showed that this site was a storage area for trichloroethylene and freon waste. However, contamination is expected to be minimal.

5.12.2 Description

PRS 53-001(b), Waste Accumulation Area at Building TA-53-2, is located on the south side of TA-53-2. The site consists of four locked cabinets for storage of hazardous products and waste.

5.12.3 Previous Investigation(s)

No previous environmental sampling has been conducted a this site.

5.12.4 Field Investigations

5.12.4.1 Results of Field Surveys

During a geomorphic survey, the sample locations were chosen in a sediment catchment, downstream of the site, in the drainage channel.

5.12.4.2 Results of Field Screening

All samples collected were field screened for radioactivity and organic vapors to identify gross concentrations. Surface radiological screening was performed before the start of intrusive activities. The screening showed no radioactivity above background. Field screening of the soils with a portable photoionization detector was performed prior to collection of samples. The field screening showed no organic vapors above background.

5.12.4.3 Results of Mobile Laboratory Screening

Four soil samples were analyzed for gross alpha, beta, and gamma radioactivity. No results were encountered at this PRS that required special labeling or packaging of samples being sent off-site for analysis.

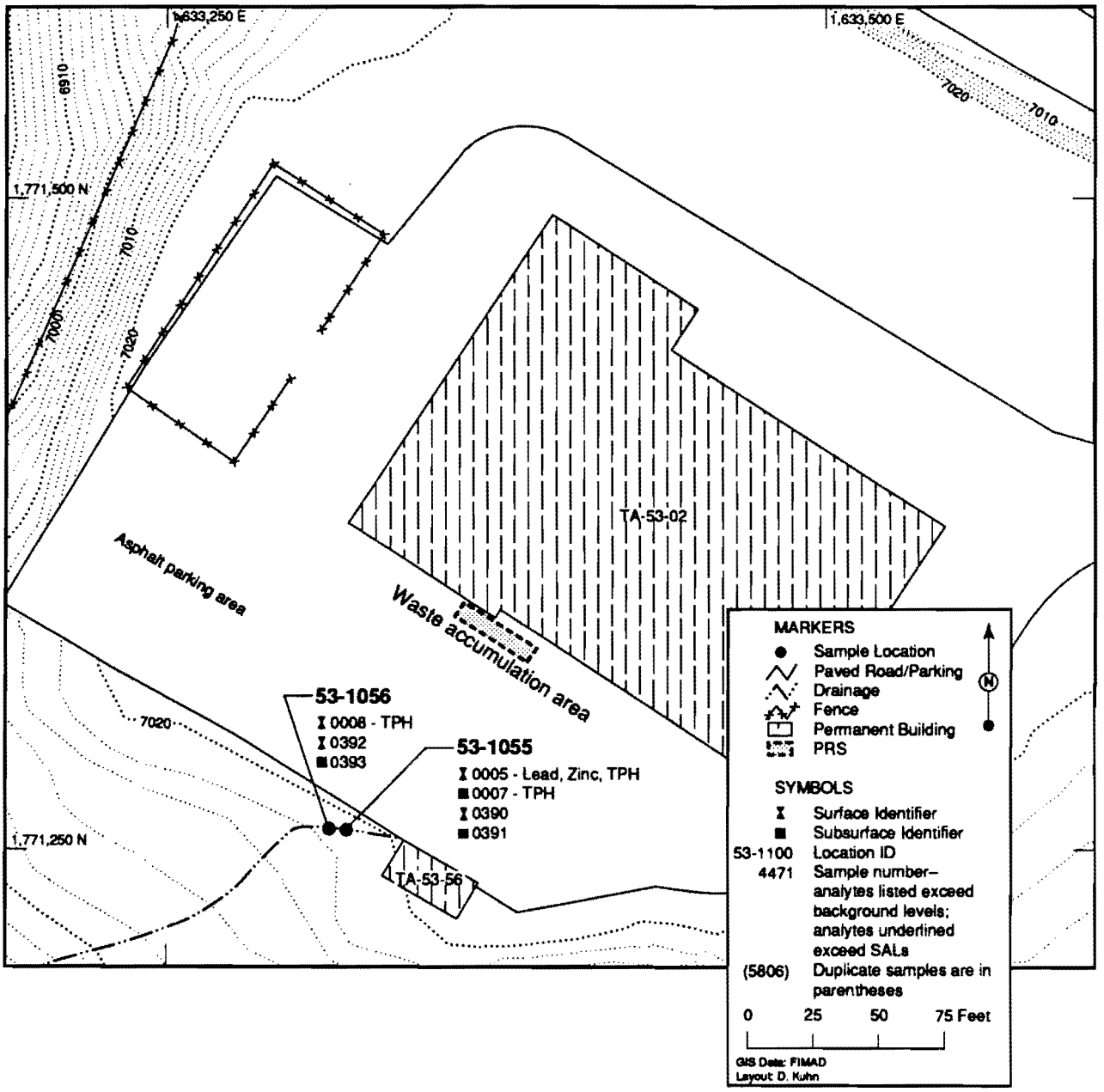

Figure 5.12-1 PRS 53-001(b), Waste Accumulation at Building TA-53-2, with sample locations and results

5.12.4.4 Sample Collection and Submittal for Analysis

The objective of Phase I sampling was to determine whether COPCs from PRS 53-001(b) are present in the downstream drainage channel. Because the storage pad at this PRS is situated on an asphalt parking lot, surface soil at this site cannot be sampled. Figure 5.12-1 shows all sample locations at this PRS, and Table 5.11-1 shows a summary of samples taken.

Three samples were collected, both surface and subsurface, at two different sample locations. Analysis was requested for TAL metals, PCBs, TPH, VOCs, and SVOCs.

5.12.5 Background Comparisons

Inorganics

Lead, zinc, and copper were detected in one surface soil sample (0-0.5 ft) at concentrations (50.3 mg/kg, 105 mg/kg, and 37.2 mg/kg, respectively) that are above their background UTLs (23.3 mg/kg, 50.8 mg/kg, and 15.5 mg/kg, respectively) and were carried forward to the SAL comparison (see Figure 5.12-1).

Radionuclides

PRS 53-001(b) was not sampled for radionuclides.

5.12.6 Evaluation of Organic Constituents

TPH was detected in three soil samples at concentrations of 75.2 mg/kg, 15.7 mg/kg, and 18.1 mg/kg. However, VOC and SVOC analyses of the soil resulted in no detected concentrations of any individual organic compounds. Therefore, TPH is not considered a COPC and will not be evaluated further.

No other organics were detected and therefore were eliminated as COPCs.

5.12.7 Human Health Assessment

5.12.7.1 Screening Assessment

At PRS 53-001(b), lead, copper, and zinc were detected below their SALs of 400 mg/kg, 28000 mg/kg, and 23000 mg/kg, respectively. An MCE for noncarcinogens resulted in a sum of maximum normalized concentrations of 0.148, which is less than the decision value of 1.0 (Table 5.12.-1). Therefore, no COPCs are retained.

TABLE 5.12-1
MULTIPLE CHEMICAL EVALUATION FOR NONCARCINOGEN CHEMICALS AT PRS 53-001(b)

Chemical	Maximum Normalized Concentrations
Copper	0.013
Lead	0.13
Zinc	0.005
TOTAL	0.148

5.12.7.2 Risk Assessment

No human health risk assessment was performed for PRS 53-001(b) because no COPCs were retained as a result of the screening assessment.

5.12.8 Ecological Assessment

The general landscape condition around this PRS is moderately developed and disturbed, and the potential for receptors to come in contact with COPCs at the site is moderate (Table 2.4-1). Therefore, this PRS will be included in the ecological risk assessment that will be conducted when an approach has been approved by state and federal regulators. The completed ecological risk assessment will be submitted to EPA. Threatened and endangered species and/or sensitive habitat listed in Chapter 2 will be evaluated in the ecological risk assessment.

5.12.9 Extent of Contamination

No COPCs were retained, therefore, this section is not applicable.

5.12.10 Conclusions and Recommendations

PRS 53-001(b) has been characterized, and no COPCs are retained based on the sample results and screening assessment. A deferred action has been recommended for this site, and based on NFA Policy Criterion 4, a Class III permit modification will be submitted requesting removal of this site from the HSWA module of the Laboratory's RCRA operating permit. This site is managed as a waste accumulation area under 40 CFR 266.

5.13 PRS 53-001(e), Waste Accumulation at Building TA-53-25

PRS 53-001(e) is a waste storage area located adjacent to TA-53-25. Based on the sample results and screening assessment, we recommend NFA for this site under on NFA Policy Criterion 4: The site has been characterized, and no COPCs are retained from the screening assessment. Figure 5.13-1 shows the site with sample locations and results posted.

5.13.1 History

The SWMU Report identified a waste accumulation area east of TA-53-25, a technical shop adjacent to the accelerator building. Material reportedly stored at this site were solvents, freon, and vacuum pump oil. (LANL 1990, 0145). However, a 1989 photograph indicated that the waste accumulation area was located on gravel approximately 30 ft south of TA-53-25 (LANL 1989, 0049).

During the preparation of the RFI Work Plan, the site was visited to confirm the location of the waste storage area. Nothing was found either on the east side of the shop or on the gravel 30 ft south of the building. However, a new waste storage area was noted adjacent to TA-53-25 on the asphalt pavement (LANL 1994, 1157). The waste area 30 ft south of the building probably served TA-53-25 from 1981 until approximately 1992 (LANL 1994, 1157). There was no evidence of spills or leaks at any location.

5.13.2 Description

PRS 53-001(e) consists of three locked, forklift-transportable cabinets located on asphalt pavement. There is no evidence of spills or leaks at the site.

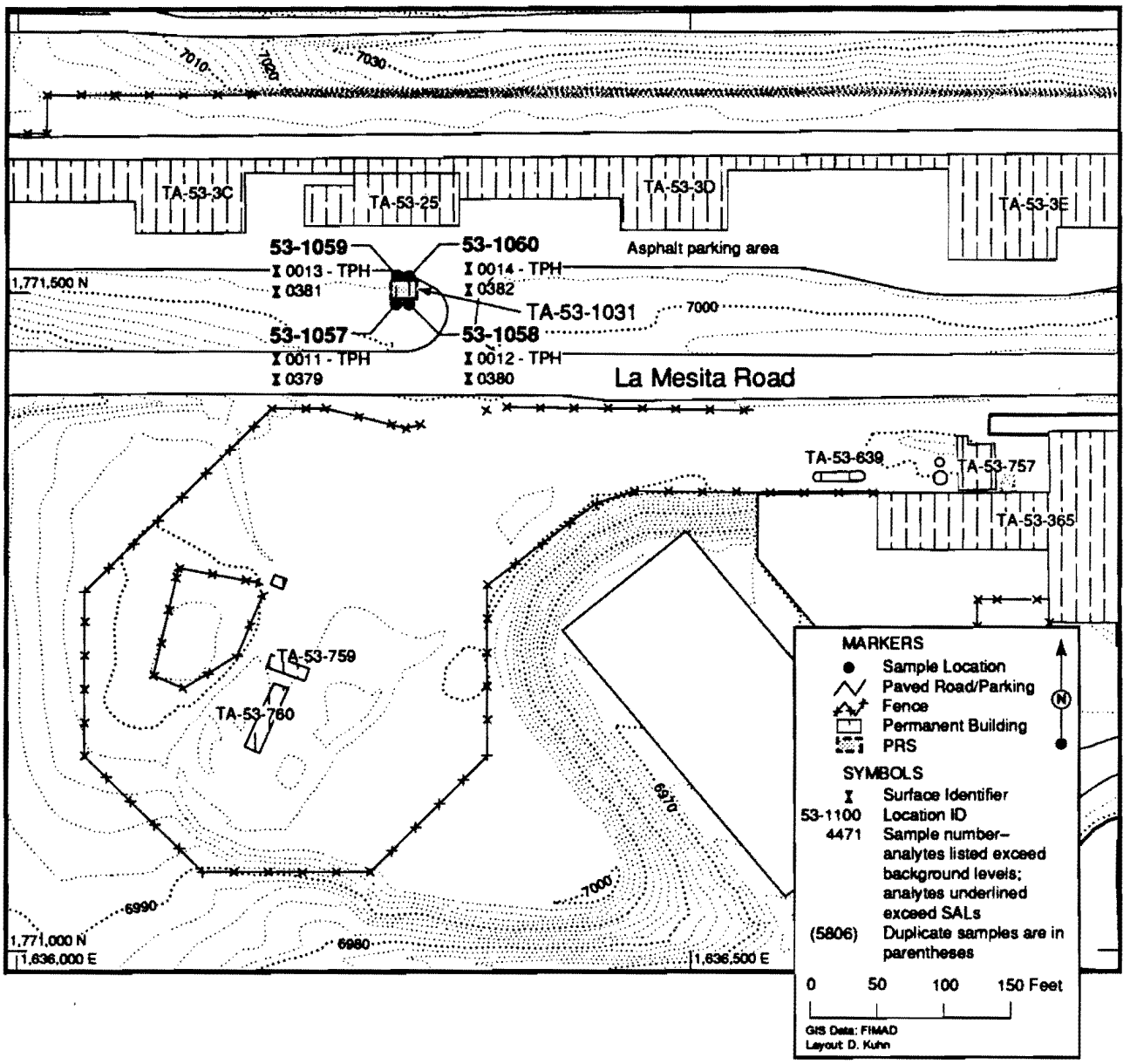

Figure 5.13-1 **PRS 53-001(e), Waste Accumulation at Building TA-53-25, with sample locations and results**

5.13.3 Previous Investigation(s)

No previous environmental sampling has been conducted at this site.

5.13.4 Field Investigations

5.13.4.1 Results of Field Surveys

A field survey was not conducted at PRS 53-001(e).

5.13.4.2 Results of Field Screening

All samples collected were field screened for radioactivity and organic vapors to identify gross concentrations. Surface radiological screening was performed before the start of intrusive activities. The screening showed no radioactivity above background. Field screening of the soils with a portable photoionization detector was performed prior to collection of samples. The field screening showed no organic vapors above background.

5.13.4.3 Results of Mobile Laboratory Screening

Four soil samples were analyzed for gross alpha, beta, and gamma radioactivity. No results were encountered at this PRS that required special labeling or packaging of samples being sent offsite for analysis.

5.13.4.4 Sample Collection and Submittal for Analysis

The objective of the Phase I sampling was to determine whether COPCs are present at this site. Figure 5.13-1 shows all sample locations at this PRS, and Table 5.11-1 shows a summary of samples taken.

At PRS 53-001(e), four surface samples were collected at different sample locations. Analysis was requested for TPH, VOCs, and SVOCs

5.13.5 Background Comparisons

Inorganics

PRS 53-001(e) was not sampled for inorganics.

Radionuclides

PRS 53-001(e) was not sampled for radionuclides.

5.13.6 Evaluation of Organic Constituents

TPH was detected in four soil samples at concentrations of 19.7 mg/kg, 28.5 mg/kg, 104 mg/kg, and 32 mg/kg. However, VOC and SVOC analyses of the soil resulted in no detected concentrations of any individual organic compounds. Therefore, TPH is not considered a COPC and will not be evaluated further.

No other organics were detected and were eliminated as COPCs.

5.13.7 Human Health Assessment

5.13.7.1 Screening Assessment

No organics were detected and PRS 53-001(e) was not sampled for inorganics or radionuclides. Therefore, a screening assessment was not conducted.

5.13.7.2 Risk Assessment

No human health risk assessment was performed for PRS 53-001(e) because no COPCs were retained.

5.13.8 Ecological Assessment

No organics were detected, so these constituents are eliminated as contaminant sources for ecological risk. No further ecological evaluation is required for this PRS.

5.13.9 Extent of Contamination

No COPCs were retained, therefore, this section is not applicable.

5.13.10 Conclusions and Recommendations

PRS 53-001(e) has been characterized and no COPCs are retained based on the sample results and screening assessment. No further action is recommended for this site, and based on NFA Policy Criterion 4, a Class III permit modification will be submitted requesting removal of this site from the HSWA module of the Laboratory's RCRA operating permit.

5.14 PRS 53-001(g), Waste Storage Shed TA-53-1031

PRS 53-001(g) is a waste and product storage shed (TA-53-1031) located in a fenced area south of TA-53-30. Based on the sample results and screening assessment, we recommend NFA for this site under NFA Policy Criterion 4: The site has been characterized, and no COPCs are retained from the screening assessment. Figure 5.14-1 shows the site with sample locations and results posted.

5.14.1 History

According to the SWMU Report (LANL 1990, 0145), solvents, lead sheets and bricks, cadmium sheets, gasoline, and waste oil was being stored in the northeast corner of TA-53-1031. A site visit conducted during preparation of the RFI Work Plan noted drums containing gasoline, acetone, ethanol, hydraulic oil and fluid, and vacuum pump oil. Oil had been leaking onto the floor, and sorbent had been placed to collect the leaks. Lead in various forms was also being stored. The drain in the curbing was inspected, but no staining was visible in the area outside the curb (LANL 1994, 1157).

5.14.2 Description

PRS 53-001(g) is a waste and product storage shed located in a locked, fenced area south of TA-53-30 (Figure 5.14-1). The shed is enclosed on all sides and has a concrete floor with curbing that acted as secondary containment. There was no evidence of staining or contamination outside the locked valve at ground level.

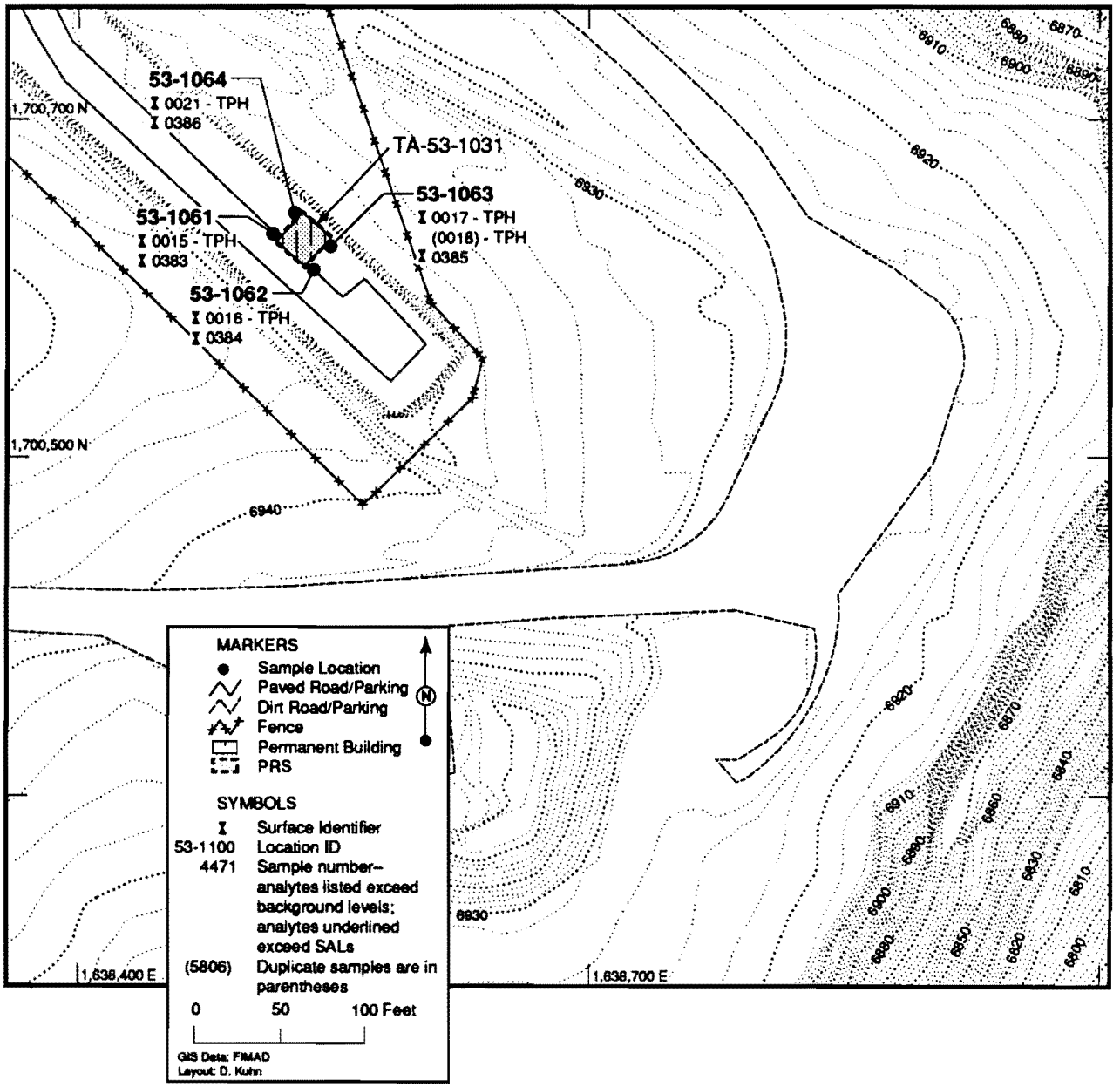

Figure 5.14-1 PRS 53-001(g), Waste Storage Shed, TA-53-1031, with sample locations and results

5.14.3 Previous Investigation(s)

No previous environmental sampling has been conducted at this site.

5.14.4 Field Investigations

5.14.4.1 Results of Field Surveys

Field surveys were not conducted at PRS 53-001(g).

5.14.4.2 Results of Field Screening

All samples collected were field screened for radioactivity and organic vapors to identify gross concentrations. Surface radiological screening was performed before the start of intrusive activities. The screening showed no radioactivity above background. Field screening of the soils with a portable photoionization detector was performed prior to collection of samples. The field screening showed no organic vapors above background.

5.14.4.3 Results of Mobile Laboratory Screening

Four soil samples were analyzed by an on-site mobile laboratory for gross alpha, beta, and gamma radioactivity. No results were encountered at this PRS that required special labeling or packaging of samples being sent offsite for analysis.

5.14.4.4 Sample Collection and Submittal for Analysis

The objective of Phase I sampling was to determine whether COPCs are present at the site. Figure 5.14-1 shows all sample locations at this PRS, and Table 5.11-1 shows a summary of samples taken.

At PRS 53-001(g), 5 surface samples were collected at different sample locations. Analysis was requested for TAL metals, TPH, VOCs, and SVOCs

5.14.5 Background Comparisons

Inorganics

One surface soil sample (0 - 0.5 ft) had a detected concentration of zinc (57.9 mg/kg) that exceeded the background UTL (50.8 mg/kg). Further analysis of the zinc concentrations observed at this site show that they are not statistically different from LANL background zinc concentrations. (Gehan p-value = 0.0700, Quantile test p-value = 0.0536, Slippage test p-value = 0.1218. See Appendix D for a discussion of these tests.) Therefore, all inorganics are eliminated as COPCs.

Radionuclides

PRS 53-001(g) was not sampled for radionuclides.

5.14.6 Evaluation of Organic Constituents

TPH was detected in five soil samples at concentrations of 10.8 mg/kg (J), 10.4 mg/kg (J), 15.9 mg/kg, 9.97 mg/kg (J), and 33.2 mg/kg. However, VOC and SVOC analyses of the soil resulted in no detected concentrations of any individual organic compounds. Therefore, TPH is not considered a COPC and will not be evaluated further.

One surface soil sample (0 - 0.5 ft), had a reported concentration of bis(2-ethylhexyl)phthalate (0.866 mg/kg).

5.14.7 Human Health Assessment

5.14.7.1 Screening Assessment

The detected concentration of bis(2-ethylhexyl)phthalate (0.866 mg/kg) was below its SAL (32 mg/kg). An MCE was not conducted because there was only one carcinogen (bis[2-ethylhexyl]phthalate) carried forward from the evaluation of organic constituents. No COPCs are retained by the screening assessment.

5.14.7.2 Risk Assessment

No human health risk assessment was performed for PRS 53-001(g) because no COPCs were retained as a result of the screening assessment.

5.14.8 Ecological Assessment

The general landscape condition around this PRS is highly developed and disturbed, and the potential for receptors to come in contact with COPCs at the site is low (Table 2.4-1). Therefore, this PRS will be included in the ecological risk assessment that will be conducted when an approach has been approved by state and federal regulators. The completed ecological risk assessment will be submitted to EPA. Threatened and endangered species and/or sensitive habitat listed in Chapter 2.0 will be evaluated in the ecological risk assessment.

5.14.9 Extent of Contamination

No COPCs were retained, therefore, this section is not applicable.

5.14.10 Conclusions and Recommendations

PRS 53-001(g) has been characterized, and no COPCs are retained based on the sample results and screening assessment. No further action has been recommended for this site, and based on NFA Policy Criterion 4, this PRS will not be added to the HSWA module of the Laboratory's RCRA operating permit and is proposed for removal from the ER Project List of PRSs.

5.15 PRS 53-005, Waste Oil Pit

The Waste Oil Pit was not located during field operations. Selection of the site location was based on the historical memory of personnel at the site. A preliminary reconnaissance-type geophysical investigation of the proposed sampling site was conducted prior to excavation of the site. The geophysical investigation did indicate an anomaly that could be associated with the buried pit at the identified location. However, excavation at the location revealed 2 in. to 4 in. of soil over welded tuff bedrock.

A long-time Laboratory employee who remembered the pit was re-interviewed about the general location of the pit. An expanded geophysical investigation of the area was subsequently conducted, and a new location has been identified, and will be sampled in 1996. An addendum to the RFI Report will be submitted for this PRS after sampling and analysis. All specific results, conclusions, and recommendations will be included in the addendum.

5.16 PRS 53-008, Boneyard

PRS 53-008 is a boneyard containing shield blocks and other miscellaneous materials. No RCRA chemicals were retained, but radionuclides were detected above SAL. Based on the sample results and screening assessment, we recommend: NFA for RCRA chemicals for this site under NFA Policy Criterion 4: The site has been characterized, and no RCRA COPCs are retained form the screening assessment. In addition, we propose a VCA to address the radionuclides above SAL. A VCA Plan for this PRS will be submitted on November 23, 1996. All specific results, conclusions, and recommendations will be included in the plan.

5.17 PRS 53-010, Mineral Oil Storage Area

PRS 53-010 was a bermed storage area used as secondary containment for tanks containing mineral-oil-based scintillator liquid. During the Phase I investigation, TPH (5100 mg/kg) contamination was discovered. A VCA Plan was submitted for this PRS on September 30, 1995. Based on the sampling results, the site was cleaned up as a VCA for housekeeping measures. A VCA Report for this PRS was submitted to DOE on September 30, 1995. All specific results, conclusions, and recommendations were included in the report.

5.18 PRS 20-004, Septic Tank TA-20-49 and Drain Line

PRS 20-004 was a septic system constructed in 1952 to serve the guard house at TA-72. Based on the sample results and screening assessment, we recommend NFA for this site under NFA Policy Criterion 4: The site has been characterized, and no COPCs are present. Figure 5.18-1 shows the site with sample locations posted.

5.18.1 History

PRS 20-004 was discussed in detail in Section 5.5 of the RFI Work Plan (LANL 1994, 1157). This septic system was constructed to serve the guard house (TA-20-47) on East Jemez Road in May 1952. The septic tank was abandoned in 1957 (LANL undated, 22-0051), probably in conjunction with the closing of the guard house. The tank was returned to service in 1966 when the firing range was opened. A 1985 memo indicated that the septic tank was still active at that time and was being used by the Laboratory security force (Montoya 1985, 22-0067), but in 1987 the tank was reportedly became overloaded, potentially causing surface discharge. In 1989, the tank was collapsed and filled in by Pan Am World Services.

The Range Master of the firing site was present when the septic tank and line were removed and reported that the tank and line were removed during a Safeguards and Security Upgrades, Phase One, construction project in the early 1990s. There is no documented record of the tank removal.

5.18.2 Description

PRS 20-004, was a single septic-tank chamber made of 6-in.-thick reinforced concrete with inside dimensions of 6 ft by 3 ft by 5 ft high as indicated in an engineering drawing (AEC 1951, 22-0022). The tank had a capacity of 540 gal. with a flow capacity of 200 gal./day. A vitrified pipe carried the effluent 100 ft to the drain. No mention was made of a drainfield although it was reported in the SWMU Report (LANL 1990, 0145).

5.18.3 Previous Investigation(s)

Environmental sampling at this septic system has not been conducted, but releases may have occurred if it discharged to the surface.

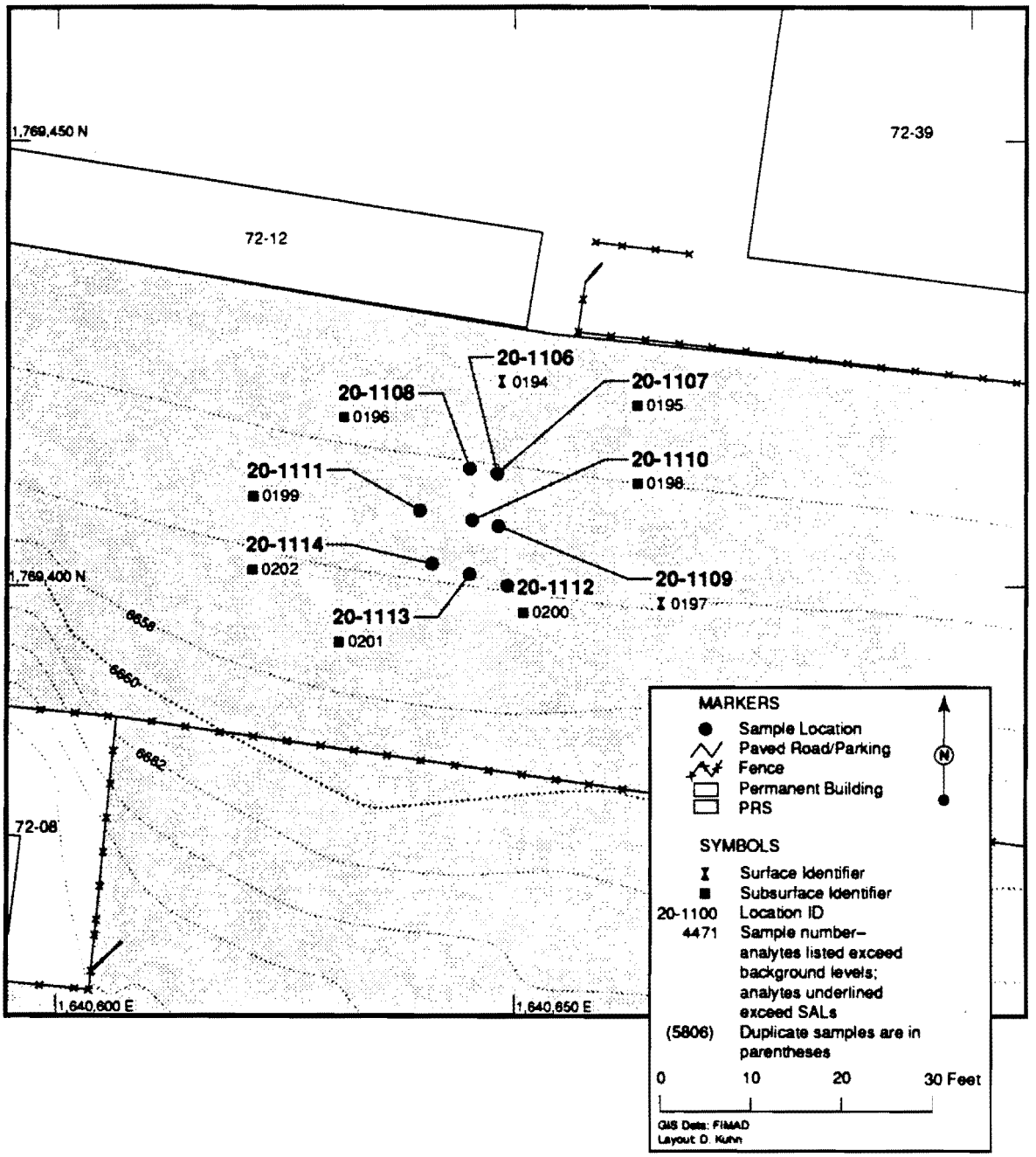

Figure 5.18-1 **PRS 20-004, Septic Tank TA-20-49 and Drain Line with sample locations and results**

5.18.4 Field Investigation

Before any analytical sample locations were chosen, a geophysical survey was conducted. The geophysical surveys were conducted by taking both EM and MAG readings at the site.

5.18.4.1 Results of Field Surveys

The geophysical investigation of the area of the septic system produced no anomalies associated with buried objects; therefore, no contour mapping of the geophysical data was done for this site. From the geophysical investigation, results and personal interviews, it has been inferred that the tank was removed as reported.

5.18.4.2 Results of Field Screening

Sample were field screened for radioactivity and organic vapors to identify gross concentrations. Surface radiological screening was performed before the start of intrusive activities. The screening showed no radioactivity above background. Field screening of the soils with a portable photoionization detector was performed prior to collection of samples. The field screening showed no organic vapors above background.

5.18.4.3 Results of Mobile Laboratory Screening

Nine soil samples were analyzed by an on-site mobile laboratory for gross alpha, beta, and gamma radioactivity. No results were encountered at this PRS that required special labeling or packaging of samples being sent off-site for analysis.

5.18.4.4 Sample Collection and Submittal for Analysis

The objective of the Phase I sampling was to determine whether COPCs are present at the site. Figure 5.18-1 shows all sample locations at this PRS, and Table 5.18-1 shows a summary of samples taken.

PRS 20-004 was sampled at surface locations and at subsurface locations in a hand-dug trench approximately 3 ft deep. The septic tank itself was not found, and only the area around its site was sampled. The samples were analyzed for cyanide, VOCs, SVOCs, and TAL metals.

5.18.5 Background Comparisons

Inorganics

No inorganics were detected in the sampling area either at concentration above background UTLs or that did not have background values. Therefore, inorganics were eliminated as COPCs.

Radionuclides

PRS 20-004 was not sampled for radionuclides.

5.18.6 Evaluation of Organic Constituents

No organics were detected and were eliminated as COPCs.

TABLE 5.18-1
SAMPLE SUMMARY - SEPTIC SYSTEMS

Location ID	Sample ID		Depth (in.)	Matrix	Sample Methods*			
					Metals	Cyanide	SVOC	VOC
PRS 20-004								
20-1106	0220-95-	0194	0-6	Soil	362	NA	361	361
20-1107		0195	24-36	Soil	362	NA	361	361
20-1108		0196	24-36	Soil	362	NA	361	361
20-1109		0197	0-6	Soil	362	NA	361	361
20-1110		0198	12-16	Soil	362	NA	361	361
20-1111		0199	30-34	Soil	362	NA	361	361
20-1112		0200	0-6	Soil	362	NA	361	361
20-1113		0201	12-16	Soil	362	NA	361	361
20-1114		0202	24-36	Soil	362	NA	361	361
PRS 20-005								
20-1135	0220-95-	0228	54-60	Soil	430	430	NA	NA
20-1135		0229D	54-60	Soil	430	430	NA	NA
20-1136		0232	54-60	Soil	430	430	NA	NA
20-1137		0233	54-60	Soil	430	430	NA	NA
20-1138		0234	54-60	Soil	430	430	NA	NA
20-1139		0235	54-60	Soil	430	430	NA	NA
20-1140		0236	54-60	Soil	430	430	NA	NA
20-1141		0237	54-60	Soil	430	430	NA	NA
20-1142		0238	54-60	Soil	430	430	NA	NA
20-1143		0239	54-60	Soil	430	430	NA	NA

D: duplicate sample *batch numbers

5.18.7 Human Health Assessment

5.18.7.1 Screening Assessment

No inorganics were detected either at concentrations above background or that did not have background values. No organics were detected. Therefore, a screening assessment was not conducted.

5.18.7.2 Risk Assessment

No human health risk assessment was performed for PRS 20-004 because no COPCs were retained in the inorganic background comparison or the organic evaluation.

5.18.8 Ecological Assessment

No inorganics were detected either at concentrations above background UTLs, or that did not have background values. Therefore, these constituents are eliminated as contaminant sources for ecological risk. No further ecological evaluation is required for this PRS.

5.18.9 Extent of Contamination

No COPCs were retained; therefore, this section is not applicable.

5.18.10 Conclusions and Recommendations

PRS 20-004 has been characterized, and no COPCs are present based on the sample results and screening assessment. No further action is recommended for this site, and based on NFA Policy Criterion 4, a Class III permit modification will be submitted requesting removal of this site from the HSWA module of the Laboratory's RCRA operating permit.

5.19 PRS 20-005, Septic Tank TA-20-27

PRS 20-005 was a septic system that served TA-20-1. Based on the sample results and screening assessment, we recommend NFA for this site under NFA Policy Criterion 4: The site has been characterized, and no COPCs are retained from the screening assessment. Figure 5.19-1 shows the site with sample locations posted.

5.19.1 History

This septic system was constructed in 1945 and abandoned in 1948 (LANL undated, 22-0051). The plumbing drawing of this building showed that a toilet, restroom sink, and darkroom sink were connected to the 4-in. drainline leaving the building. The septic system was reported as removed (LANL 1990, 0145). In 1985, the tank was not located during a Laboratory investigation, but a depression in the tuff was found at the tank's location (LANL 1985, 22-0016). Excavation of the area turned up no evidence of the tank or waste lines. A soil sample was collected, but it showed no evidence of radioactivity (Scholl 1989, 0485).

5.19.2 Description

The septic tank was shown in an engineering drawing as having 6-in.-thick concrete walls with interior dimensions of 3 ft by 6 ft by 5 ft high, and a capacity of 540 gal. The discharge point of the tank is not known, and documentation does not exist, indicating that remediation was conducted at the time of removal of the tank and drainline. The area currently appears as a grassland with isolated trees and brush (LANL 1994, 1157).

5.19.3 Previous Investigation(s)

During a 1985 program to remove structures from Sandia Canyon, a soil sample was collected in the area and screened for radioactivity, with negative results.

5.19.4 Field Investigation

Before any analytical sample locations were chosen, a geophysical survey was conducted. The geophysical surveys were conducted by taking both EM and MAG readings at the site.

5.19.4.1 Results of Field Surveys

The geophysical investigation of the area of the septic system produced no anomalies associated with buried objects; therefore, no contour mapping of the geophysical data was done for this site. From the geophysical investigation results and personnel interviews, it has been inferred that the septic system was removed as reported. Therefore, the drainage downgradient from the septic system was identified for sampling.

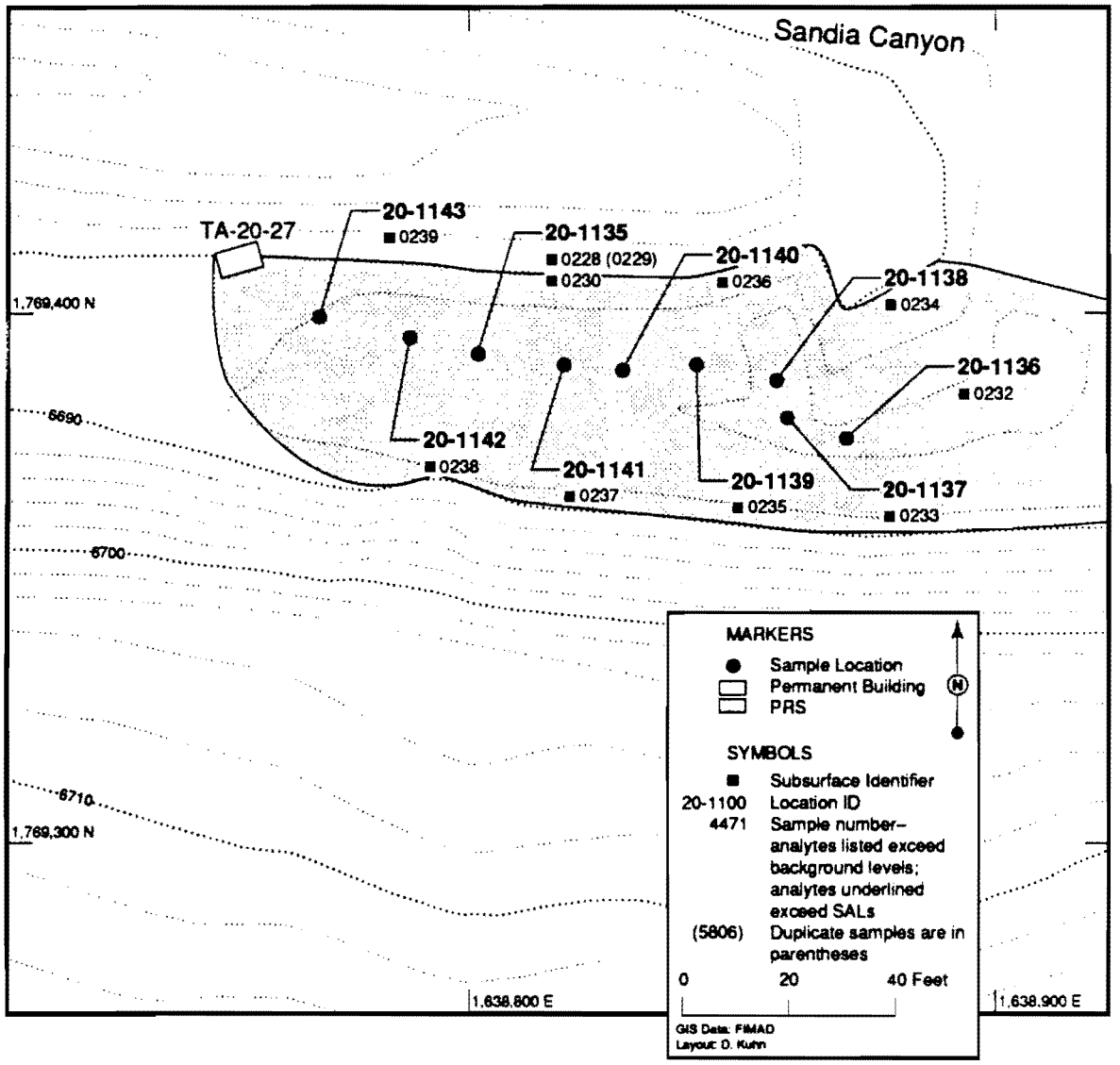

Figure 5.19-1 PRS 20-005, Septic Tank TA-20-27, with sample locations and results

5.19.4.2 Results of Field Screening

Sample were field screened for radioactivity and organic vapors to identify gross concentrations. Surface radiological screening was performed before the start of intrusive activities. The screening showed no radioactivity above background. Field screening of the soils with a portable photoionization detector was performed prior to collection of samples. The field screening showed no organic vapors above background.

5.19.4.3 Results of Mobile Laboratory Screening

Ten samples, including one duplicate sample, were analyzed by an on-site mobile laboratory for gross alpha, beta, and gamma radioactivity. No results were encountered at this PRS to require special labeling or packaging of samples being sent offsite for analysis.

5.19.4.4 Sample Collection and Submittal for Analysis

The objective of the Phase I sampling was to determine whether COPCs are present at the site. Figure 5.19-1 shows all sample locations, and Table 5.18-1 shows a summary of samples taken.

PRS 20-005 was sampled at subsurface locations, hand augered to a depth of 5 ft. The septic system was not found, but the area drainage downgradient from the septic system was sampled. Ten samples were collected, and analysis was requested for cyanide and TAL metals.

5.19.5 Background Comparisons

Inorganics

One subsurface soil sample (54-60 in.) had a detected concentration of lead (25.3 mg/kg) that exceeded the background UTL (23 mg/kg). Further analysis of the lead concentrations observed at this site show that they are not statistically different from the Laboratory background lead concentrations (Gehan p-value = 0.9486, Quantile test p-value = 0.8672, Slippage test p-value = 1.0000; see Appendix D for a discussion of these tests). Therefore, all inorganics are eliminated as COPCs for this PRS.

Radionuclides

PRS 20-005 was not sampled for radionuclides.

5.19.6 Evaluation of Organic Constituents

PRS 20-005 was not sampled for organics.

5.19.7 Human Health Assessment

5.19.7.1 Screening Assessment

No inorganics were detected either at concentrations above background or that did not have background values. Therefore, a screening assessment was not conducted.

5.19.7.2 Risk Assessment

No human health risk assessment was performed for PRS 20-005 because no COPCs were retained in the inorganic background comparison or the organic constituent evaluation.

5.19.8 Ecological Assessment

The general landscape condition around this PRS is moderately developed and disturbed, and the potential for receptors to come in contact with COPCs at the site is low (Table 2.4-1). Therefore, this PRS will be included in the ecological risk assessment that will be conducted when an approach has been approved by state and federal regulators. The completed ecological assessment will be submitted to EPA. Threatened and endangered species and/or sensitive habitat listed in Chapter 2.0 will be evaluated in the ecological risk assessment.

5.19.9 Extent of Contamination

No COPCs were identified, therefore, this section is not applicable.

5.19.10 Conclusions and Recommendations

PRS 20-005 has been characterized, and no COPCs are retained based on the sample results and screening assessment. No further action has been recommended for this site, and based on NFA Policy Criterion 4, a Class III permit modification will be submitted requesting removal of this site from the HSWA module of the Laboratory's RCRA operating permit.

5.20 PRS-53-012(e), Outfall

PRS-53-012(e) is an outfall and drainline for discharges from TA-53-2, the Equipment Test Laboratory. This site is managed as an active outfall under the National Pollutant Discharge Elimination System (NPDES). Based on the sampling results and screening assessment, we recommend NFA for this site under NFA Policy Criterion 4: The site has been characterized, and no COPCs are retained from the screening assessment. Figure 5.20-1 shows the site with sample locations and results posted.

5.20.1 History

This outfall probably has been in use since 1968, when operations at TA-53-2 began. The outfall discharges treated cooling water from the cooling tower at an average flow of 2.9 gal./min (LANL 1990, 22-0018).

5.20.2 Description

PRS 53-012(e), which operates under the Laboratory's NPDES permit, discharges cooling water from the cooling tower as well as draining 12 trench drains, 2 sink drains, and a floor drain (Santa Fe Engineering 1993, 22-0070). The discharges drain to a sump outside the southwest corner of TA-53-2 and from there to a drainline that runs underneath the parking lot south of the building and discharges to the rim of Sandia Canyon.

5.20.3 Previous Investigations

Environmental sampling has not been conducted at this site, but contaminants are known to be present because of the nature of the outfall. This outfall was in a category that the Laboratory classified "worst case. " Four of the worst case outfalls were sampled, but these may not be indicative of this outfall.

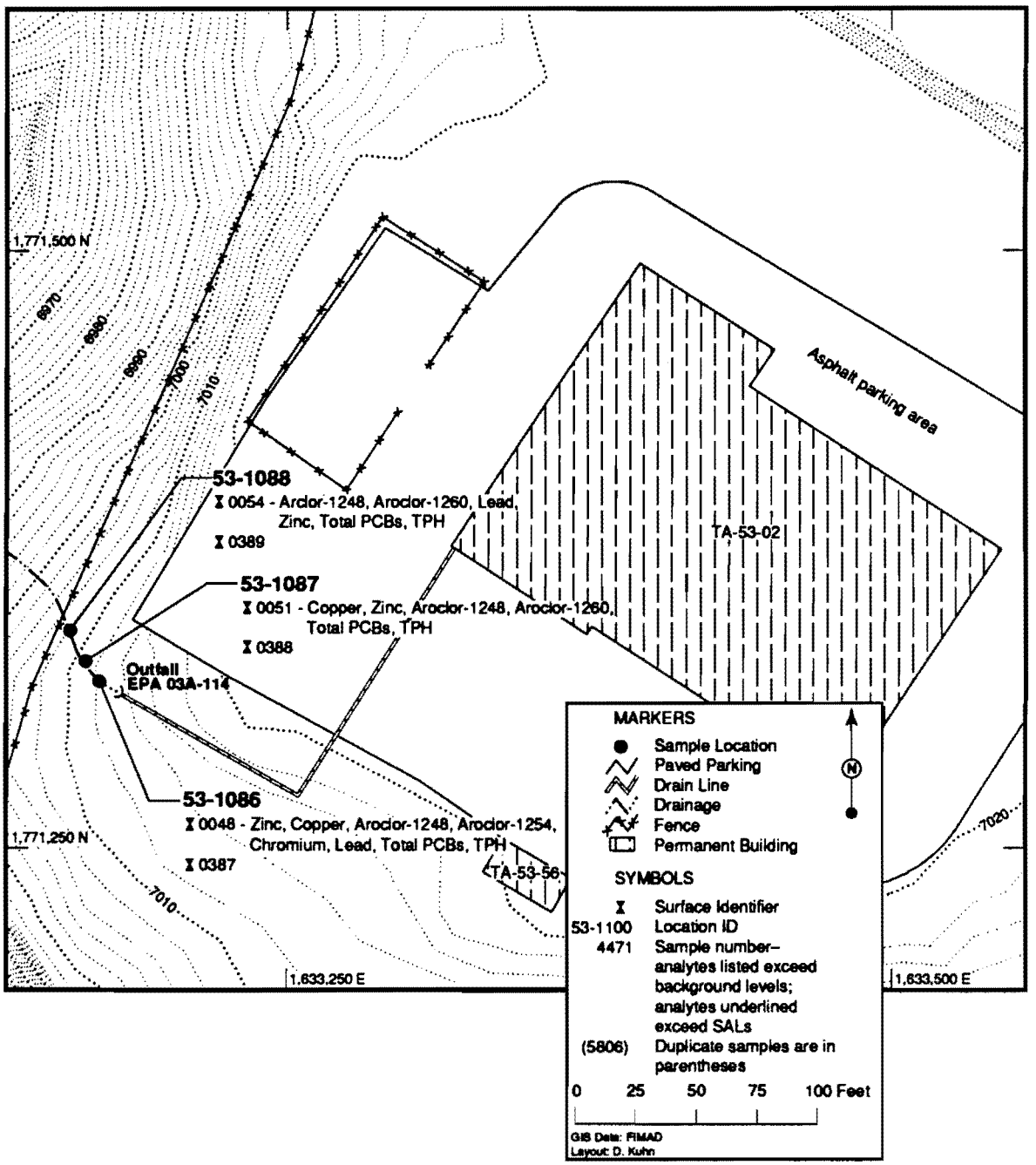

Figure 5.20-1 PRS 53-012(e), Outfall, with sample locations and results

5.20.4 Field Investigation

5.20.4.1 Results of Field Surveys

Before any analytical sample locations were chosen, a geomorphic survey was conducted to locate sediment catchments in the downstream drainage. Sample locations were chosen at the sediment catchments.

5.20.4.2 Results of Field Screening

All samples collected were field screened for radioactivity and organic vapors to identify gross concentrations. Surface radiological screening was performed before the start of intrusive activities. The screening showed no radioactivity above background. Field screening of the soils with a portable photoionization detector was performed prior to collection of samples. The field screening showed no organic vapors above background.

5.20.4.3 Results of Mobile Laboratory Screening

Three soil samples were analyzed for gross alpha, beta, and gamma radioactivity. All results were negative, and the samples did not require special labeling or packaging for shipment to offsite laboratories.

5.20.4.4 Sample Collection and Submittal for Analysis

The objective of the Phase I sampling was to determine whether COPCs were present in the outfall drainage. Figure 5.20-1 shows all sample locations at this PRS, and Table 5.20-1 shows a summary of samples taken.

Three samples were collected from the outfall drainage. The tuff was close to the surface, and no material was available for the subsurface samples proposed in the RFI Work Plan.

TABLE 5.20-1
SAMPLE SUMMARY - OUTFALLS

Location ID	Sample ID		Depth (in.)	Matrix	Sample Methods*				
					Metals	PCB	TPH	SVOC	VOC
PRS 53-012(e)									
53-1086	0253-95-	0048	0-4	Soil	185/5195	184	184	NA	184
53-1087		0051	0-8	Soil	185/5195	184	184	NA	184
53-1088		0054	0-4	Soil	185/5195	184	184	NA	184
53-1086		0387	0-4	Soil	NA	NA	NA	DS	NA
53-1087		0388	0-8	Soil	NA	NA	NA	DS	NA
53-1088		0389	0-4	Soil	NA	NA	NA	DS	NA

DS: Direct Ship sample; no request number *batch numbers

5.20.5 Background Comparisons

Inorganics

Chromium, copper, lead, mercury, nickel, and zinc were detected at concentrations greater than their background UTLs (Table 5.20-2) and were carried forward to the SAL comparison. Figure 5.20-1 presents the spatial distribution of inorganic COPCs at PRS 53-012(e) that are above background.

TABLE 5.20-2
INORGANICS WITH CONCENTRATIONS GREATER THAN BACKGROUND UTL FOR PRS 53-012(e)

Sample ID	Depth (ft)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)
LANL UTL	N/A	19.3	30.7	23.3	0.1	15.2	50.8
SAL	N/A	210	2800	400	2.3	150.0	23000
0253-95-0048	0 - 0.33	23.5	267	38.6	0.27	27	218
0253-95-0051	0 - 0.67	13.2	46.2	19.5	ND	ND	87.4
0253-95-0054	0 - 0.33	10.9	46.2	29.7	ND	ND	159

N/A: Not Applicable; ND: Not Detected

Radionuclides

PRS 53-012(e) was not sampled for radionuclides.

5.20.6 Evaluation of Organic Constituents

Alpha-chlordane, aroclor-1248, aroclor-1254 and aroclor-1260 were detected above their EQL (Table 5.20-3) and were carried forward to the SAL comparison. Figure 5.20-1 presents the spatial distribution of PCBs at PRS 53-012(e) that are detected above the EQL.

Because of possible drainage from the parking lot, TPH was detected in three soil samples (Table 5.20-3). However, VOC and SVOC analyses of the soil resulted in no detected concentrations of any individual organic compounds. Therefore, TPH is not considered a COPC and will not be evaluated further.

TABLE 5.20-3
PRS 53-012(e) SOIL CONCENTRATIONS FOR ORGANIC DETECTED ANALYTES

Sample ID	Depth (ft)	Alpha-Chlordane (mg/kg)	Aroclor-1248 (mg/kg)	Aroclor-1254 (mg/kg)	Aroclor-1260 (mg/kg)	PCBs (total) (mg/kg)	TPH (mg/kg)
SAL	N/A	0.34	1*	7.1	1*	1	No SAL
EQL	N/A	0.002	0.04	0.044	0.038	N/A	N/A
0253-95-0048	0 - 0.33	0.008	0.76	0.351	ND	1.11**	2000
0253-95-0051	0 - 0.67	ND	0.06	ND	0.332	0.39**	2090
0253-95-0054	0 - 0.33	ND	0.047	ND	0.335	0.38**	1150

N/A: Not Applicable ND: Not Detected *: SAL is for mixed aroclors (total PCBs)
**: Value for total aroclors (i.e., the sum of aroclor-1248, aroclor-1254, and aroclor-1260)

5.20.7 Human Health Assessment

5.20.7.1 Screening Assessment

Although no one individual aroclor exceeded the SAL, the total concentration of PCBs (sum of aroclor-1248, aroclor-1254, and aroclor-1260) exceeded the SAL for total PCBs (1 mg/kg) in one sample (Table 5.20-3). Therefore, PCBs (total) are retained as a COPC and are carried forward to the risk assessment.

An MCE for the noncarcinogens above background (copper, lead, mercury, nickel, and zinc) resulted in a sum of maximum normalized concentrations of 0.24, which is less than the decision value of 1.0 (Table 5.20-4). These analytes were eliminated as COPCs.

An MCE for carcinogenic effects from (alpha-chlordane and chromium) resulted in a sum of maximum normalized concentrations of 0.136, which is less than the target value of 1.0 (Table 5.20-5). These analytes were eliminated as COPCs.

TABLE 5.20-4
MULTIPLE CHEMICAL EVALUATION FOR NONCARCINOGEN CHEMICALS AT PRS 53-012(e)

Chemical	Maximum Normalized Concentrations
Copper	0.10
Lead	0.10
Mercury	0.01
Nickel	0.02
Zinc	0.01
TOTAL	0.24

TABLE 5.20-5
MULTIPLE CHEMICAL EVALUATION FOR CARCINOGENS AT PRS 53-012(e)

Chemical	Maximum Normalized Concentrations
Alpha-Chlordane	0.024
Chromium	0.112
TOTAL	0.136

5.20.7.2 Risk Assessment

It is current Laboratory policy that OU 1100, and specifically the TA-53 complex, will remain under continued Laboratory land use. Because of the continued Laboratory land use and the nature of the site, which makes it highly unlikely that intrusive work would be conducted, the potential risk for total PCBs is calculated based on a nonintrusive industrial exposure scenario. Under this exposure scenario, the receptors of concern are workers that may be onsite for no more than 8 hours per day, 250 days per year, for 25 years. The potential exposure pathways include inhalation of dust and incidental ingestion of soil.

The lifetime average daily doses and the average daily doses for cancer and noncancer doses, respectively, are calculated for exposure through the oral route (ingestion) and through inhalation. EPA's standard default parameters were used to calculate the daily doses.

It is conservatively assumed that health effects resulting from exposure to a particular aroclor are representative of health effects that may be produced by other aroclors. For total PCBs, carcinogenic doses were calculated to be 6.99 x 10^{-9} mg/kg for inhalation and 1.95 x 10^{-7} mg/kg for ingestion. Noncarcinogenic doses were calculated to be 1.95 x 10^{-8} mg/kg for inhalation and 5.43 x 10^{-7} mg/kg for ingestion. Carcinogenic and noncarcinogenic doses were used to calculate a lifetime cancer risk of 1.55 x 10^{-6} mg/kg and a hazard index of 0.08 for total PCBs, respectively. The calculated potential risk is well within the EPA-established acceptable cancer risk range of 10^{-6} to 10^{-4}. The calculated potential risk and hazard values are more than one order of magnitude below the decision values of 10^{-4} cancer risk and hazard index of 1. Therefore, no further work is necessary to limit exposure to PCBs at this PRS.

Appendix C presents a detailed discussion of the components of the risk assessment for total PCBs conducted at this PRS, (i.e., exposure assessment, toxicity characterization, and risk/dose characterization) as well as the equations and calculations used to derive the potential risk values.

5.20.8 Ecological Assessment

The general landscape condition around this PRS is moderately developed and disturbed and the potential for receptors to come in contact with COPCs at the site is high (Table 2.4-1). Therefore, this PRS will be included in the ecological risk assessment that will be conducted when an approach has been approved by state and federal regulators. The completed ecological risk assessment will be submitted to EPA. Threatened and endangered species and/or sensitive habitat listed in Chapter 2.0 will be evaluated in the ecological risk assessment.

5.20.9 Extent of Contamination

The calculated potential risk and health hazard are more than one order of magnitude below COPC target values (i.e., the upper bound of cancer risk of 10^{-4} at and a hazard index of 1 were retained, therefore, this section is not applicable.

5.20.10 Conclusions and Recommendations

PRS 53-012(e) has been characterized, and no RCRA COPCs are retained based on the sample results and screening assessment. TPH analyses showed positive evidence of compounds however, presumably highly weathered and not identified by SW-846 VOC and SVOC methods because no specific compounds were identified. This site is regulated as an active outfall under the NPDES permit and will not be added to the HSWA module of the Laboratory's RCRA operating permit and is recommended for NFA.

All analytical data from the outfall will be transmitted to ESH-18, the Laboratory Water Quality Group for review for NPDES permit notification requirements.

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APPENDIX A

ANALYTICAL DATA

APPENDIX A

ANALYTICAL DATA

All analytical data are available on FIMAD. If FIMAD is not accessible, data will be provided upon request. A hard copy of the data is available from the ER Records Processing Facility.

APPENDIX B

DATA QUALITY EVALUATION TABLES

APPENDIX B

DATA QUALITY EVALUTION TABLES

There were no QA problems associated with PRS 72-001. Thus, no QA tables are being included for TA-72. Table B-1 provides QA for PRSs in TA-20. Table B-2 provides QA for PRSs in TA-53.

TABLE B-1
DATA QUALITY EVALUATION FOR TA-20 SAMPLES

SUITE	REQUEST NUMBER	COMMENTS
Inorganics	265	Barium and thallium recoveries in the Laboratory Control Sample (LCS) are above EPA established limits (80-120%). Four of 23 barium samples are qualified as "J" and one of 23 thallium samples is qualified as "UJ". Data usability unaffected because the recoveries are biased high.
	425	Matrix spike recovery for antimony is less than EPA established limits (75-125%). All antimony data (23 samples) are qualified as "UJ". The antimony data are usable because the matrix spike recovery is <1% below the limit and antimony would have been detected if present.
		Mercury recovery in the LCS is less than EPA established limits (80-120%). One of 23 mercury samples is qualified as "J", the remaining 22 mercury samples are qualified as "UJ". The mercury data are usable because the recovery in the LCS is within reasonable limits and the matrix spike recovery is acceptable.
	445	The calculated Relative Percent Difference (RPD) between chromium concentrations in sample 0220-95-0256 (3.5 mg/kg) and its field duplicate, sample 0220-95-0257 (5.4 mg/kg) is 43%. The calculated RPD between zinc concentrations in sample 0220-95-0256 (20.9 mg/kg) and its field duplicate, sample 0220-95-0257 (31.7 mg/kg) is 41%. For these sample results, the chromium and zinc RPDs indicate the variability of the soil matrix; therefore, these results are usable as individual analyses.
		Mercury recovery in the LCS is less than EPA established limits (80-120%). Seven of 25 mercury samples are qualified as "J", the remaining 18 mercury samples are qualified as "UJ". Data usability is unaffected because the recovery is within reasonable limits (>70<80%) so the analyte could be accurately quantified.
	462	Following Method of Standard Addition (MSA) analysis, correlation coefficients for selenium in one sample and arsenic in another sample are less than EPA established limits (<0.995). One of 10 selenium samples and one of 10 arsenic samples are qualified as "J". Data are usable because the analytes can be quantified.
		Cobalt recovery in the LCS is greater than the EPA established limits (80-120%). One of 10 cobalt samples is qualified as "J", the remaining 9 cobalt samples are qualified as "UJ". The cobalt data are usable because the recovery is biased high.
		The calculated RPD between manganese concentrations in sample 0220-95-176 (176 mg/kg) and its field duplicate, sample 0220-95-177 (1250 mg/kg) is 151%. The manganese concentrations in all other samples are within the range of sample 0220-95-176 (176 mg/kg), not the duplicate sample 0220-95-176 (1250 mg/kg). Therefore, the manganese data for sample number 0220-95-177 is considered an outlier and is unusable. Manganese data for the remaining 8 samples are qualified as "J" because the matrix spike recovery is less than EPA established limits (75-125%). With the exception of manganese data for sample 0220-95-177 which is unusable, all other manganese data are considered usable because the percent recovery in the matrix spike is within reasonable limits (>65<75%) and the LCS recovery is acceptable, so manganese is accurately quantified.

TABLE B-1
DATA QUALITY EVALUATION FOR TA-20 SAMPLES
(Continued)

SUITE	REQUEST NUMBER	COMMENTS
Radionuclides	297	With the exception of one Sr-90 sample and eight U-234 and U-238 samples, all detected radioisotopes of potential concern in eight samples are less than 3 standard deviations (3σ) of the detected value and are usable as nondetects. All other radionuclide data are usable as reported.
	319	With the exception of 16 Ra-226, U-234 and U-238 samples, all detected radioisotopes of potential concern in 16 samples are less than 3 standard deviations (3σ) of the detected value and are usable as nondetects. All other radionuclide data are usable as reported.
	360	With the exception of nine Ra-226, 22 U-234, and 23 U-238 samples, all detected radioisotopes of potential concern in 23 samples are less than 3 standard deviations (3σ) of the detected value and are usable as nondetects.
		The U-235 recoveries in the LCS are 69% and 58.3%, which are greater than the contractual requirements (+/- 20%). Twenty-two U-235 samples (eight associated with 20-001(b)) are qualified as "J". The data are usable because the recoveries are biased high. All other radionuclide data are usable as reported.
	330, 353, & 454	With the exception of seven U-238 samples, all detected radioisotopes of potential concern in seven samples are less than 3 standard deviations (3σ)of the detected value and are usable as nondetects. All other radionuclide data are usable as reported.
	283	With the exception of nine Cs-137, one U-235, and 23 U-234 and U-238 samples, all detected radioisotopes of potential concern in 23 samples are less than 3 standard deviations (3σ)of the detected value and are usable as nondetects.
		The method blank contained U-234 and U-238. The sample values reported for these radioisotopes for sample 0220-95-071 is less than 5 times the blank concentration, indicating that their presence may be due to contamination. Therefore, the U-234 and U-238 data in sample 0220-95-071 are considered usable as nondetects. All other radionuclide data are usable as reported.

TABLE B-1
DATA QUALITY EVALUATION FOR TA-20 SAMPLES
(Continued)

SUITE	REQUEST NUMBER	COMMENTS
Radionuclides	427	With the exception of nine Cs-137, one U-235, and 23 U-234 and U-238 samples, all detected radioisotopes of potential concern in 23 samples are less than 3 standard deviations (3σ)of the detected value and are usable as nondetects. All other radionuclide data are usable as reported.
	443	With the exception of two Cs-137, one U-235, and 25 U-234 and U-238 samples, all detected radioisotopes of potential concern in 25 samples are less than 3 standard deviations (3σ)of the detected value and are usable as nondetects. All other radionuclide data are usable as reported.
	403	With the exception of nine Ra-226 and two U-235 samples, all detected radioisotopes of potential concern in 10 samples are less than three standard deviations (3σ)of the detected value and are usable as nondetects. All other radionuclide data are usable as reported.

Sr-90: strontium-90; Cs-137: cesium-137; U-234: uranium-234; U-235: uranium-235; U-238: uranium-238; Ra-226: radium-226

TABLE B-2
DATA QUALITY EVALUATION FOR TA-53 SAMPLES

SUITE	REQUEST NUMBER	COMMENTS
Inorganics	220	Cobalt was detected in the analytical blank. The sample values in eight of 16 samples are greater than five times the blank concentration and are qualified as "J". The results are considered valid detects because they exceeded the 5X rule of blank contamination and are therefore considered to be present in the environmental samples.
		The Relative Percent Differences (RPDs) for lead and manganese duplicate data are greater than EPA established limits (+/- 20%). All lead data (16 samples) are qualified as "J". In addition, matrix spike recovery for manganese is less than EPA established limits (75-125%) and all manganese data (16 samples) are qualified as "J". The lead data are usable because the high RPD is an indication of the variability of the soil matrix, while the manganese data are usable because the recoveries are within reasonable limits (>50<75%) and the analytical spike recovery is acceptable.
		Analytical spike recovery for selenium is less than the EPA established limits (85-115%) and four of 16 selenium samples are qualified as "UJ". The selenium data are usable because the recoveries are within reasonable limits (>75<85%) so the analyte would have been detected if present. Analytical spike recoveries for arsenic and thallium are greater than the EPA established limits (85-115%) in one sample and are qualified as "J" and "UJ", respectively. The data are usable because the recoveries are biased high in both samples.
Pesticides	184	The quantitative value for dieldrin, endosulfan II, endrin aldehyde, and gamma-chlordane in two analytical columns differed by more than the EPA recommended value. Therefore, the detected concentrations of gamma-chlordane and dieldrin in one sample, endrin aldehyde in three samples, and endosulfan II in four of seven samples are considered to be false positives and usable as nondetects.
Polychlorinated Biphenyls (PCBs)		One of seven PCB samples exceeded the calibration range of the method and is qualified as "E". The sample was diluted and re-analyzed. The diluted analysis is used for the quantified result for this sample. With the exception of the undiluted PCB sample all other data are considered usable.

TABLE B-2
DATA QUALITY EVALUATION FOR TA-53 SAMPLES
(Continued)

SUITE	REQUEST NUMBER	COMMENTS
Semivolatiles (SVOCs)	BATCH 77057	2-Chlorophenol, 4-chloro-3-methyl phenol, 1,4-dichlorobenzene, 4-nitrophenol, , n-nitrosodipropylamine, and phenol recoveries in the Laboratory Control Sample (LCS) are less than EPA established limits (75-125%). The data for these analytes in all samples are qualified as "UJ". The data are usable because the recoveries are within reasonable limits (>50<75%) so the analytes would have been detected if present.
		Surrogate recoveries of 2,4,6-tribromophenol and p-terphenyl-d14 in five samples are less than EPA established limits (19-122% and 18-137%, respectively) and all data for five of 19 samples are qualified as "UJ". Data are usable because only one base-neutral extractable and one acid extractable surrogate are affected and the surrogate recoveries from the other surrogates are sufficient to quantify the analytes so that they would have been detected if present.
		Surrogate recovery of p-terphenyl-d14 in one of 19 samples is less than EPA established limits (18-137%) and all data for this one sample are qualified as "UJ". Data are usable because the other surrogate recoveries are acceptable so the analytes would have been detected and quantified if present.
		Matrix spike recoveries are outside of control limits in one of 19 samples for acenaphthene, 1,4-dichlorobenzene, 2,4-dinitrotoluene, 4-nitrophenol, N-nitrosodipropylamine, and 1,2,4-trichlorobenzene. All data for sample 0253-95-0392 are qualified as "UJ". Data are usable because the surrogate recoveries are acceptable.
		Chrysene in one of 19 samples is detected above the Estimated Quantitation Limit (EQL), but below the Method Detection Limit (MDL). As a result, chrysene in sample 0253-95-0385 is considered a nondetect and is usable as such.
Volatiles (VOCs)	184	Three samples exhibited low internal standard response for 1,4-dichlorobenzene-d4. Therefore, the data for bromobenzene, n-butylbenzene, sec-butylbenzene, tert-butylbenzene, 2-chlorotoluene, 4-chlorotoluene, 1,2-dibromo-3-chloropropane, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, isopropyl benzene, p-isopropyltoluene, n-propylbenzene, 1,1,2,2-tetrachloroethane, 1,2,3-trichloropropane, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene in three of seven samples are qualified as "UJ". Data are usable because the responses are sufficient to detect and quantify the target compounds.
		One sample exhibited low internal standard response for chlorobenzene-d5. Therefore, the data for bromoform, chlorobenzene, dibromochloromethane, 1,2-dibromoethane, 1,3-dichloropropane, ethylbenzene, 2-hexanone, styrene, 1,1,1,2-tetrachloroethane, tetrachloroethene, and xylene in one of seven samples are qualified as "UJ". Data are usable because the responses are sufficient to detect and quantify the target compounds.

TABLE B-2
DATA QUALITY EVALUATION FOR TA-53 SAMPLES
(Concluded)

SUITE	REQUEST NUMBER	COMMENTS
Volatiles (VOCs)	210	The method blank contained methylene chloride. The methylene chloride sample concentrations are less than10 times the blank concentration, indicating that its presence in the samples may be due to contamination. Therefore, the methylene chloride data in 10 samples are considered usable as nondetects.
		Two samples exhibited low internal standard response for 1,4-dichlorobenzene-d4. Therefore, the data for bromobenzene, n-butylbenzene, sec-butylbenzene, tert-butylbenzene, 2-chlorotoluene, 4-chlorotoluene, 1,2-dibromo-3-chloropropane, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, isopropyl benzene, p-isopropyltoluene, n-propylbenzene, 1,1,2,2-tetrachloroethane, 1,2,3-trichloropropane, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene in two of 10 samples are qualified as "UJ". Data are usable because the responses are sufficient to detect and quantify the target compounds.
	219	The method blank contained methylene chloride. The methylene chloride sample concentrations are less than10 times the blank concentration, indicating that its presence in the samples may be due to contamination. Therefore, the methylene chloride data in 13 samples are considered usable as nondetects.
		The Relative Standard Deviations (RSD) for 1,2-dibromo-3-chloropropane and 2,2-dichloropropane in the initial calibration are greater than EPA established limits (≤30%). The RSDs for 2-butanone, 2,2-dichloropropane, 2-hexanone, and 4-methyl-2-pentanone in the continuing calibration are greater than EPA established limits (≤25%). Therefore, 2-butanone, 2-dibromo-3-chloropropane, 2,2-dichloropropane, 2-hexanone, and 4-methyl-2-pentanone in all samples are qualified as "UJ". Data usability is unaffected because the data are biased high.

APPENDIX C

RISK ASSESSMENT CALCULATIONS

APPENDIX C

RISK ASSESSMENT CALCULATIONS

1.0 RISK ASSESSMENT

All calculations supporting the risk assessments for PRS 53-001(a) and PRS 53-012(e) are provided in Section 2.0 of the appendix.

1.1 Review of COPCs

PRS 53-001(a) had detected concentrations of aroclor-1260 in two soil samples that were greater than the SAL for total polychlorinated biphenyls (PCB) (1.0 mg/kg), while PRS 53-012(e) had a detected concentration of total PCBs in one soil sample greater than its SAL (1.0 mg/kg). As a result, these analytes have been retained as COPCs by the screening assessments conducted at each of the sites.

1.2 Exposure Assessment

PRS 53-001(a) is limited in size (the waste storage pad is approximately 18 ft by 6 ft) and is located immediately north of a parking lot. In addition, there is only approximately 6 ft of ground north of the pad before the ground slopes steeply up to a road which is approximately 25 ft away and 15 ft higher than the pad. PRS 53-012(e) is located approximately 22 ft from the boundary fence where the ground drops fairly steeply to the canyon below. In addition, there is only about 2 ft of soil before the underlying tuff is encountered. Therefore, it is highly unlikely that either of the PRSs will ever be developed with structures requiring intrusive work (e.g., the laying of electrical conduit or plumbing installation). In addition, current Laboratory policy indicates that OU 1100, and specifically the TA-53 complex, will remain under continued laboratory land use. As a result, only a nonintrusive industrial exposure scenario was considered for the two sites.

Under the nonintrusive industrial exposure scenario, the receptors of concern are workers that may be on site for no more than 8 hours a day, 250 days per year, for 25 years. The potential pathways of exposure, under the nonintrusive industrial exposure scenario, include inhalation of dust and incidental ingestion of soil.

The estimated carcinogenic occupational average daily doses for aroclor-1260 are calculated to be 2.05×10^{-8} mg/kg-day and 6.99×10^{-9} mg/kg-day through inhalation, and 5.68×10^{-7} mg/kg-day, and 1.94×10^{-7} mg/kg-day through incidental ingestion. The estimated noncarcinogenic occupational average daily doses are calculated to be 5.73×10^{-8} mg/kg-day and 1.95×10^{-8} mg/kg-day through inhalation, and 1.59×10^{-6} mg/kg-day and 5.43×10^{-7} mg/kg-day through incidental ingestion.

1.3 Toxicity Assessment

Hazard Identification. PCBs are comprised of approximately 209 individual congeners. Aroclor-1260 is a PCB mixture that contains 60% chlorine. However, most of the analytical methods approved by regulatory agencies are not capable of distinguishing between congeners. For the purpose of the toxicity assessment, it is conservatively assumed that health effects resulting from exposure to a particular aroclor are representative of health effects that may be produced by other aroclors. Therefore, the discussion of toxicity assessment will focus primarily on PCBs as a group.

Receptors may be potentially exposed to PCBs through inhalation of dusts and fumes, incidental soil ingestion, ingestion of food, and dermal exposure. Information on PCBs has been gathered from experimental studies with animals and epidemiological studies of humans occupationally exposed in the past. In addition, health effects on humans following consumption of contaminated fish have also been investigated.

Hepatotoxicity has been demonstrated in rats following acute-duration oral exposure, although whether the liver is the most sensitive organ for acute oral exposure is unclear. Other targets appear to include the kidneys, stomach, and thyroid. Some information on intermediate-duration exposure through inhalation and dermal exposure indicate that the liver, kidneys, and skin are the main targets of toxicity. The majority of toxicity data for PCBs are available from animals exposed to PCBs in the diet in intermediate-duration exposures, with the liver, skin, and stomach as the toxicological targets. However, oral intermediate- and chronic-duration studies suggest that the immune system may be one of the most sensitive targets for PCBs.

In humans, epidemiological studies of workers chronically exposed to aroclors through inhalation and dermal exposure indicate that the liver, skin, and thyroid may be the target organs in humans. Increased serum levels of PCBs have been observed in individuals consuming contaminated fish. Studies of humans also suggests that maternal exposure to PCBs leads to adverse developmental effects in children including lower birth weight and alterations in neurobehavioral function.

There is sufficient evidence that commercial mixtures of PCBs are carcinogenic in rats and mice. Results of occupational studies indicate that occupationally exposed individuals can have an excess of cancer at some site, but follow-up and other epidemiological studies are needed to verify PCB carcinogenicity in humans.

PCBs are readily absorbed through all routes of exposure. Once absorbed, PCBs are distributed biphasically, first to liver and muscle, then subsequently translocated to adipose tissue and skin for storage. Fecal excretion is the main route of elimination of PCBs in animals following oral exposure and, although there are insufficient data, the excretion mechanism is expected to remain the same for all other routes of exposure.

Dose-Response Evaluation. PCBs are classified as a B2 carcinogen (probable human carcinogen), that is, there is sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans. PCBs are considered carcinogenic through the inhalation and oral routes of exposure with a cancer slope factor of 7.7 $(mg/kg\text{-}day)^{-1}$ for both routes of exposure. There are no reference doses (RfD) for the noncarcinogenic effects of mixed PCBs. The RfDs for both routes of exposure for aroclor-1016 and aroclor-1254 are 7.0×10^{-5} mg/kg-day and 2.0×10^{-5} mg/kg-day, respectively. Aroclor-1260 most closely corresponds in physical and chemical characteristics to aroclor-1254. Therefore, the noncarcinogenic RfD for aroclor-1254 (2.0×10^{-5} mg/kg-day for both routes of exposure), which is the most health-conservative value, will be used as a surrogate RfD for aroclor-1260 and for total PCBs.

1.4 Risk and Dose Characterization

Aroclor-1260. The estimated carcinogenic occupational average daily dose of 2.05×10^{-8} mg/kg aroclor-1260 through inhalation and 5.68×10^{-7} mg/kg aroclor-1260 through incidental ingestion corresponds to a potential cancer risk of 4.53×10^{-6}. Approximately 96% of the potential cancer risk can be attributed to exposure through incidental ingestion.

The estimated noncarcinogenic occupational average daily dose of 5.73×10^{-8} mg/kg aroclor-1260 through inhalation and 1.59×10^{-6} mg/kg aroclor-1260 through incidental ingestion

corresponds to a potential hazard index of 0.08. Approximately 97% of the potential hazard may be attributed to exposure through incidental ingestion.

Total PCBs. The estimated carcinogenic occupational average daily dose of 6.99 x 10^{-9} mg/kg PCBs through inhalation and 1.94 x 10^{-7} mg/kg PCBs through incidental ingestion corresponds to a potential cancer risk of 1.55 x 10^{-6}. Approximately 97% of the potential cancer risk may be attributed to exposure through incidental ingestion.

The estimated noncarcinogenic occupational average daily dose of 1.95 x 10^{-8} mg/kg PCBs through inhalation and 5.43 x 10^{-7} mg/kg PCBs through incidental ingestion corresponds to a potential hazard index of 0.03. Approximately 97% of the potential hazard may be attributed to exposure through incidental ingestion.

Uncertainty Regarding Site Conditions. The likelihood is high that the assumed site conditions used to estimate exposure and risk under the nonintrusive industrial exposure scenario will remain the same in the future. It is the Laboratory's current policy that OU 1100, and specifically the TA-53 complex will remain under continued industrial land use

PRS 53-001(a) is located within an industrial setting north of a parking lot and south of La Mesita Road that serves the Los Alamos Meson Physics Facility (LAMPF). This PRS is an inactive waste accumulation area associated with the Equipment Test Laboratory (TA-53-2), which contains laboratories and shops for fabrication, repair, and testing of equipment used at LAMPF. PRS 53-012(e) is a drainline and outfall that receives discharges from TA-53-2 and operates under the Laboratory's National Pollutant Discharge Elimination System permit. The specification of continued industrial use for PRSs 53-001(a) and 53-012(e) is in accordance with EPA guidance (p. 9, RAGS, Volume I, Part B, Development of Risk-based Preliminary Remediation Goals, 1991) which states that "sites that are surrounded by operating industrial facilities can be assumed to remain industrial areas unless there is an indication that this is not appropriate."

The likelihood is high that the risks will not be greater than that calculated as a result of exclusion of some chemicals in the risk assessment. The only chemicals detected above background or above their estimated quantitation limit (EQL) at PRS 53-001(a) were the insecticide alpha-chlordane and the VOC trichloroethene. Both of these chemicals were detected below their SALs by more than two orders of magnitude and were eliminated from consideration. A concentration-toxicity screen using the maximum detected concentration and the most health-conservative, route-specific toxicity criteria for each chemical (PCBs, alpha-chlordane, and trichloroethene) indicates that PCBs contribute more than 99% of the potential carcinogenic risk and noncarcinogenic health hazard.

The only other chemicals detected above background or above their EQL at PRS 53-012(e) were alpha-chlordane and the inorganics chromium, copper, lead, and zinc. All of the chemicals were detected below their SALs by approximately one order of magnitude and were eliminated from consideration. A concentration-toxicity screen using the maximum detected concentration and the most health-conservative, route-specific toxicity criteria for each chemical except lead (i.e., PCBs, alpha-chlordane, chromium, copper, and zinc) indicates that PCBs contribute more than 99% of the potential carcinogenic risk and more than 81% of the potential noncarcinogenic health hazard. Lead was not included in the noncarcinogenic toxicity screen because there are no RfDs for lead. However, lead is an order of magnitude below its SAL and is not expected to contribute substantially to the overall potential noncarcinogenic health hazard.

The likelihood is similarly high that the type and concentrations of COPCs present onsite will remain the same. The waste storage area is no longer in use, while the discharge from TA-53-2 is unlikely to change because operations at the Equipment Test Laboratory will remain the same in

the future. Therefore, the chance that additional chemicals may be released into the immediate areas of PRSs 53-001(a) and 53-012(e) is remote.

Uncertainty Regarding Toxicology of the COPCs. Inherent uncertainty exists in the derivation of any toxicity criteria, including aroclor-1260. It is conservatively assumed that health effects resulting from exposure to a particular aroclor are representative of health effects that may be produced by other aroclors. Therefore, the cancer slope factor for mixed aroclors is based on a representative aroclor that may or may not be more toxic than aroclor-1260. In addition, the carcinogenicity of PCBs is based on evidence of carcinogenicity in animals. There is inadequate or a lack of evidence of carcinogenicity in humans. Therefore, there is inherent uncertainty in the calculation of a cancer potency factor for humans that is extrapolated from animal exposure data. Mixed PCBs or aroclor-1260 have no RfD. Because aroclor-1254 most closely matches the chemical and physical properties of aroclor-1260, the RfD for aroclor-1254 is used as a surrogate for aroclor-1260. Aroclor-1260 may be more or less toxic than aroclor-1254. The more health-conservative RfD (i.e., for aroclor-1254) was also used as a surrogate RfD for total PCBs. In addition, the RfDs for the aroclors are similarly based on animal data that is extrapolated to humans. Therefore, there is considerable uncertainty in the derivation of toxicity criteria for PCBs.

Uncertainty Regarding Exposure Characteristics. There is a high likelihood that the actual health hazard and risk would be considerably less than that calculated. There is inherent uncertainty in the estimation of exposure. The estimation of exposure and risk is deterministic. A deterministic evaluation assumes that a worker will be exposed and estimates his/her exposure, health hazard, and risk once exposed. The probability of exposure is not accounted for. In addition, the calculated exposure, health hazard, and risk is based on a most likely exposed individual (MLE). For the industrial nonintrusive worker scenario, the MLE is a generic worker that conservatively works within the limited area for 8 hours a day, 250 days a year, for a total of 25 years. These exposure parameters produce a highly conservative estimation of health hazard and risk.

2.0 QUANTIFICATION OF PATHWAY-SPECIFIC EXPOSURES

2.1 Exposure Point Concentration

Exposure point concentrations (EPC) represent the concentrations of chemicals to which people may be exposed at specific exposure points. These concentrations are generally estimated using measured concentrations at actual exposure points or estimated concentrations based on fate and transport models. Depending on a number of factors, including the slope of the distribution of the data (normal vs. lognormal), the proportion of the samples reported as nondetect (ND), and the total number of samples, several statistical parameters can be used to estimate EPCs. These include the arithmetic mean, the geometric mean, the maximum, an upper confidence limits on the mean, or an upper percentile value.

EPA recommends using the 95% upper confidence level (UCL) of the arithmetic mean (95% UCL) to estimate EPCs. UCLs of the mean are used, rather than the actual mean, to account for variability in the data. The W-test (Gilbert 1987) is a statistical method that can be used to determine if a data set is normally or lognormally distributed. One half the limit of detection is used for nondetects.

PRS 53-001(a). Using the W-test, the aroclor-1260 data set for PRS 53-001(a) were found to be lognormally distributed. When data are lognormally distributed, EPA recommends using the UCL of the arithmetic mean calculated using the Land equation (as described in Land 1975). The 95% UCL of the arithmetic mean was calculated for aroclor-1260s at PRS 53-001(a) using the following equation, based on a lognormal distribution:

$$UCL = e^{(x + 0.5s^2 + sH/\sqrt{n-1})}$$

Where:

UCL = 95% upper confidence limit of the mean

e = constant (base of the natural log, equal to 2.718)

x = mean of the log-transformed data
Calculated to be 0.84 for PRS 53-001(a)

s = standard deviation of the log-transformed data
Calculated to be 1.61 for PRS 53-001(a)

H = H-statistic for the one-sided upper confidence limit (e.g., from the table published in Gilbert 1987)
Taken to be 11.21 for PRS 53-001(a)

n = number of samples
Considered to be 4 for PRS 53-001(a)

The calculated 95% UCL of the mean exceeded the maximum detected concentration (3.25 mg/kg aroclor-1260) at PRS 53-001(a). Therefore, the maximum detected value (3.25 mg/kg aroclor-1260) was used as the EPC for PRS 53-001(a).

PRS 53-012(e). The data sets for PCBs (total) at PRS 53-012(e) were neither normally or lognormally distributed. Therefore, a 95% UCL of the mean was not calculated and the maximum detected concentration (1.11 mg/kg PCBs [total]) was used as the EPC.

2.3 Exposure Parameters

Exposure parameters are quantitative estimates of the frequency, duration, and magnitude of exposure to various media. The exposure parameters selected for the nonintrusive occupational exposure scenario for PRS 53-001(a) and PRS 53-012(e) are provided in Table C-1 and Table C-2, respectively. The exposure parameters are EPA default exposure parameters for occupational exposure and are considered extremely conservative for the exposures expected at PRS 53-001(a) and PRS 53-012(e).

2.4 Exposure Dose

The Average Daily Dose (ADD) or Lifetime Average Daily Dose (LADD) of a chemical is the exposure parameter of concern for long-term exposure durations, such as might be considered to occur at this site. The ADD characterizes exposures that are relatively long in duration, such as a 25-year duration for workers, is used as a standard measure for characterizing long-term non-carcinogenic effects. ADDs do not necessarily incorporate a lifetime duration of exposure. On the other hand, the LADD addresses exposures that can occur over varying durations from a single event to a lifetime. The LADD is an estimate of the daily dose of a chemical associated with any particular exposure situation or duration, averaged over a 70-year lifetime. The LADD characterizes exposures associated with evaluations of the likelihood of occurrence of carcinogenic endpoints. The Averaging Times (AT) in the following equations were adjusted to reflect dose for noncarcinogenic exposure (ADD) and carcinogenic exposure (LADD). The reasonably maximally exposed individual (RME) will be calculated using the following equations.

The potential dose for noncarcinogen ingestion of chemicals in soil is calculated using the following equation:

$$(L)ADD_o = \frac{EPC_s \times EF \times ED \times (IRS/10^{+6}\ mg/kg)}{BW \times AT \times 365\ d/y}$$

where:

$(L)ADD_o$	=	(Lifetime) Average Daily Dose through the oral route of exposure (mg/kg-day)
EPC_s	=	Exposure Point Concentration of chemical in soil (mg/kg)
EF	=	Exposure Frequency - occupational (d/y)
ED	=	Exposure Duration - occupational (years)
IRS	=	Ingestion Rate of Soil - occupational (mg/day)
BW	=	Body Weight, adult (kg)
AT	=	Averaging Time (years)

The potential dose for carcinogen inhalation of chemicals in air (vapors or dusts) is calculated using the following equation:

$$(L)AAD_i = \frac{EPC_s \times EF \times ED \times IRA \times (1/VF + 1/PEF)}{BW \times AT \times 365\ d/y}$$

where:

$(L)AAD_i$	=	(Lifetime) Average Daily Dose through inhalation (mg/kg-day)
EPC_s	=	Exposure Point Concentration of chemical in soil (mg/kg)
EF	=	Exposure Frequency - occupational (d/y)
ED	=	Exposure Duration - occupational (years)
IRA	=	Inhalation Rate of Air- occupational (m^3/day)
BW	=	Body Weight, adult (kg)
AT	=	Averaging Time (70 years)
1/Vf	=	1/Volatilization factor for soil (mg/kg) 1/Vf considered to be zero for chemicals with MW> 200 g/mole and Henry's Law Constant <1 x 10^{-5} atm-m^3/mole
PEF	=	Particulate Emission Factor (mg/kg) Considered to be 1.11 x 10^{+7} (m^3/kg) (LANL 1993)

TABLE C-1
EXPOSURE PARAMETERS FOR PRS 53-001(a)

Dose	Exposure Point Concentration In Soil EPCs (mg/kg)	Exposure Frequency EF (d/y)	Exposure Duration ED (y)	Ingestion Rate for Soil IRS (mg/d)	Inhalation Rate of Air IRA (m^3/d)	Body Weight (kg)	Averaging Time (y)
LADD	3.25	250	25	50	20	70	70
ADD	3.25	250	25	50	20	70	25

TABLE C-2
EXPOSURE PARAMETERS FOR PRS 53-012(e)

Dose	Exposure Point Concentration In Soil EPCs (mg/kg)	Exposure Frequency EF (d/y)	Exposure Duration ED (y)	Ingestion Rate for Soil IRS (mg/d)	Inhalation Rate of Air IRA (m^3/d)	Body Weight (kg)	Averaging Time (y)
LADD	1.11	250	25	50	20	70	70
ADD	1.11	250	25	50	20	70	25

3.0 RISK CHARACTERIZATION METHODOLOGY

3.1 Potential Cancer Risk

The potential for the development of cancer as a result of exposure to chemicals in the environment is evaluated by estimating the excess lifetime cancer risk. Excess lifetime cancer risk is the incremental increase in the probability of developing cancer during the lifetime of an individual in addition to the background probability of developing cancer (i.e., if no exposure to the chemicals of concern had occurred). For example, a 1×10^{-6} excess lifetime cancer risk means that for every 1 million people exposed to the carcinogen throughout their lifetimes, the average incidence of cancer may increase by one case of cancer.

Cancer slope factors developed by the EPA represent-upper bound estimates, so the excess lifetime cancer risks estimated in this risk assessment should be regarded as upper bounds on the potential cancer risks rather than the true cancer risk. The true cancer risk is likely to be less than the estimated excess lifetime cancer risk.

Excess lifetime cancer risks are generally estimated using the following formula:

$$Risk = (LADD_o \times CSF_o) + (LAAD_i \times CSF_i)$$

Where:

Risk	=	Potential cancer risk (unitless)
$LADD_o$	=	Lifetime average daily oral dose (mg/kg-day)
CSF_o	=	Cancer slope factor-oral $(mg/kg\text{-}d)^{-1}$ (chemical-specific) Considered to be 7.7 $(mg/kg\text{-}day)^{-1}$
$LAAD_i$	=	Lifetime average daily Inhalation dose (mg/kg-day)
CSF_i	=	Cancer slope factor-inhalation $(mg/kg\text{-}d)^{-1}$ (chemical-specific) Considered to be 7.7 $(mg/kg\text{-}day)^{-1}$

Therefore, the calculated potential cancer risk under the nonintrusive industrial exposure scenario is 4.53×10^{-6} at PRS 53-0-01(a) and 1.55×10^{-6} at PRS 53-012(e), more than one order of magnitude below the upper bound (10^{-4}) of the target cancer risk range (10^{-6} to 10^{-4}) for industrial sites.

3.2 Characterization of Noncancer Risk

For noncancer effects, the likelihood that a receptor will develop an adverse effect is estimated by comparing the predicted level of exposure (the average daily dose, or ADD) to a particular chemical to the highest level of exposure that is considered protective (i.e., its RfD). The ratio of the ADD divided by RfD is the hazard quotient (HQ). The sum of exposure-route specific HQs is the hazard index (HI):

$$HI = ADD_o / RfD_o + Dose_i / RfD_i$$

Where:

HI	=	Hazard index (unitless)
ADD_o	=	Average daily oral dose (mg/kg-day)

RfD_o = Reference dose-oral (mg/kg-d) (chemical-specific)
Considered to be 2.0×10^{-5} mg/kg-day

ADD_i = Average daily Inhalation dose (mg/kg-day)

RfD_i = Reference dose inhalation (mg/kg-d) (chemical-specific)
Considered to be 2.0×10^{-5} mg/kg-day

Therefore, the calculated potential noncancer hazard under the nonintrusive industrial exposure scenario is 0.08 at PRS 53-001(a) and 0.03 at PRS 53-012(e), more than one order of magnitude below the target hazard index of 1.

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APPENDIX D

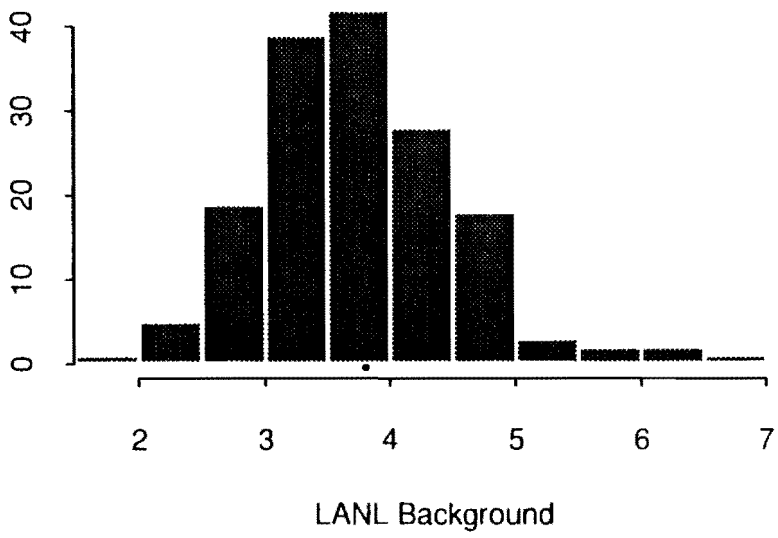
DISTRIBUTIONAL COMPARISONS WITH BACKGROUND

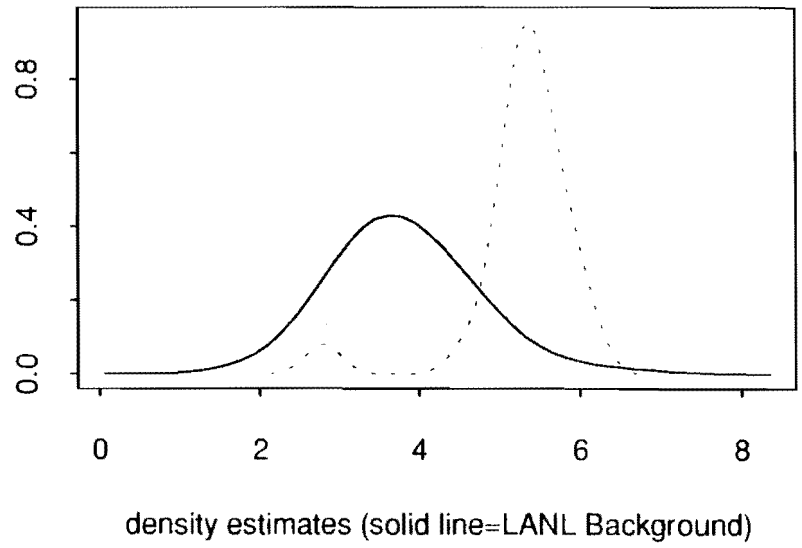
APPENDIX D

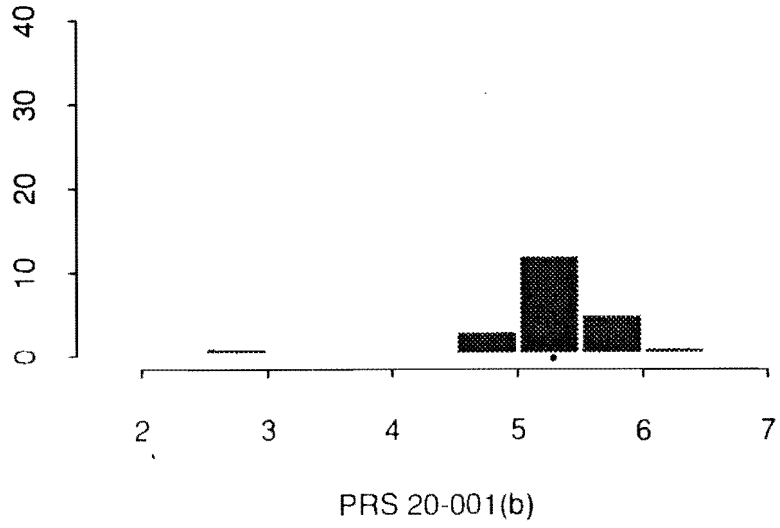
DISTRIBUTIONAL COMPARISONS WITH BACKGROUND

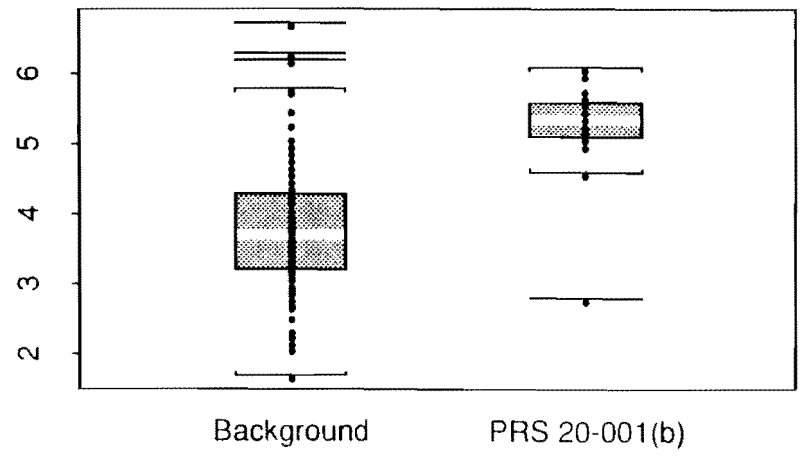
Background comparisons were performed for the analytes that exceed their UTLs to determine whether statistically significant differences exist between the site and background datasets. The Wilcoxon Rank Sum test, the Quantile test, and the Slippage test were used for these evaluations. The Wilcoxon Rank Sum test is best suited for assessing complete shifts in distribution, whereas the Quantile test is better suited for assessing partial shifts. The Slippage test determines the probability of any one site concentration being greater than the maximum background concentration, given that the site data originates from the same distribution as the background data. Between the three tests, most types of differences between distributions can be captured. The figures in this appendix are comparison charts for the comparison of COPCs with Laboratory background values for PRS 20-001(b), PRS 20-002(a), PRS 20-003(b), PRS 20-002(c), and PRS 53-001(g).

Comparison of Uranium at PRS 20-001(b) to LANL Background

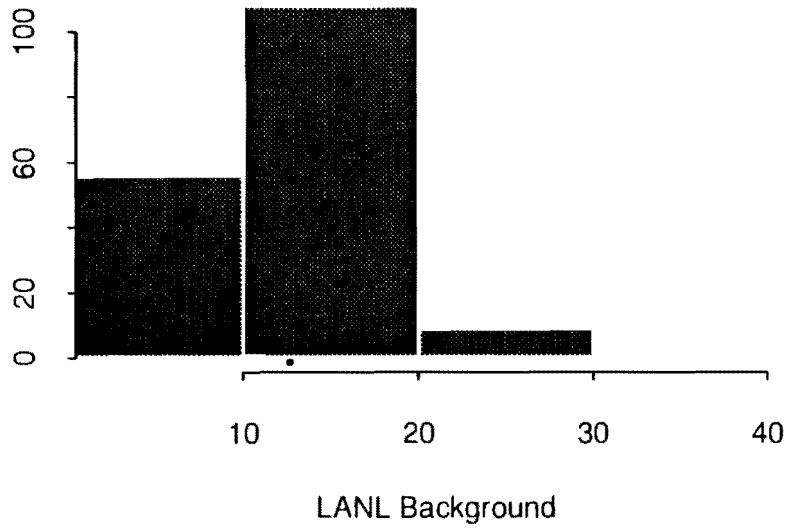


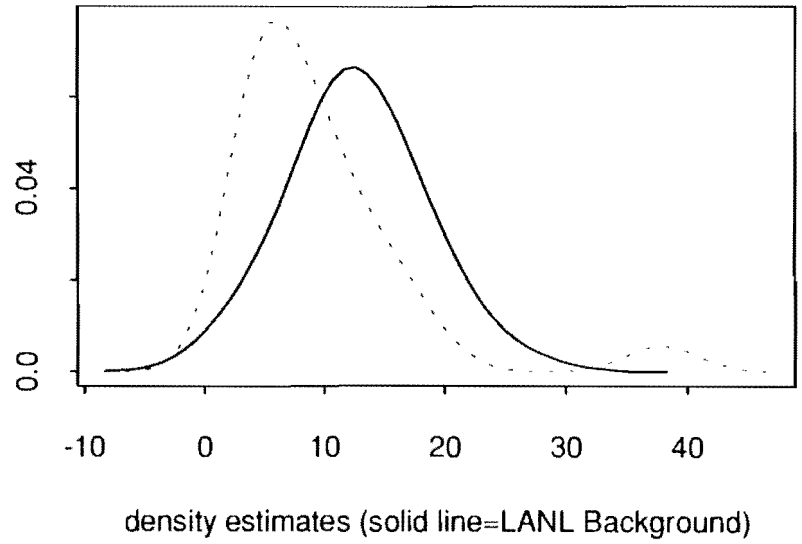


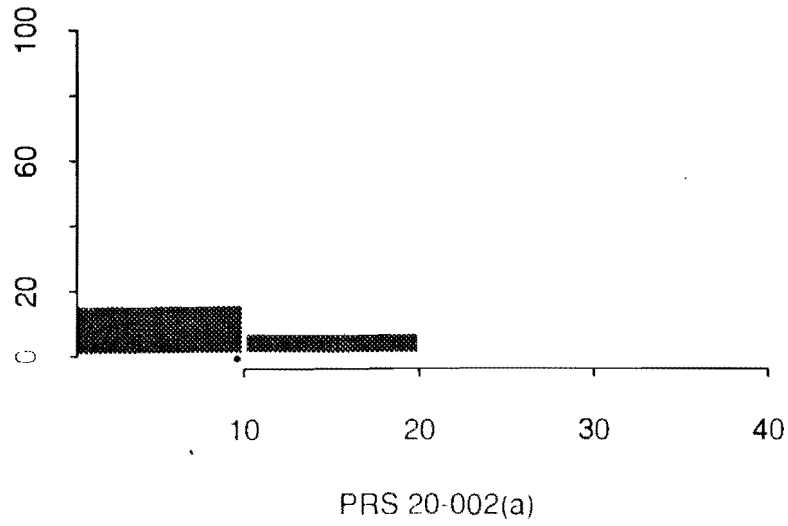


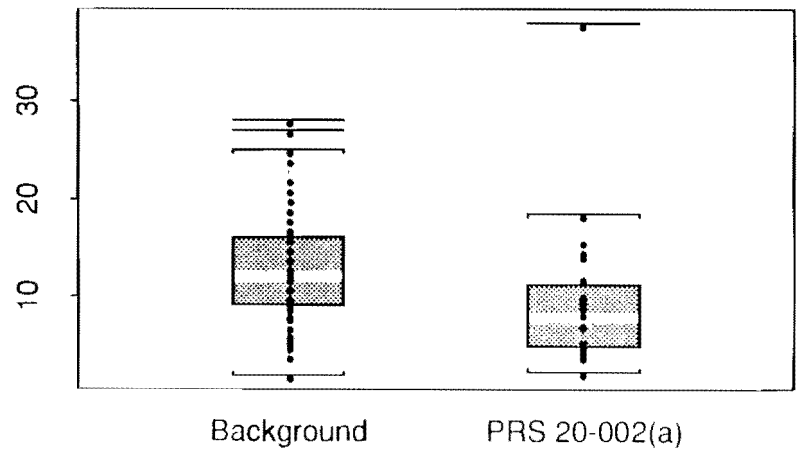


Comparison of Lead at PRS 20-002(a) to LANL Background

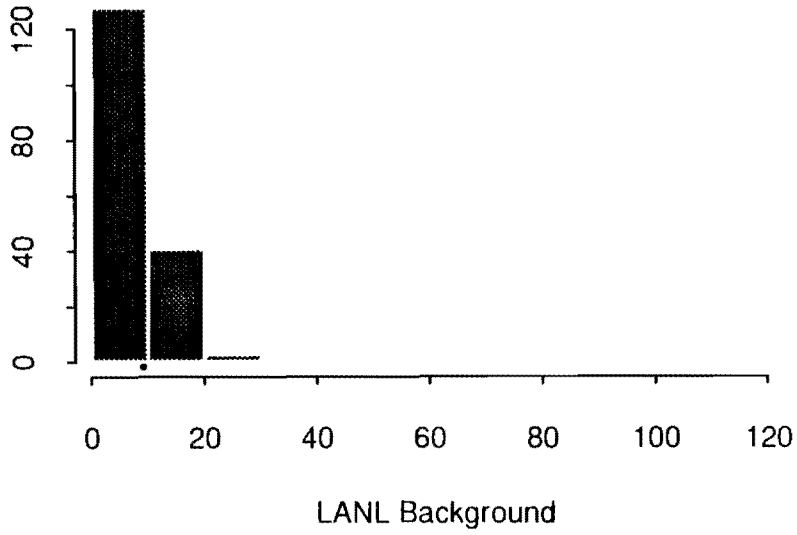


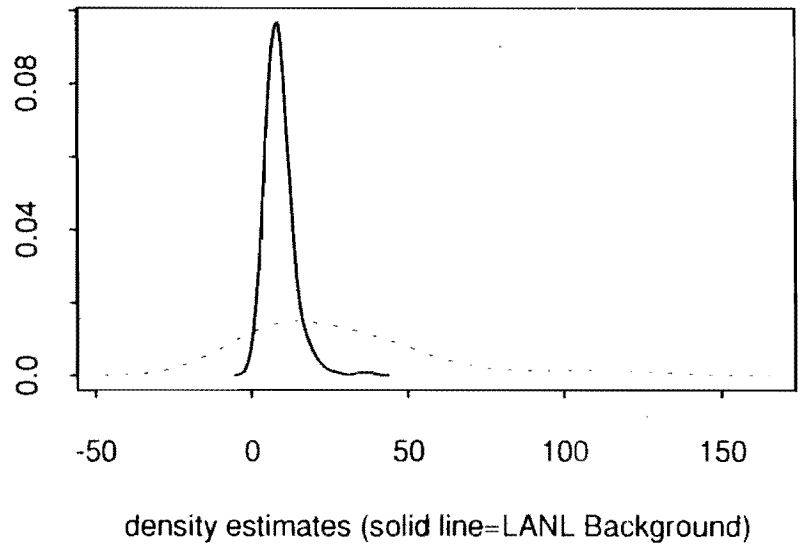


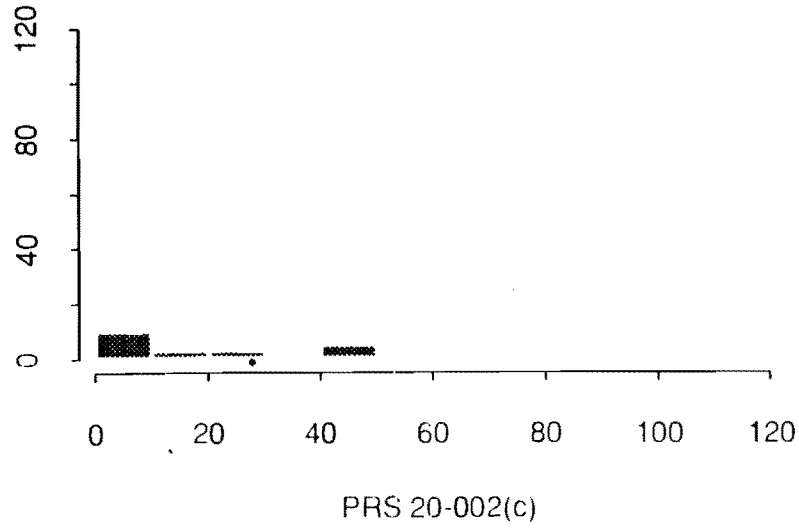


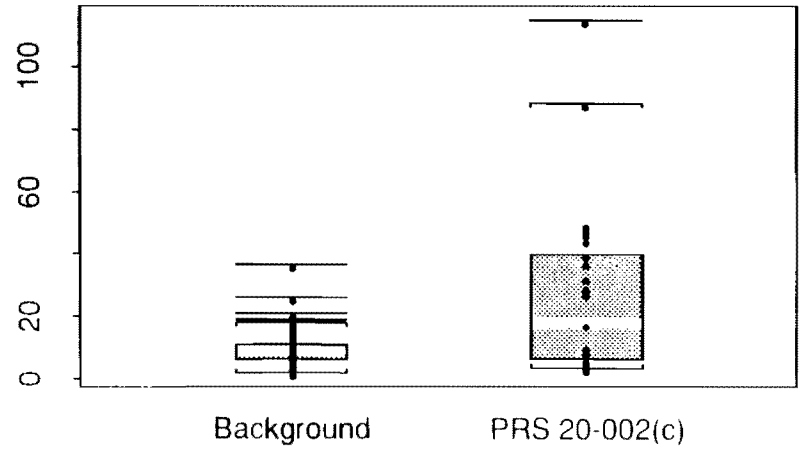


Comparison of Chromium at PRS 20-002(c) to LANL Background

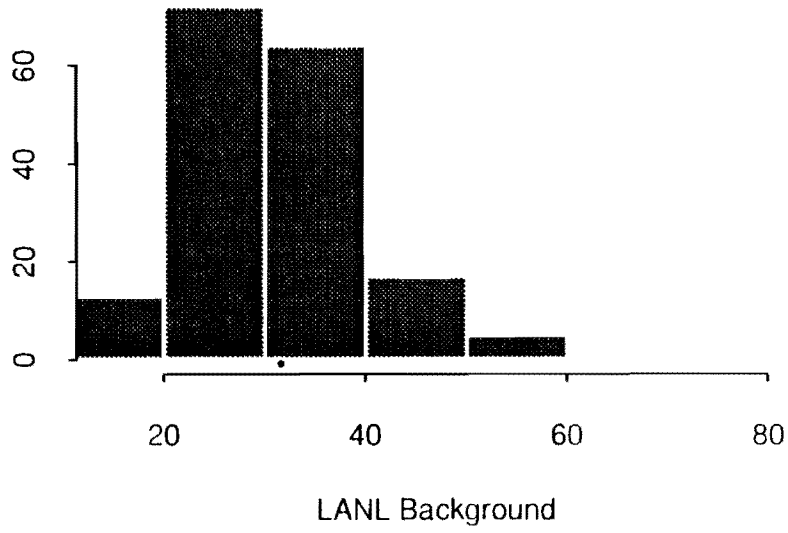


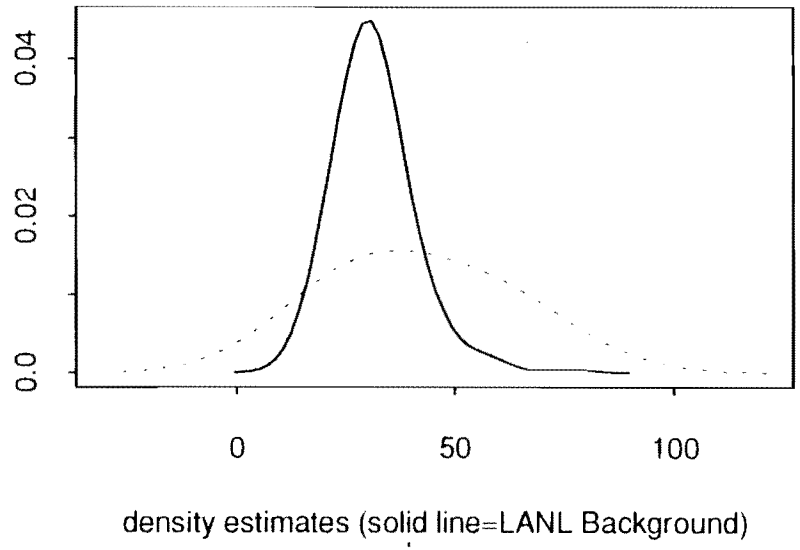


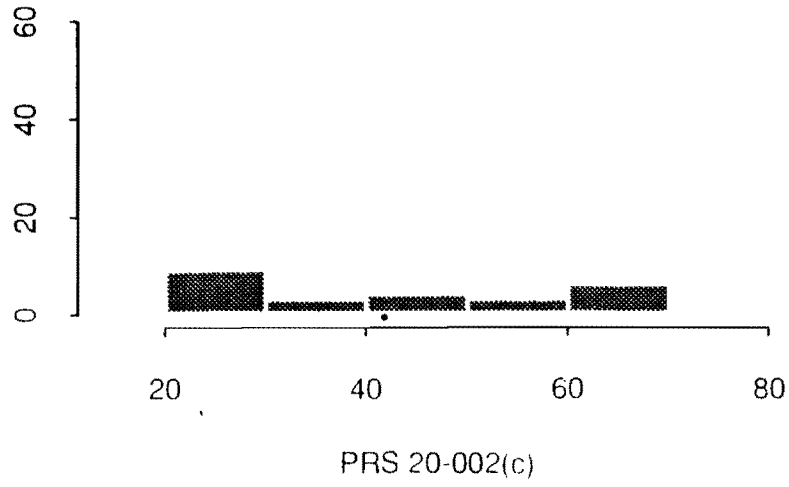


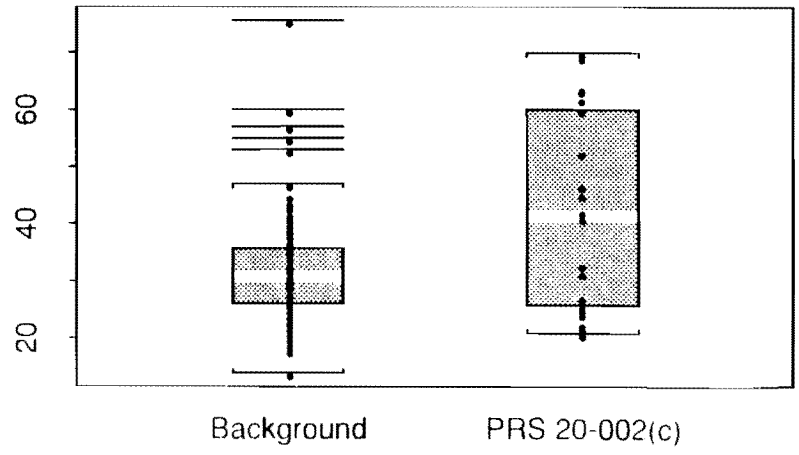


Comparison of Zinc at PRS 20-002(c) to LANL Background

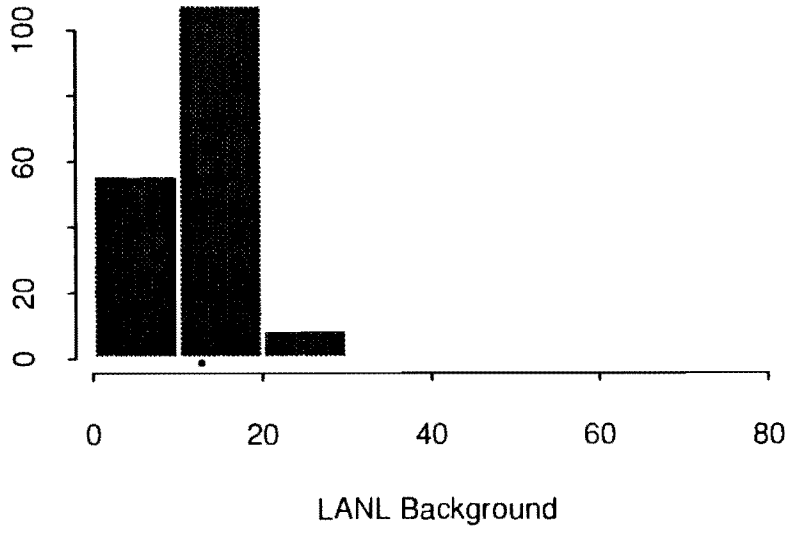


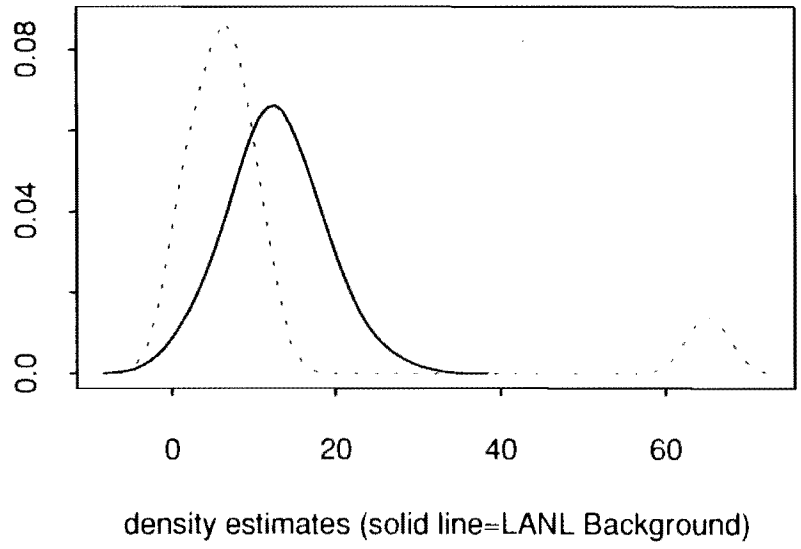


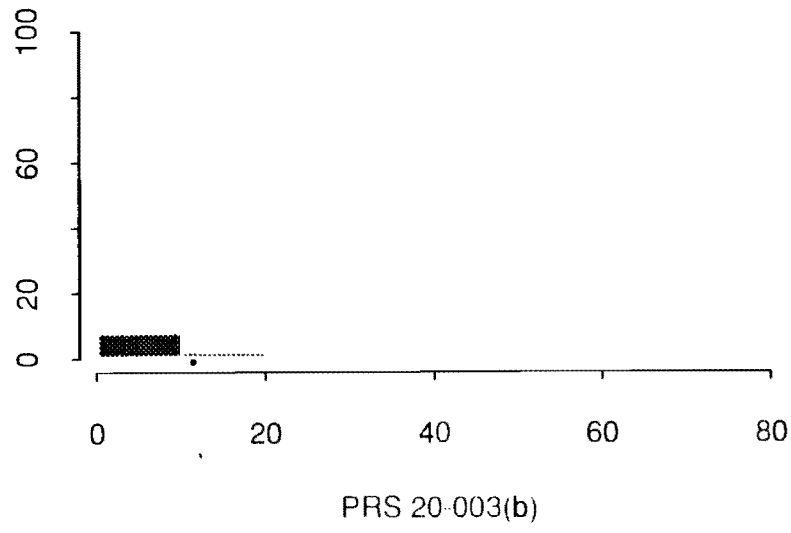


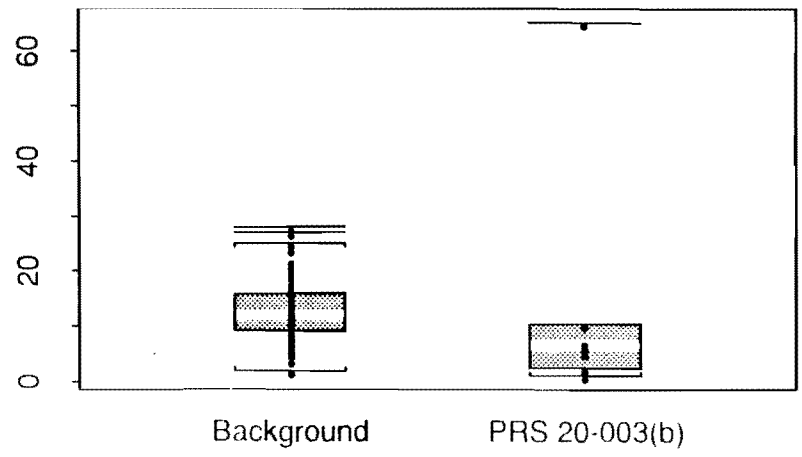


Comparison of Lead at PRS 20-003(b) to LANL Background

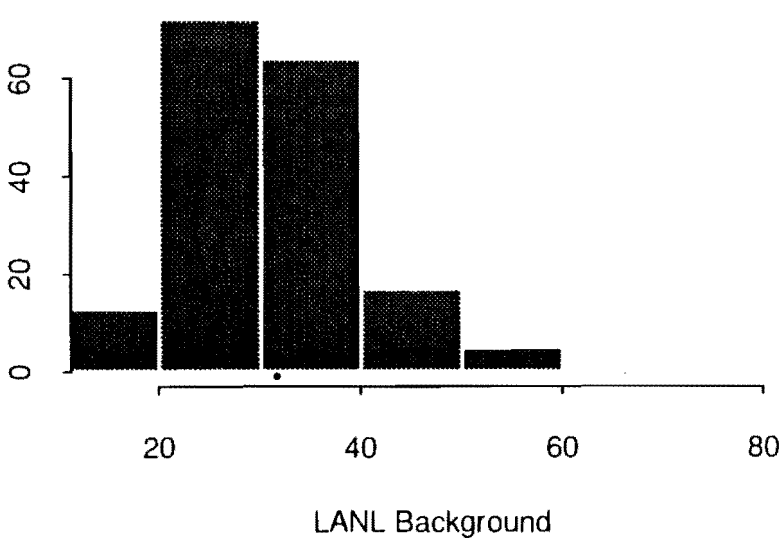


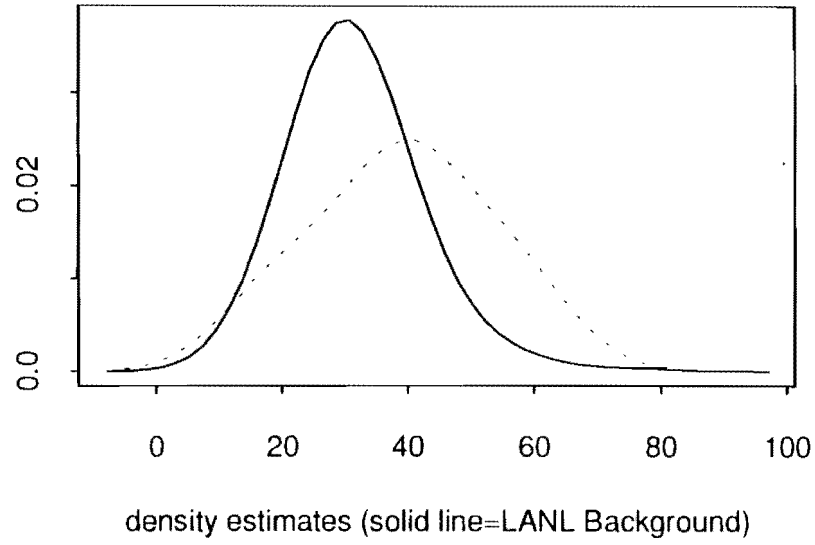


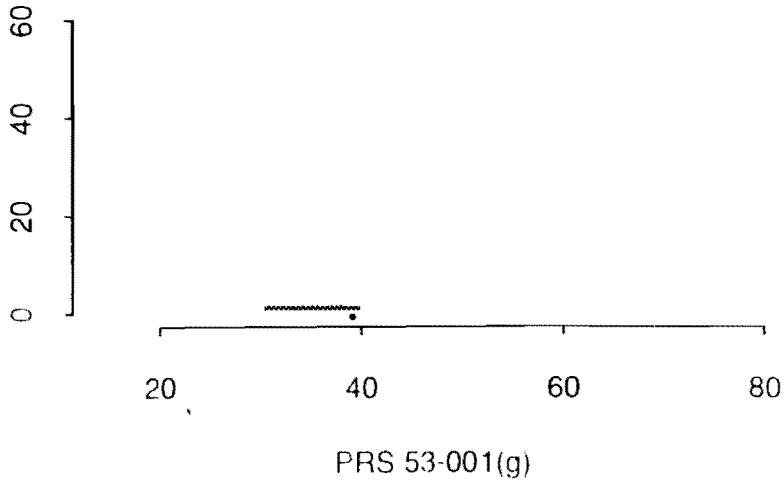


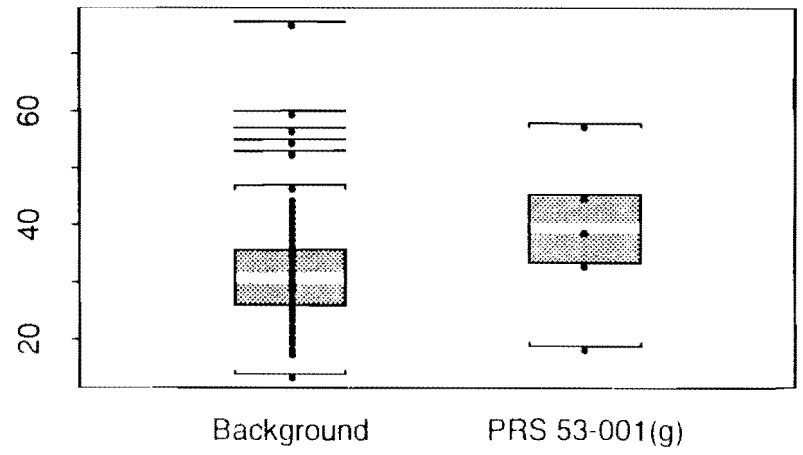


Comparison of Zinc at PRS 53-001(g) to LANL Background









APPENDIX E

PROCEDURES AND METHODS USED FOR SAMPLES

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The following ER Project procedures were used at the sampling site:

- LANL-ER-SOP-06.09, Spade and Scoop Method of Collection of Soil Samples
- LANL-ER-SOP-06.10, Hand Auger and Thin-Wall Tube Sampler
- LANL-ER-SOP-10.06, High Explosives Field Spot Test
- LANL-ER-SOP-10.07, Field Monitoring for Surface and Volume Radioactivity Levels

The following analytical methods were used for analyzing the samples according to EPA requirements (EPA, 1222):

- EPA SW-846 Method 6010, for metals
- EPA SW-846 Method 8260, for VOCs
- EPA SW-846 Method 8270, for SVOCs
- EPA SW-846 Method 8081, for PCBs
- EPA SW-846 Method 8330, for HE
- EPA SW-846 Method 8015, for TPH
- EPA SW-846 Method 9018, for cyanide

The following radioanalyses were conducted:

- DOE HASL 300, for strontium-90
- KPA ASTM Z2907, for uranium
- DOE HASL 300, for isotopic uranium
- DOE HASL 300, for gamma spectroscopy