CERTIFICATION

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

Document Title: Submittal of RFI Report for PRSs 35-004(a), (g), (h), and (m), 35-014(g1 and g2), and 35-016(b), (i), (m), and (q) in TA-36

Name: _______________ Date: 7-3-96
for Jorg Jansen, Program Manager
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Environment Restoration Program
DOE-Los Alamos Area Office

RFI Report for Potential Release Sites

35-004(a, g, h, and m)
35-009(e)
35-014(g_1 and g_2)
35-016(b, j, n, and q)

(Located in former Operable Unit 1129)

Field Unit 4

Environmental Restoration Project

July 1996

A Department of Energy
Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

LA-UR-96-2082

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EXECUTIVE SUMMARY

This is the third of several reports that describe the Phase I results of the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) to evaluate contamination at Technical Area (TA) -35. TA-35 is located in former Operable Unit 1129, which is part of Field Unit 4 in the Environmental Restoration Project at Los Alamos National Laboratory (the Laboratory). Included in this RFI report are the results of investigations for Potential Release Site (PRS) Nos. 35-004(a, g, h, and m), 35-009(e), 35-014(g_1 and g_2), and 35-016(b, j, n, and q).

TA-35 (also known as Ten Site) is currently used for nuclear safeguard studies, laser research and development, physical research, fusion work, and other experimental research. It is one of the largest technical areas at the Laboratory with approximately 300 designated structures. It is located on Ten Site Mesa between Mortandad Canyon and Ten Site Canyon.

Operations at TA-35 began in 1951 and include research operations; two experimental reactors (between 1956 and 1964); lasers and laser fusion research, including development, fabrication, and operation of lasers and laser targets; nuclear safeguards research and development of assay instrumentation; and research in ceramics, robotics, polymer synthesis, high-speed impact studies, and strain-rate measurements on a variety of materials. Other operations include the Ten Site Waste Treatment Facility (from 1951 to 1963).

Effluent and emission routes from TA-35 include ventilation stacks, septic systems, storm sewer lines and discharge channels, industrial waste lines and outfalls, and leaking storage structures including underground and aboveground tanks and surface compounds. The chemicals and other constituents that contributed to the list of potential contaminants include metals, volatile organic compounds, semivolatile organic compounds, polychlorinated biphenyl compounds, and radionuclides. Radionuclides were investigated as part of this RFI, although radiological contamination is not regulated by RCRA.

The purpose of the Phase I RFI was to determine whether chemicals of potential concern (COPCs) are present in the PRSs at TA-35. Field activities followed sampling and analysis plans (SAPs) that were designed to confirm the presence or absence of COPCs. These SAPs were submitted as part of the RFI Work Plan for Operable Unit 1129 (LANL 1992, 7666) and the addendum to the work plan (Pratt 1994, 43475), except as noted in Chapter 5.0 of this RFI report.

Field activities for the PRSs described in this RFI report began on March 1, 1995, and ended on December 8, 1995.

The data analysis process consisted of using a decision approach that involved a series of qualitative and quantitative steps. First, analytical data are verified and validated, then the data undergo a data quality assessment, and finally the data are compared with appropriate site-specific background values. A human health screening assessment is then performed to determine if COPCs are present. Ecological risk assessment will be deferred until the site can be assessed as part of the new Ecological Exposure Unit (Ecozone) methodology, which is in development.

No significant concerns are associated with the quality of the data; data quality evaluation is presented in Chapter 4.0 of this RFI report. Radiological sample results are not presented or discussed in this RFI report and will be provided by November 31, 1997, as an addendum when the radiological data evaluation is completed.

For the purposes of the screening assessments reported in this RFI report, the PRSs at TA-35 have been organized into the decision units listed in Table ES-1. Where appropriate, PRSs are reported individually.

The following PRSs are recommended for no further action: PRS Nos. 35-004(a, g, h, and m), 35-009(e), 35-014(g_1 and g_2), and 35-016(b, j, n, and q). The results of the RFI for each PRS are summarized in Table ES-1.

TABLE ES-1

SUMMARY OF PROPOSED ACTIONS

		Proposed Action			
PRS	**HSWA**	**NFA Criteria**	**Further Action**	**Rationale**	**Section No.**
35-004(a) 35-009(e)	X X	4		COPC was determined to pose a negligible threat to human health	5.1
35-004(g)	X	4		Contamination below SALs, no COPCs identified in human health screening assessment	5.2
35-004(h)	X	4		Contamination below SALs, no COPCs identified in human health screening assessment	5.3
35-004(m) 35-014(g_2)	 X	4		COPCs were determined to pose a negligible threat to human health	5.4
35-014(g_1) 35-016(n)	X	4		COPC was determined to pose a negligible threat to human health	5.5
35-016(b)		3,4		Contamination below SALs, no COPCs identified in human health screening assessment	5.6
35-016(j)		4		COPC was determined to pose a negligible threat to human health	5.7
35-016(q)	X	4		COPCs were determined to pose a negligible threat to human health	5.8

ACRONYMS AND ABBREVIATIONS

CCRMP	Canadian Certified Reference Material Program
CMP	corrugated metal pipe
CO_2	carbon dioxide
COC	chemical of concern
COPC	chemical of potential concern
cpm	counts per minute
CRQL	contract required quantitation limit
CVAA	cold vapor atomic absorption
D&D	decontamination and decommissioning
DL	detection limit
DOE	Department of Energy
DOE/LAAO	Los Alamos Area Office of the Department of Energy
EDL	estimated detection limit
EDXRF	energy dispersive x-ray fluorescence
EPA	Environmental Protection Agency
EQL	estimated quantitation limit
ER	Environmental Restoration
FIMAD	Facility for Information Management, Analysis, and Display
GC/ECD	gas chromatography/electron capture detector
GC/FID	gas chromatography/flame ionization detector
GC/MS	gas chromatography/mass spectrometry
GFAA	graphite furnace atomic absorption
GPC	gas proportional counter
gpm	gallons per minute
HPGe	high-purity germanium
H&S	health and safety
HSWA	Hazardous and Solid Waste Amendments
ICPES	inductively coupled plasma emission spectroscopy
ICPMS	inductively coupled plasma mass spectrometry
IQR	interquartile range
IWP	Installation Work Plan
J	The analyte was positively identified, and the associated numerical value is the approximate concentration of the analyte in the sample.
J+	Reported value is an estimate and likely biased high.
J–	Reported value is an estimate and likely biased low.
KrF	krypton fluoride
LAMPRE	Los Alamos Molten Plutonium Reactor Experiment
LANL-ER-SOP	Laboratory Environmental Restoration Project standard operating procedure
LAPRE	Los Alamos Power Reactor Experiment
LCS	laboratory control sample
MA DEP	Massachusetts Department of Environmental Protection
MCE	multiple chemical evaluation
Myr	million years
NA	not analyzed
N/A	not applicable
N.A.	not available
NaI(Tl)	thallium-doped sodium iodide
ND	not detected

NFA	no further action
NIST	National Institute of Standards and Technology
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
NR	not requested
OVA	organic vapor analyzer
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
ppm	parts per million
PRG	preliminary remediation goal
PRS	potential release site
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
Qbt2	cooling unit 2 of the Tshirege Member of the Bandelier Tuff
Qbt3	cooling unit 3 of the Tshirege Member of the Bandelier Tuff
QC	quality control
R	The sample results are rejected because of serious deficiencies in the ability to analyze the sample and meet quality control criteria; presence or absence cannot be verified.
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RPD	relative percent difference
S	The sample results were obtained using a screening analytical method performed in a mobile laboratory facility.
SAL	screening action level
SAP	sampling and analysis plan
SRM	standard reference material
SVOC	semivolatile organic compound
TA	Technical Area
TIC	tentatively identified compound
TLV	threshold limit value
TPH	total petroleum hydrocarbons
U	The analyte was analyzed for but not detected. Reported value is the sample quantitation limit or detection limit.
UJ	The analyte was analyzed for and was not detected. The reported value is an estimate of the sample quantitation limit or detection limit.
UTL	upper tolerance limit
VCP	vitrified clay pipe
VOC	volatile organic compound
XRF	x-ray fluorescence

1.0 INTRODUCTION

This report describes the Phase I results of the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) in portions of Technical Area (TA) -35 at Los Alamos National Laboratory (hereafter referred to as "the Laboratory"). The purpose of the investigation was to evaluate contamination at former Operable Unit 1129 in Field Unit 4 of the Laboratory's Environmental Restoration Project. Sampling activities were conducted under the guidelines described in the *RFI Work Plan for Operable Unit 1129* (LANL 1992, 7666) (hereafter referred to as "the work plan") and the June 1994 addendum to the work plan (Pratt 1994, 43475). The work plan was approved by the Environmental Protection Agency (EPA) on November 3, 1993, and the addendum was approved by EPA on May 22, 1995. Included in this RFI report are the results of Phase I investigations for potential release site (PRS) Nos. 35-004(a, g, h, and m); 35-009(e); 35-014(g_1 and g_2); and 35-016(b, j, n, and q).

1.1 General Site History

Details of the history of TA-35 are discussed more completely in Section 3.3 of the work plan (LANL 1992, 7666). See Figure 1.1-1 and Figure 1.1-2 for the location of TA-35.

TA-35 (also known as Ten Site) is one of the largest technical areas at the Laboratory with approximately 300 designated structures. It is currently used for laser and laser fusion research, which consist of development, fabrication, and operation of lasers and laser targets; nuclear safeguards research and the development of assay instrumentation; and research in ceramics, robotics, polymer synthesis, high-speed impact studies, and strain-rate measurements on a variety of materials.

Operations at TA-35 began in 1951 with the completion of the original Ten Site Laboratory and office building (TA-35-2). The building has been used for a wide variety of research operations and housed two experimental reactors between 1956 and 1964: the Los Alamos Power Reactor Experiment (LAPRE) -I and the Los Alamos Molten Plutonium Reactor Experiment (LAMPRE). The building also housed a hot cell used for preparing kilocurie sources of radioactive lanthanum (^{140}La), plutonium research laboratories, and a facility in which lithium tritide components were developed and handled (DOE 1987, 8663).

The TA-35 wastewater treatment plant was operated from 1951 to 1963. Waste liquids, which were generated by washings of the hot cell, were stored in four tanks to allow decay of short-lived ^{140}La. When concentrations of other radionuclides with longer half-lives, such as ^{90}Sr, were discovered in the stored liquid wastes, a wastewater treatment plant with ion-exchange capabilities was constructed. The wastewater treatment plant was constantly beset with problems and required numerous retrofittings and additional equipment.

Other major facilities at TA-35 include the following:

- Fast Reactor Core Test Building (TA-35-27) built in 1968 to house the LAPRE-II reactor, which was never completed;
- Gas Laser Building (TA-35-29) built in 1961 to house a small reactor test pit and currently used to house the Gemini gas laser facility, which uses helium and nitrogen lasers;

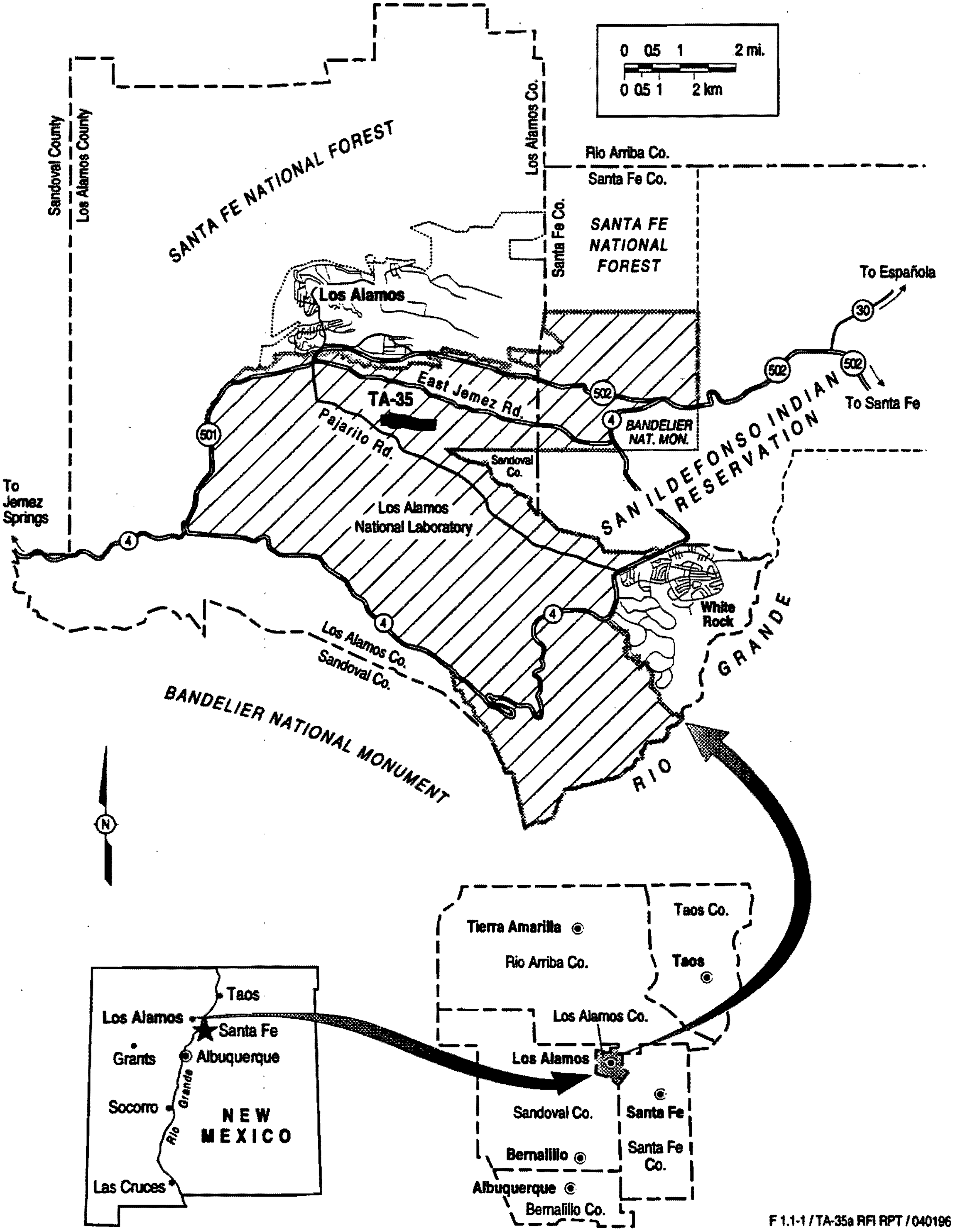

Figure 1.1-1. Location map of TA-35 within Los Alamos National Laboratory.

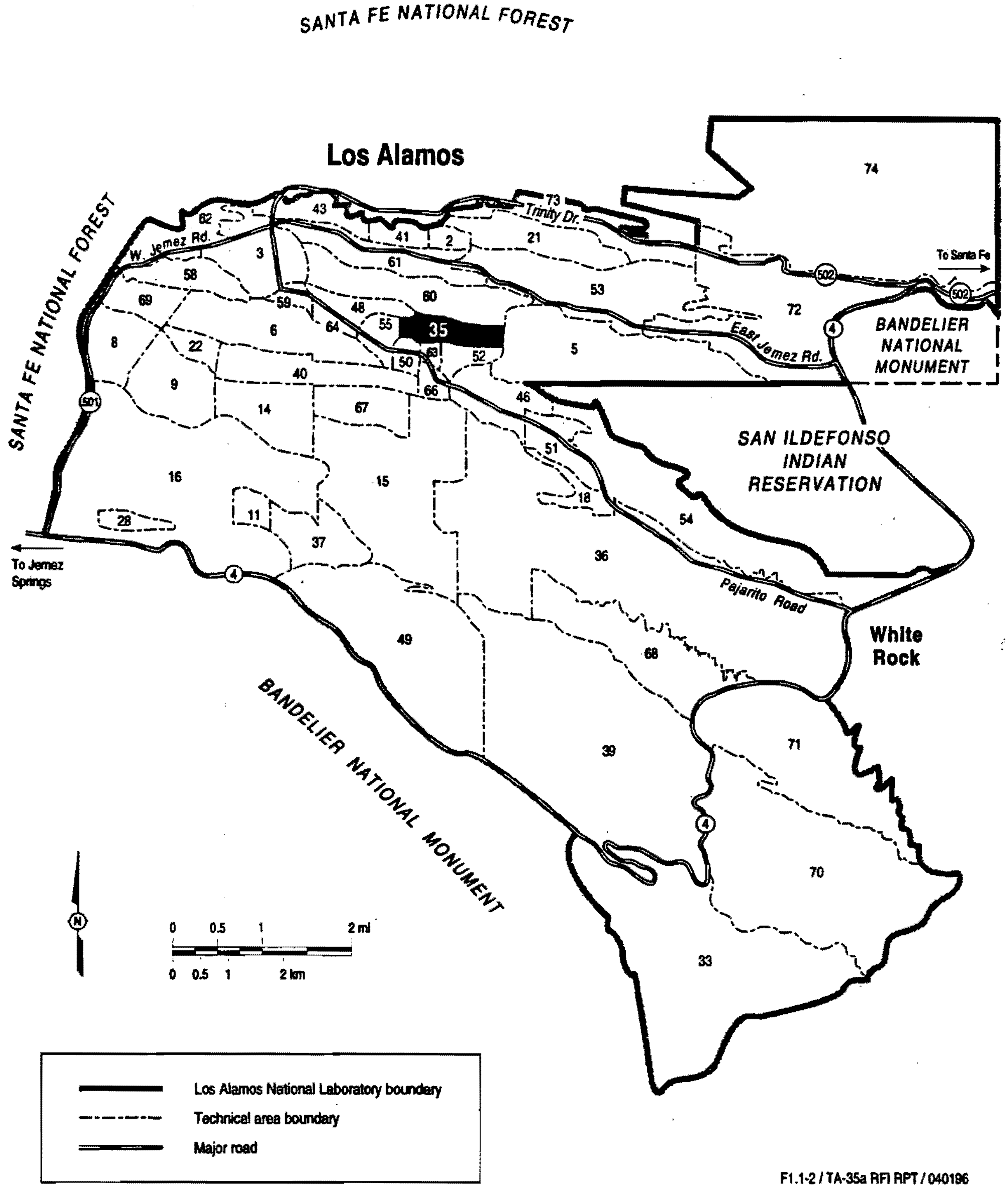

Figure 1.1-2. Location of TA-35 with respect to Laboratory technical areas and surrounding land holdings.

- Sodium Testing Building (TA-35-34) built in 1958 and used as a high-voltage switching laboratory;
- Chemical Laser Facility (TA-35-85) completed in 1977 and used for research and development of krypton fluoride (KrF) lasers;
- Carbon Dioxide Laser Building (TA-35-86) that housed the Helios carbon dioxide (CO_2) laser facility and now houses the Z-Pinch machine, which is used to focus electron beams on targets;
- buildings TA-35-124, -125, and -126 completed in the mid-1980s that housed the Antares CO_2 laser experiments, which used large CO_2 lasers and tritium/deuterium microsphere targets;
- High-Voltage Development Laboratory (TA-35-188) completed in 1976 in which the components for the KrF laser facility are assembled; and
- Target Fabrication Facility (TA-35-213) completed in 1976 and used for processing deuterium and tritium microsphere targets for various laser operations at TA-35 and also for processing beryllium.

Effluent and emission routes from TA-35 include ventilation stacks, septic systems, storm sewer lines and discharge channels, industrial waste lines and outfalls, and leaking storage structures such as underground and above ground tanks and surface compounds. Chemicals and other constituents used at the site that contributed to the chemicals of potential concern investigated during Phase I include metals, volatile organic compounds, semivolatile organic compounds, polychlorinated biphenyl compounds, and radionuclides.

Radionuclides were investigated as part of this RFI, although radiological contamination is not regulated by RCRA. Radiological sample results are not presented or discussed in this RFI report and will be provided by September 1997 as an addendum when the radiological data evaluation is completed.

In the work plan (LANL 1992, 7666) PRSs were aggregated based on several criteria including proximity, type (for example, outfalls or septic systems), or the operational history of the facility. However, in many cases the aggregation of PRSs in the work plan is not appropriate for the screening assessment, reporting, or recommendations for remedial action. For example, Aggregate T contains various container storage areas that are widely separated on the mesa top.

For the purposes of the assessments in this RFI report, the PRSs at TA-35 have been organized into the decision sets listed in Table 1.1-1. Where appropriate, PRSs have been reported individually. For example, some of the PRSs in Aggregate V (Section 7.26 of the work plan) have been evaluated separately because they are geographically separated, and placing them in one exposure unit for the purpose of screening assessment is not appropriate. PRS No. 35-016(b) is an outfall that discharges effluents from a laboratory building (TA-35-87), and PRS No. 35-016(j) is an active storm drain that handles rainwater runoff and electropolishing wastewater from TA-35-125. Conversely, where PRSs are in such close proximity that contamination, if any, from one release would be intermingled with contamination, if any, from another release, the PRSs have been combined to

TABLE 1.1-1

POTENTIAL RELEASE SITE DECISION SETS

RFI Report Section	Work Plan Section	PRSs Included In Decision Set	Description
5.1	7.24	35-004(a) 35-009(e)	Former container storage area southeast of TA-35-25; and sewage drain line from TA-35-25 that discharges to an outfall in Ten Site Canyon.
5.2	7.24	35-004(g)	Former container storage area south of TA-35-67
5.3	7.24	35-004(h)	Former container storage area northeast corner of TA-35-7
5.4	7.26	35-004(m) 35-014(g_2)	Former container storage area and stained asphalt near the fence on the south side of TA-35-86
5.5	7.26	35-014(g_1)	Stained area (~4 ft by 2 ft) in discharge area of storm drain system near the northeast corner of TA-35-207
		35-016(n)	Active daylight channels established in 1977 to handle rainwater runoff from TA-35-86
5.6	7.26	35-016(b)	Active outfall established in 1977 to discharge photographic processing effluent from TA-35-87
5.7	7.26	35-016(j)	Active storm drains installed in 1975 to handle rainwater run-off from TA-35-125
5.8	7.24	35-016(q)	Storm water collection basins that are located between TA-35-34 and the edge of Ten Site Canyon

create a single decision set. For example, PRS No. 35-014(g_1) spatially overlaps PRS No. 35-016(n), and the contamination from the releases, if any, cannot be evaluated independently; therefore, they have been combined to form a decision set.

1.2 RFI Overview

The purpose of the Phase I investigation was to determine whether chemicals of concern (COCs) are present in the PRSs at TA-35. Results of the investigation are used to determine if a site

- requires additional investigation,
- may be removed from the RCRA Hazardous and Solid Waste Amendments Module VIII Permit and recommended for no further action, or
- is a candidate for expedited cleanup or voluntary corrective action.

A complete description of the conceptual model is discussed in Chapter 4.0 of the work plan (LANL 1992, 7666). The conceptual model was based on three contaminant transport scenarios: resuspension and possible transport of soil particles by the action of wind, vapor- or liquid-phase transport in the vadose zone, and surface water runoff and erosion.

Site-specific factors such as contaminant type(s), contaminant volume(s), release history, and physical conditions also govern the movement of contaminants from a release. Primary release mechanisms consist of two types: operational and accidental. An operational loss of contaminants includes the release of constituents through either routine process operations or intentional but unplanned releases. These release mechanisms include system discharges, outfalls, septic systems, air emissions, and test procedures. An accidental loss of contaminants may include unintentional releases such as leaking underground storage tanks, surface overflows, spills, leaks, and operational accidents. Secondary release mechanisms are those processes that mobilize contaminants within a medium or among media. Mobilizing processes for contaminants in water include surface water bulk flow, percolation and migration in the vadose zone, ground water transport, and volatilization. Mobilizing processes for soil include aeolian processes, biotic uptake, and soil erosion. Aeolian processes are the mobilizing processes for airborne particulates or vapor phase contamination.

Because the purpose of the Phase I investigation was to determine whether COCs are present, the conceptual model used site-specific information for the above processes to determine a potential worst-case contaminant migration as the basis for developing a sampling and analysis plan (SAP). SAP development included the use of models, such as the EPA-sponsored personal computer graphical exposure modeling system (SESOIL and AIRDOS-EPA) and contouring software (SURFER). In addition to the use of models, judgmental sampling combined with search sampling was the method chosen to select the number and location of samples to be collected for most PRSs at TA-35.

1.3 Field Activities

Field activities followed the SAPs that were submitted as part of the work plan, except as noted in Chapter 5.0 of this RFI report. Field activities began on March 1, 1995, and ended on December 8, 1995. The SAPs called for field surveys to be performed at the PRSs before collecting samples. These surveys included site engineering surveys to locate the PRSs and associated features, and environmental surveys to initially screen for environmental concerns at each site. All survey activities and sampling activities followed applicable Laboratory Environmental Restoration Project standard operating procedures (LANL-ER-SOPs) (LANL 1991, 21556).

Site engineering surveys generally included a review of archival data, engineering drawings provided by the Laboratory's Facility Project Delivery Group (FSS-6), aerial photographs, and site visits. These engineering surveys were conducted by the field team leader, geologists, and environmental scientists with support from the field team sampling technicians. During the surveys, the PRSs were located, staked, and documented. If the results of these reviews corresponded accurately to the original SAPs, then predetermined sample locations were staked. However, if the engineering surveys found discrepancies between actual site conditions and the original SAPs, then environmental surveys, geophysical surveys, and other field surveys were used to determine appropriate sample locations. These discrepancies and changes to the original SAPs were documented through memoranda to file. The results of the engineering surveys were documented in daily activity logs, and when appropriate the changes were incorporated into the database at the Laboratory's Facility for Information Management, Analysis, and Display.

Environmental surveys and health and safety surveys were conducted at each PRS and usually consisted of walking surveys using field screening instruments to screen for radiation and organic compounds. These surveys were performed by the field team health and safety officer or radiation control technician with support from field team geologists, environmental scientists, and sampling technicians. Preliminary health and safety radiological surveys were conducted at each site using an Eberline ESP-1 beta/gamma meter with probe model HP-260 and the Ludlum Model 139 alpha meter. Radiation grid surveys were conducted using an Eberline ESP-1 beta/gamma meter with probe model HP-260 and the Ludlum Model 139 alpha meter following the grid pattern specified in the SAP or by the engineering survey. If warranted by the topography of a specific site, environmental surveys were also conducted in erosion cuts or outfalls to complement the data collected using grid patterns. Some SAPs required that environmental survey results be used to select sample locations for biased sampling at a specific PRS. In those cases, the sample sites were located, staked, mapped, and documented in daily activity logs. Information obtained as a result of the engineering and environmental surveys allowed for directed sampling, when appropriate.

As described in the work plan (LANL 1992, 7666), judgmental sampling combined with search sampling was used as the primary method for determining the quantity and location of samples. Judgmental sampling is the subjective selection of sample locations based on professional knowledge of contaminant behavior in the media being sampled. Search sampling is the selection of strategic sampling locations based on archival information and the results of surveys that indicate where potential contamination may be located.

The following LANL-ER-SOPs were followed during sampling activities (LANL 1991, 21556).

- Surface soil samples were collected from the ground surface to a depth of 6 in. using a stainless steel scoop in accordance with LANL-ER-SOP-6.09, "Spade and Scoop Method for Collection of Soil Samples."
- Subsurface soil samples were collected from 1-ft intervals of 3-in.-diameter cores using either hand augers for near-surface samples in accordance with LANL-ER-SOP-6.10, "Hand Auger and Thin-Wall Tube Sampler," or hollow-stem augers with split-spoon core barrels for sample recovery using a drill rig in accordance with LANL-ER-SOP-6.24, "Sample Collection from Split-Spoon Samplers and Shelby Tube Samplers."

Chapter 5.0 of this RFI report describes in detail the specific field activities performed for each PRS.

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2.0 ENVIRONMENTAL SETTING

The environmental setting of the Laboratory is described in Section 2.4 of the *Installation Work Plan for Environmental Restoration Program* (IWP) (LANL 1995, 52009). A detailed discussion of the environmental setting of Technical Area (TA) -35, including climate, geology, hydrology, and a conceptual hydrogeologic model for the area and its surroundings, is presented in the *RFI Work Plan for Operable Unit 1129* (the work plan) (LANL 1992, 7666). A summary is presented in the following sections.

TA-35 is located off Pajarito Road in the north-central part of the Laboratory. It is situated on a finger-like mesa known as Ten Site Mesa, which is bounded by Mortandad Canyon to the north and east and Ten Site Canyon, a branch of Mortandad Canyon, to the south. The elevation of TA-35 is approximately 7,200 ft above sea level.

2.1 Climate

Bowen (1990, 6899) has compiled and interpreted climatological data for the Los Alamos area. This information is summarized below.

Los Alamos County has a semiarid, temperate, mountain climate typical of the northern New Mexico area. Summers are generally sunny with moderate, warm days and cool nights. Maximum daily temperatures usually do not exceed 90°F. High altitude, light winds, clear skies, and dry atmosphere allow summer temperatures to range from 50°F to 95°F in the TA-35 area. During the winter, temperatures typically range from 15°F to 50°F. However, winter temperatures occasionally drop to 0°F or below.

The average annual rainfall in the TA-35 area is about 16 in. In a typical year, approximately 40% of the annual precipitation occurs during intense thunderstorms in July and August. Winter precipitation falls primarily as snow, with accumulations of about 51 in. annually. Snowfall is common in the TA-35 area, and accumulations exceeding 4 in. are not unusual. Individual snowfalls can occasionally exceed 12 in. and can be associated with frigid air and strong winds. Stream flow in canyons can occur as a result of summer thunderstorms and spring snowmelt runoff.

Winds are usually light and blow predominantly from the southwest to the northeast. However, strong winds are common in early spring, and winds can gust to more than 60 mph. Strong dust devils can develop on the mesa tops during the summer and can cause brief gusts of 75 mph or greater in the immediate area of the dust devils. Strong winds can also occur during summer thunderstorms and winter snowstorms.

2.2 Geology

2.2.1 Geologic Setting

A detailed discussion of the geology of the entire Los Alamos area can be found in Chapter 2 of the work plan (LANL 1992, 7666) and in Section 2.5.1 of the IWP (LANL 1995, 52009). A summary of that material, emphasizing the conditions expected near TA-35, is presented below.

Figure 2.2.1-1 depicts a generalized stratigraphic cross section of the geologic units described in this section.

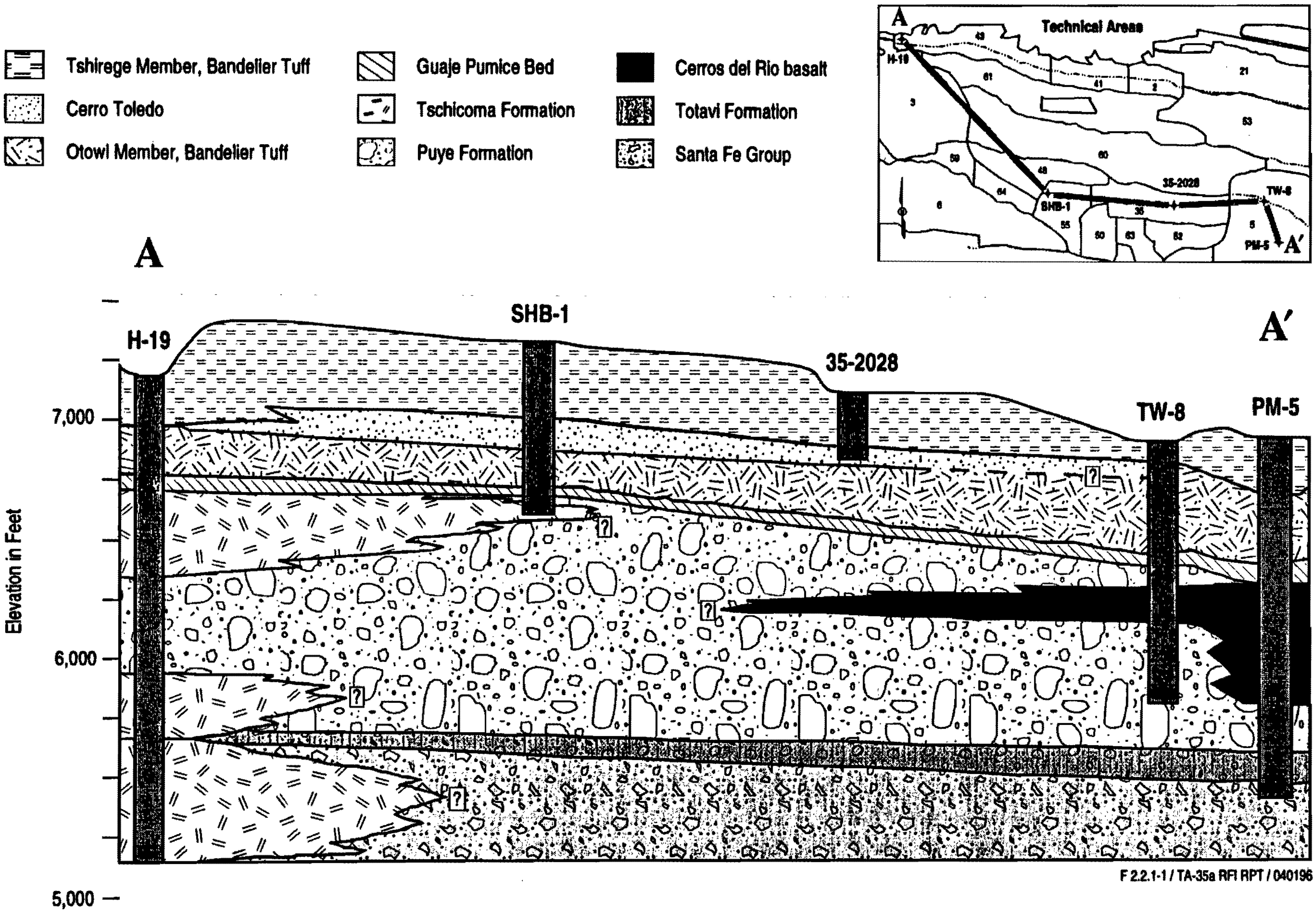


Figure 2.2.1-1 Generalized stratigraphy of TA-35.

2.2.1.1 Stratigraphy

TA-35 is located on the Pajarito Plateau, which is a large volcanic feature composed of a series of deep east-west trending canyons and finger-like mesas on the western flanks of the Española Basin in the Rio Grande rift, a major tectonic feature of western North America. The Pajarito Plateau was formed by a massive outpouring of volcanic ash and tuffs from the Jemez volcanic field to the area immediately west of the plateau. The Jemez volcanic field has been active for the last 13 million years (Myr), and the latest volcanic activity is estimated to have occurred about 60,000 years ago (Wolff and Gardner 1995, 48821).

The thicknesses of the stratigraphic units described below are derived from a constructed cross section, which was created from geologic logs from the following five borings: water supply well PM-5, located on the Mesita del Buey east of TA-35; test well TW-8, located in Mortandad Canyon; core hole SHB-1, located in TA-55; test hole H-19, located in Los Alamos Canyon near the Diamond Drive bridge; and the borehole drilled at PRS No. 35-003(r) (Location ID No. 35-2028). The stratigraphic units in PM-5, TW-8, and H-19 are described by Purtymun (1995, 45344). The stratigraphic units in SHB-1 are described by Gardner et al. (1993, 12582). The stratigraphic units in Location ID No. 35-2028 are described in LANL 1996 (54422).

2.2.1.1.1 Bandelier Tuff

The Pajarito Plateau in the TA-35 area is capped by the Tshirege Member of the Bandelier Tuff. This unit is composed of crystal-rich ash-flow tuffs that were formed by multiple eruptions of the Valles Caldera in the Jemez Mountains about 1.22 Myr ago (Izett and Obradovich 1994, 48817). This unit is approximately 300 ft thick in the TA-35 area. The Tshirege Member is subdivided into four mappable cooling units. The area of TA-35 that is located on the mesa top lies on cooling unit 3 (Qbt3), a poorly welded cliff-forming tuff that forms the surface of the Mesita del Buey. The eastern part of TA-35, which is located on the canyon slope, lies on the uppermost, nonwelded section of cooling unit 2 (Qbt2) (Vaniman and Wohletz 1993, 48822).

Underlying the Tshirege Member is the Otowi Member of the Bandelier Tuff. The Otowi Member is composed of multiple flow units of soft, unwelded ash-flow tuffs that were formed by eruptions about 1.61 Myr ago (Izett and Obradovich 1994, 48817). This unit is approximately 210 ft thick in the TA-35 area.

At the base of the Otowi Member is the Guaje pumice bed. It is an ashfall of pumice with some water-laid or surge-bed pumiceous tuff that rests unconformably on older rocks (Purtymun 1995, 45344).

2.2.1.1.2 Cerro Toledo Rhyolite and Interbedded Sediments

An interbedded sequence of rhyolitic tuffs and sediments commonly occurs between the Otowi and Tshirege Members of the Bandelier Tuff. The rhyolitic tuffs were formed between 1.2 and 1.5 Myr ago, predominantly by eruptions from the Cerro Toledo domes in the northeastern Jemez Mountains (Heiken et al. 1986, 48638). The sediments are epiclastic sands and sandy gravels that lithologically resemble the fanglomerates of the Puye Formation, discussed in Section 2.2.1.1.4. A hollow-stem auger boring (Location ID No. 35-2028) that was drilled as part of the TA-35 investigation encountered 77 ft of Cerro Toledo rocks.

2.2.1.1.3 Cerros del Rio Basalts

Basaltic flows, breccias, and scoria of the Cerros del Rio occur in the subsurface beneath much of the Pajarito Plateau (Dransfield and Gardner 1985, 6612), and nearby deep boreholes suggest that they are present beneath TA-35. These rocks have been dated at 2.0 to 4.6 Myr old (Gardner et al. 1986, 21527).

2.2.1.1.4 Puye Formation

Underlying the Bandelier Tuff is the Puye Formation (Turbeville et al. 1989, 21587), a volcanogenic alluvial fan sequence, which was formed by erosion of the Tschicoma volcanic center to the west. The Puye Formation was deposited between 1.9 and 3.5 Myr ago (Pliocene to Pleistocene age). Deep wells near the TA-35 area indicate that the Puye Formation is interstratified with basalt flows from the Cerros del Rio volcanic center. The thickness of the Puye Formation at TA-35 has not been determined; however, nearby deep wells indicate an overall thickness of as much as 1,000 ft.

2.2.1.1.5 Totavi Formation

The Totavi Formation (Turbeville et al. 1989, 21587) (formerly the Totavi Lentil) interfingers with the Puye Formation in the TA-35 area, thickening and possibly replacing the Puye Formation to the east. The Totavi Formation is a coarse, poorly consolidated conglomerate composed of granitic and metamorphic cobbles with an arkosic matrix. This formation was probably deposited between 2.5 and 3.5 Myr ago. A deep water supply well (PM-5) near TA-35 indicates that the Totavi Formation is 60 to 80 ft thick in the TA-35 area.

2.2.1.1.6 Tschicoma Formation

The Tschicoma Formation consists of a sequence of dacitic domes and lavas that erupted from vents in the central to northeastern Jemez Mountains between 3 and 7 Myr ago (Gardner et al. 1986, 21527). These rocks crop out extensively in the mountains west of TA-35, and some may be present in the subsurface near TA-35.

2.2.1.1.7 Santa Fe Group

Below the Totavi Formation are the formations of the Santa Fe Group (Galusha and Blick 1971, 21526), which were deposited during the Miocene and early Pliocene Age. The rocks of the Santa Fe Group are a thick series of terrestrial conglomerates, sandstones, and mudstones with minor limestones, evaporites, volcanic tuffs, and intercalated basalts. In the Los Alamos area, the Santa Fe Group is divided into the Chaquehui Formation, the Chamita Formation, and the Tesuque Formation. The Chaquehui Formation and the Chamita Formation have been dated at 4.5 to 6 Myr old, and the Tesuque Formation is estimated to be 7 to 21 Myr old. The total thickness of the Santa Fe Group in the area of TA-35 has not been determined.

2.2.1.2 Geological Structure

The Pajarito Plateau dips gently several degrees to the east and southeast. Most of the stratigraphic units that comprise the plateau reflect this gentle regional dip.

The plateau is bounded on the west by the Pajarito fault system, which also describes the western boundary of the Española basin referred to above. The Pajarito fault system consists of three active, or potentially active, fault segments: the Frijoles Canyon, Rendija Canyon, and Guaje Mountain segments. The Guaje Mountain segment is projected through TA-35 and is located immediately west of building TA-35-2 (Vaniman and Wohletz 1993, 48822). Although little or no vertical offset has been documented in the TA-35 area, the fault system is often expressed as an area of increased fracturing of the Bandelier Tuff.

2.2.2 Soils

A detailed discussion of the soils in the Los Alamos area can be found in Section 2.5.1.3 of the IWP (LANL 1995, 52009). A summary of that material specific to TA-35 is presented below.

A large variety of soils has developed on the Pajarito Plateau because of interactions among the underlying bedrock, the slope of the area, and the climate (Nyhan et al. 1978, 5702). The mineral components of the soil are primarily derived from the Bandelier Tuff, with some contribution from Tschicoma Formation rocks and from younger pumice eruptions from the Jemez Mountains. Windblown sediments from other areas in northern New Mexico may also contribute to the soil composition. Mesa-top soils in the TA-35 area are generally poorly developed because of the arid climate.

The predominant soils at TA-35, as described by Nyhan et al. (1978, 5702), are the Hackroy sandy loam, the Tocal very fine sandy loam, the Totavi gravelly loamy sand, and a small amount of the Carjo loam. The Hackroy soils consist of very shallow to shallow, well-drained soils that formed from material weathered from tuff on the mesa tops. Hackroy soil thickness ranges from 8 to 20 in. The Tocal series is similar to Hackroy soils and consists of shallow, well-drained soils that formed from weathered tuff on slightly sloping mesa tops. Soil thickness ranges from 8 to 20 in. The Totavi soils consist of deep, well-drained soils that formed in the alluvium on the canyon floor. The thickness of Totavi soils is 60 in. (5 ft) or greater. The Carjo series is described as moderately deep, well-drained soils that formed from weathered tuff on slightly sloping mesa tops. Soil thickness ranges from 20 to 40 in.

No geomorphological surveys to determine the rate of soil accumulation have been conducted in the TA-35 area.

The soils over most of the mesa-top area of TA-35 have been disturbed and reworked by construction and road building. Much of the eastern portion of the mesa top has been leveled by adding large quantities of fill material, which ranges from 1 to 30 ft thick.

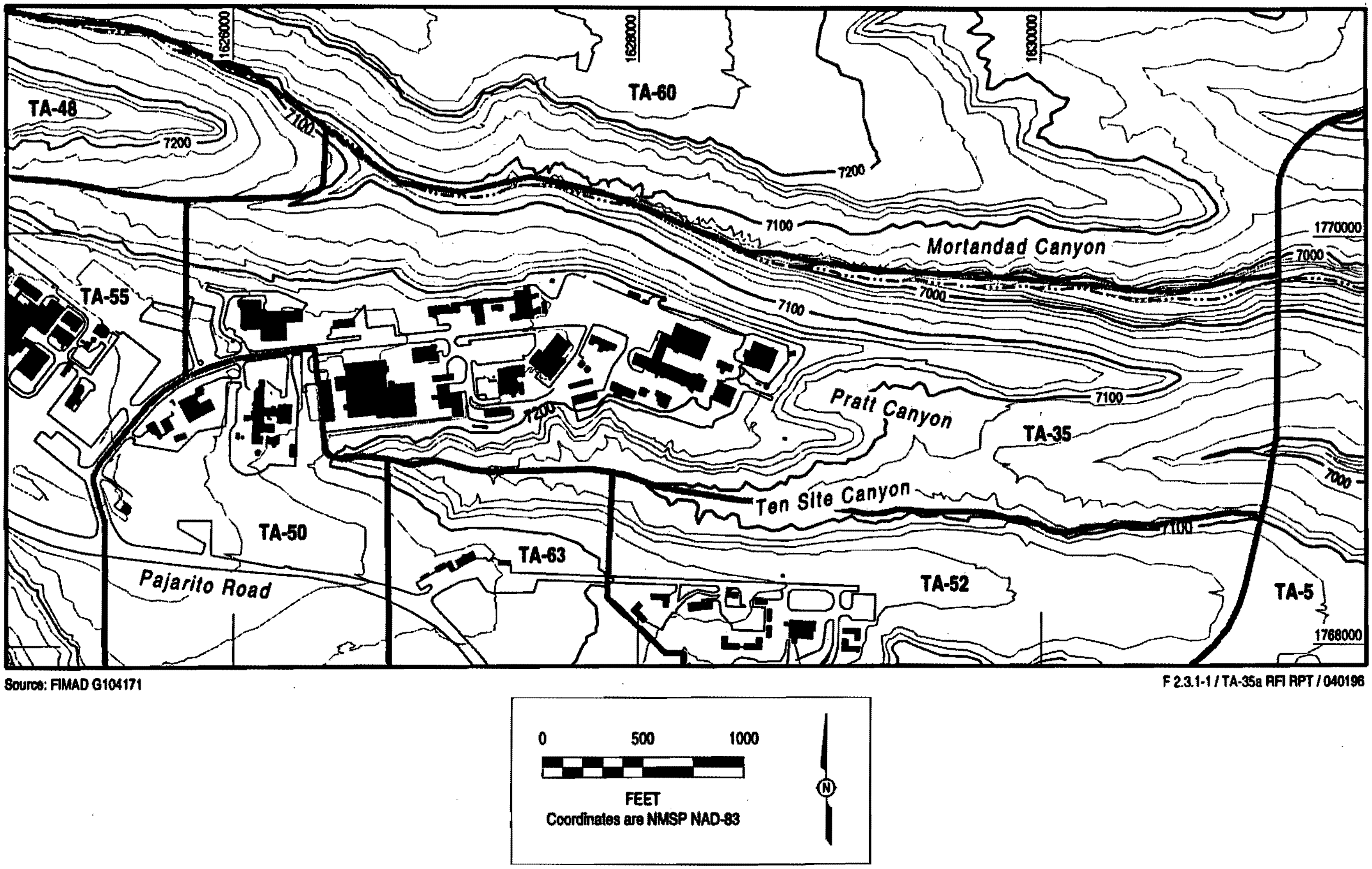
2.3 Hydrology

The hydrology of the Pajarito Plateau is summarized in Section 2.5.2 of the IWP (LANL 1995, 52009). Site-specific conditions are summarized below.

2.3.1 Surface Water

Surface waters drain generally eastward from the Jemez Mountains, across San Ildefonso Pueblo land, and down to the Rio Grande. They continue draining south to the Cochiti Reservoir through White Rock Canyon.

The surface water runoff from TA-35 flows directly into Mortandad Canyon (immediately north of TA-35), into Ten Site Canyon (immediately south of TA-35), and into a small tributary canyon



Source: FIMAD G104171

F 2.3.1-1 / TA-35a RFI RPT / 040196

Figure 2.3.1-1. Topography of TA-35.

informally known as Pratt Canyon (to the east of TA-35). Runoff occurs in drainage rills found on the mesa top and in the larger drainage gullies that are characteristic of the canyon walls. No perennial springs are present in Mortandad Canyon. However, perennial water flow is present in Mortandad Canyon; its source is storm water outfalls from Pajarito Road and outfalls from Laboratory facilities west of TA-35, which also flow into Mortandad Canyon (See Figure 2.3.1-1).

2.3.2 Ground Water

Ground water occurs under saturated conditions in the following three water-bearing zones in the Los Alamos area: shallow stream-associated alluvium in the canyons, perched water underlying the alluvium, and the main aquifer of the Los Alamos area.

The northern boundary of TA-35 includes the canyon floor and the associated intermittent stream in Mortandad Canyon. Four shallow observation and monitoring wells (MCO-3, MCM-3A, MCM-3B, and MCM-3.9) are present in the canyon floor within the TA-35 boundary. These wells indicate the presence of a shallow alluvial aquifer in the canyon floor. None of the potential release sites (PRSs) associated with TA-35 extend into the floor of Mortandad Canyon. The southern boundary of TA-35 includes the canyon floor in Ten Site Canyon. No wells are present in this part of Ten Site Canyon, and the presence of a shallow alluvial aquifer is unknown.

Studies performed near TA-35 have not indicated the presence of any other shallow or perched aquifers (Devaurs and Purtymun 1985, 7415); therefore, the saturated zone under the PRSs at TA-35 appears to be restricted to the deep main aquifer. Based on water level elevations in nearby wells TW-8 and PM-5, the top of the main aquifer at TA-35 is located in the lower Puye Formation about 950 ft beneath the surface. No evidence exists to indicate any direct interconnection between surface waters and the main aquifer in the TA-35 area.

Ground water in the main aquifer flows eastward toward the Rio Grande. The hydraulic gradient in the area of TA-35 is 60 to 80 ft per mile, and the rate of movement varies from 20 ft per year to more than 300 ft per year, depending on the permeability of the Puye Formation and the underlying Santa Fe Group rocks.

2.3.3 Vadose Zone

TA-35 overlies approximately 950 ft of unsaturated volcanic tuff, sediments, and basalts of the geologic formations discussed in Section 2.2.1.1. Studies of the moisture content of the Bandelier Tuff have not been conducted at TA-35; however, no shallow perched aquifers are known to be present beneath TA-35. The moisture content of the Tshirege Member of the Bandelier Tuff is expected to decrease dramatically with depth, so that the tuff is essentially dry a few tens of feet beneath the ground surface. Fractures in the tuff associated with the fault zones described above may allow moisture to penetrate locally somewhat deeper into the tuff, which allows higher moisture content in the more porous zones at depth.

2.4 Biological Surveys

The habitat description for the PRSs discussed in this Resource Conservation and Recovery Act facility investigation (RFI) report will be included in ecological RFI reports, which will be prepared for the Ecological Exposure Units.

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3.0 APPROACH TO DATA ASSESSMENT AND ANALYSES

The objective of the Technical Area (TA) -35 Phase I Resource Conservation and Recovery Act facility investigation (RFI) is to determine if any chemicals of potential concern (COPCs) are present at a potential release site (PRS) decision set. The Phase I decision criteria may be qualitatively stated as follows. If no COPCs are identified at a PRS decision set as a result of a human health risk screening assessment, and if the quality of the data set is adequate, then no further action (NFA) will be proposed. If any COPCs are determined to be present, the PRS decision set will be considered for either accelerated remedial action, interim action, or further investigation based on the criteria used in the draft document *Risk-Based Corrective Action Process* (Environmental Restoration Decision Support Council 1996, 53751).

The decision approach used to meet the Phase I objective involves a series of qualitative and quantitative steps that occur after the field investigation, sample analysis, and data reporting steps have been completed. Sample analyses and the analytical methods employed are discussed in Sections 3.1 and 3.1.1, respectively. Before assembling the data set for a PRS decision set, analytical data are verified and validated according to the procedures described in Section 3.1.2. The verified and validated data set then undergoes a data quality assessment process, which begins with an exploratory data analysis. The exploratory data analysis facilitates the identification of suspect results that may require focused validation. The focused validation process is described in Section 3.1.2.

Following exploratory data analysis, site data are compared with the appropriate site-specific background data for trace metals, as described in Section 3.2. Organic chemicals are evaluated separately according to the criteria discussed in Section 3.3. A human health risk screening assessment is then performed to determine if COPCs are present, following the procedure outlined in Section 3.4. An ecological assessment is performed by evaluating the potential for ecological receptors to be exposed to COPCs associated with the site (described in Section 3.5).

If no COPCs are identified during the screening assessment, the sufficiency of the data set to support an NFA decision is determined by examining certain attributes of the data for the decision set. For example, the sensitivity, bias, and precision of the analytical methods used should be adequate to detect COPCs at levels of concern and to accurately identify COPCs. Samples should have been analyzed for the appropriate analyte suites to determine the presence or absence of likely contaminants at the site based on the existing information. The degree of spatial characterization must be sufficient to support conclusions based on the data set. The assessment of the adequacy of the data set for decision-making purposes is a subjective process that requires the professional judgment of an interdisciplinary team comprising human health and ecological risk assessors, statisticians, geologists, biologists, and chemists. Other considerations in the decision-making process may include the site-specific land use scenario, potential pathways for contaminant migration, the involvement of regulatory authorities such as the New Mexico Environment Department (NMED), or regulatory guidelines such as the Toxic Substances Control Act or underground storage tank regulations.

The analytical methods for radiological analysis are presented in this chapter. However, radiological sample results are not presented or discussed in this RFI report and will be provided later as an addendum to this RFI report.

3.1 Sample Analyses

All samples requiring chemical and radiological analyses were collected and handled following Environmental Restoration (ER) Project chain-of-custody protocols described in the standard operating procedure LANL-ER-SOP-01.04 (LANL 1991, 21556). Samples collected as part of this RFI were submitted to the Sample Management Office for shipment to a fixed-site laboratory or were submitted directly to an on-site mobile laboratory facility.

3.1.1 Analytical Methods

Table 3.1.1-1 summarizes the analytical methods employed by the fixed-site and mobile laboratory facilities for the organic, inorganic, and radiological analytical suites. The analytical protocols employed by the internal fixed-site laboratories are described in the Laboratory health and environmental chemistry manual (LANL 1993, 31794) and are based on Environmental Protection Agency (EPA) SW-846 methods for organic and inorganic analyses. Analyses performed by external subcontractor laboratories follow the EPA SW-846 methods (or the equivalent EPA Contract Laboratory Program statements of work) for organic (EPA 1986, 31733) and inorganic (EPA 1986, 31732) analyses. The requirements for analyses performed by the external laboratories are described in the ER Project statement of work for analytical services (LANL 1995, 49738).

TABLE 3.1.1-1

ANALYTICAL METHODS

Analyte Suite	Analytical Method	
	Fixed-Site Laboratory	Mobile Laboratory
Inorganic Chemicals		
Trace metals	ICPES, GFAA, ICPMS	EDXRF
Organic Chemicals		
Polychlorinated biphenyl compounds	GC/ECD	GC/ECD
Polycyclic aromatic compounds	N/A	GC/FID
Semivolatile organic compounds	GC/MS	GC/MS
Total petroleum hydrocarbons	GC/FID	N/A
Volatile organic compounds	GC/MS	GC/MS
Radionuclides		
^{3}H	Liquid scintillation	N/A
^{238}Pu, $^{239,240}Pu$	Alpha spectrometry	N/A
^{234}U, ^{235}U, ^{238}U	Alpha spectrometry	N/A
Gamma spectroscopy analytes	Gamma spectroscopy	Gamma spectroscopy
Gross-alpha	GPC	GPC
Gross-beta	GPC	GPC
Gross-gamma	NaI(Tl) or HPGe detection	NaI(Tl) or HPGe detection

The analytical protocols employed for the radiological analyses were either Laboratory internal protocols (LANL 1993, 31794) or external protocols that have much in common with the Laboratory radiochemistry methods. The radiochemistry procedures will vary somewhat from laboratory to laboratory because of the lack of promulgated radiological protocols.

The analytical methods employed in the mobile laboratory facilities were modifications of the methods used by the laboratories at Los Alamos National Laboratory. Further details about the analytical procedures for inorganic and organic chemicals are given in Chapter 4.0 of this RFI report. On-site gamma spectroscopy measurements were performed by a Laboratory-operated mobile laboratory facility.

3.1.2 Data Validation

Before performing a screening assessment for a PRS or PRS aggregate, the data set underwent verification and routine validation procedures. Data verification and validation procedures are used to determine whether analytical data packages have been generated according to specifications, are of known quality, and contain the information necessary to determine data sufficiency for decision making. The data verification procedure checked that

- analytical results had been received for all samples submitted for analysis,
- the correct analysis had been performed for each sample,
- the analytical data had been reported correctly, and
- all analytical data had been correctly transmitted to the Facility for Information Management, Analysis, and Display.

Appropriate corrective actions were initiated to obtain missing analytical data and to correct errors in the data reporting.

The routine data validation process involved the comparison of quality indicators with clearly defined criteria or limits. Quality indicators such as surrogate recoveries, method blank measurements, holding times, and the differences between duplicate measurements were evaluated following EPA guidelines for inorganic data review (EPA 1994, 48639) and organic data review (EPA 1994, 48640), where applicable. Radiochemistry data were validated according to the acceptance criteria defined in the ER Project statement of work for analytical services (LANL 1995, 49738). During the validation process, data that did not meet quality criteria were designated by qualifier flags. Qualifiers resulting from the validation process are shown in the analytical data tables included in Chapter 5.0 of this RFI report. An explanation of the data qualifiers that appear in the data tables is given in Table 3.1.2-1.

As part of the data quality assessment process described in Section 3.0, focused data validation was performed when the data for a decision set contained an anomalous or outlying value that may have affected the screening assessment outcome. To determine the usability of the data, focused validation was also performed if a value that was qualified in the routine validation process was near or above an action level. In the focused validation process, the analytical data underwent varying levels of scrutiny, ranging from a check of the data reporting forms to an in-depth investigation of all the associated raw data in the data package. The results of required focused validation efforts are reported in Chapter 4.0 of this RFI report. Sample results may be further qualified as a result of focused validation.

TABLE 3.1.2-1

EXPLANATION OF DATA QUALIFIERS USED IN THE DATA VALIDATION PROCEDURE

Qualifier	Explanation
U	The analyte was analyzed for but not detected. Reported value is the sample quantitation limit or detection limit.
J	The analyte was positively identified, and the associated numerical value is the approximate concentration of the analyte in the sample.
J+	Reported value is an estimate and likely biased high.
J-	Reported value is an estimate and likely biased low.
UJ	The analyte was analyzed for and was not detected. The reported value is an estimate of the sample quantitation limit or detection limit.
R	The sample results are rejected because of serious deficiencies in the ability to analyze the sample and meet quality control criteria; presence or absence cannot be verified.
S	The sample results were obtained using a screening analytical method performed in a mobile laboratory facility.

3.1.3 Use of X-Ray Fluorescence Data

The use of the mobile laboratory facility x-ray fluorescence (XRF) data for inorganic chemicals follows the general procedures outlined in Sections 3.2 and 3.4.1. However, some modifications are required (particularly in making background comparisons) because XRF analyses do not produce results that are strictly comparable to the methods used in collecting Laboratory background data.

Longmire et al. (1995, 48818; 1995, 52227) have published upper tolerance limit (UTL) values for the Los Alamos area background soil concentrations for inorganic chemicals as measured by both partial digestion (primarily nitric acid) and total digestion (hydrofluoric acid) sample preparation and SW-846 analytical methods. The partial digestion data represent concentrations of elements localized in the surface coatings of soil and tuff particles, whereas the total digestion data also include the portion of these elements contained in the primary silicate minerals that comprise these particles.

Background soil concentrations measured by XRF are not available. However, the data published by Longmire et al. can be used to supplement XRF data collected during RFIs at TA-48 and TA-35 to permit UTL comparisons of all inorganic chemicals measured by XRF in this RFI. The XRF data are similar to the Longmire et al. total digestion data because XRF is sensitive to most or all of the quantity of an element present in silicate minerals (not just to that fraction that is soluble by nitric acid). Table 3.1.3-1 provides UTL values for partial and total digestion samples from Longmire et al. and XRF UTLs calculated using TA-48 and TA-35 data (as described below). The table shows that the percent difference among total digestion and XRF UTLs ranges from 0 to 27%, with an average of 10%, for the nine elements that have both UTLs (barium, calcium, chromium, copper, iron, lead, manganese, potassium, and zinc).

Because the total digestion and XRF UTL values are well correlated, total digestion UTLs published by Longmire et al. will be used as surrogates for XRF UTLs for those elements for which paired XRF data are either unavailable (thorium and uranium) or insufficient to calculate a statistic because they are mostly nondetects (antimony, arsenic, and nickel). Neither total digestion nor XRF UTLs are available for cadmium, mercury, and selenium. For these three elements, which frequently have background concentrations below the detection limits of the standard laboratory methods as well as XRF, it can safely be assumed that an XRF-detected value is above background.

RFIs at TA-35 and TA-48 include a total of 48 samples for which measurements were made by both XRF and SW-846 partial digestion analytical methods. Those paired samples for which the SW-846 measurement are below the ER Project's background UTLs (which is most or all of the paired samples for most analytes) provide a background XRF data set. In particular, for the nine analytes listed earlier for which at least one-third of these XRF results are reported above detection limits, these data can be used to estimate UTLs for the XRF method. These UTLs are shown in the "XRF" column of Table 3.1.3-1. In addition, these XRF background data can be used in two-sample statistical tests (see Attachment I of this RFI report, which shows data in box plots).

TABLE 3.1.3-1

UTLs FOR INORGANIC ANALYTES AS MEASURED BY SW-846 METHODS AND XRF

Analyte	SW-846, Partial Digestion (mg/kg)	SW-846 Total Digestion (mg/kg)	XRF (mg/kg)
As	7.82	18.1	Not calculated[1]
Ba	315	766	561
Ca	6120	11900	10900
Cd	2.7	N.A.	Not calculated
Cr	19.3	45.8	45.1
Cu	15.5	16.7	16.7
Fe	21300	31600	27400
Hg	0.1[2]	N.A.	Not calculated
K	3410	34200	38700
Mn	714	771	681
Ni	15.2	22.5	Not calculated[1]
Pb	23.3	35.2	28.4
Sb	1[2]	1.45	Not calculated[1]
Se	1.7	N.A.	Not calculated
Th	14.6	22.1	N.A.[1]
U	1.87	5.33	N.A.[1]
Zn	50.8	72.4	76.6

1. SW-846 total digestion value was used as a surrogate.
2. Based on maximum detected value rather than UTL when data are mostly nondetect. Background detection levels for antimony by SW-846 methods range up to 5 mg/kg.

The computation of the XRF UTL for chromium is illustrated in Figure 3.1.3-1. Of the 48 paired chromium results, 44 have SW-846 results below the SW-846 UTL of 19.3 mg/kg, and 15 of these are reported above the detection limit by XRF. Figure 3.1.3-1 is a lognormal probability plot of the 44 XRF chromium results, including the 29 that are below the detection limit of 10 to 12 mg/kg. The positive upper tail, above 12 mg/kg, is well fit by a straight line, from which a (.95,.95) UTL is estimated at 45.1 mg/kg, very close to the UTL based on the total digestion Laboratory background data.

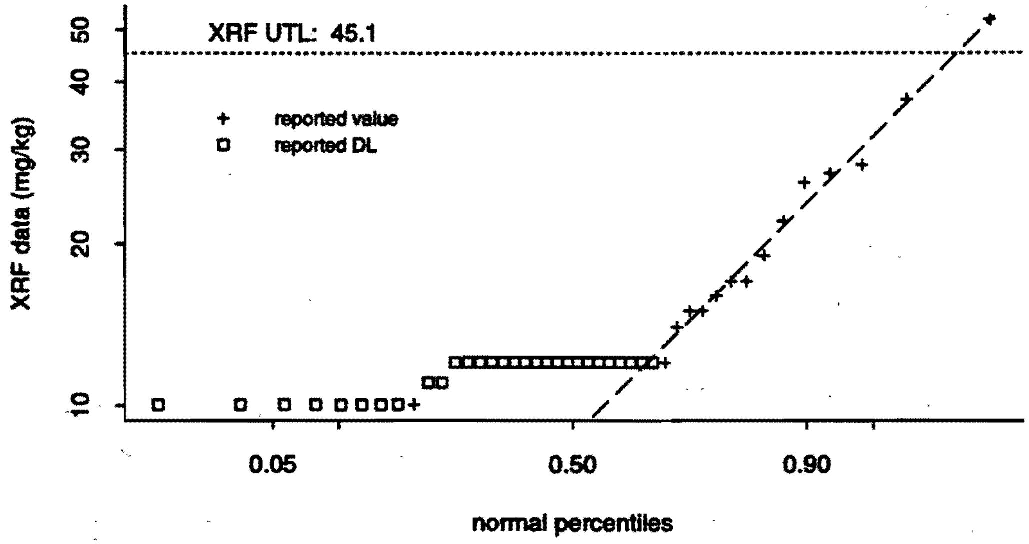

Figure 3.1.3-1. Lognormal probability plot of XRF chromium data for 44 background samples at TA-35 and TA-48.

XRF data will also be used in the human health screening assessment. However, XRF data are biased high relative to standard SW-846 data (obtained using a partial digestion sample preparation technique). The partial digestion SW-846 method is taken as the standard for risk assessment data both because it is the EPA-recommended sample preparation and analysis methodology and because the partial digestion values are likely to correspond more closely to the sample fraction that is soluble in gastrointestinal and acidic intercellular fluids. The relative bias between the two methods at naturally occurring concentration levels is illustrated by the differences between the partial digestion UTLs and the XRF UTLs shown in Table 3.1.3-1. Any anthropogenic contamination, defined as contamination above the UTL value, is assumed to be soluble by partial digestion methods. This information may be used when evaluating human health risks associated with COPCs measured by XRF methods.

3.2 Background Comparisons

After 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 an analytical laboratory or field contamination, analytical interference, or improper analyte identification or quantitation. The purpose of this decision step is to determine if chemicals for which natural or anthropogenic background distributions are available should be retained as COPCs or eliminated from further consideration. Background data used in this report were obtained from the following two sources:

- soil samples collected throughout Los Alamos County for which chemical analyses were performed for certain inorganic chemicals (metals) (Longmire et al. 1995, 48818; Longmire et al. 1995, 52227) and
- soil samples collected during RFIs at TA-35 and TA-48 and analyzed by XRF, for which confirmatory SW-846 samples indicated that inorganic chemical concentrations were indicative of natural background.

Comparisons between site data and background data are initially performed by comparing each observed concentration datum with a UTL value estimated from the background data (calculated as the 95% upper confidence limit of the 95th percentile of the background distribution where sufficient data were available. Details of statistical methods used to generate UTL values from the background data sets and suggestions for statistical methods for comparing site and background concentration distributions are presented in the guidance document *Application of LANL Background Data to ER Project Decision-Making, Part I: Inorganics* (Ryti et al. 1996, 53953) and are also discussed in Attachment I of this RFI report. Because the surface of TA-35 has been disturbed and distinct soil horizons are not evident, the "all data" soil UTL is used for background comparisons of soil samples. When samples are collected from tuff, the UTL value for the specific tuff unit from which the sample was collected is used.

If a chemical has a reported concentration that exceeds its UTL value, then that chemical is carried forward to the screening assessment process. If a chemical does not have a reported concentration that exceeds the UTL value, then that chemical is removed from further consideration. Chemicals for which one or more soil or tuff UTL values are either unavailable or are below detection limits are also carried forward to the screening assessment process. Attachment I of this RFI report contains distribution plots for the XRF data for inorganic chemicals. The statistical test results are indicated next to the PRS table (see Figures AI-1 through AI-18). If a chemical has one or more measured values exceeding its UTL value but does not fail statistical background comparison tests (that is, if the distribution of site concentrations are not statistically different from background), the chemical is generally removed from further consideration.

The ER Project has developed UTL values for the most commonly sampled chemicals and the most commonly analyzed media. For chemicals and/or media not included in the Longmire or Laboratory environmental surveillance reports, UTL values will be developed by the Decision Support Council as needed.

3.3 Evaluation of Organic Chemicals

Background data are not available for organic chemicals. The 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 if 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 limit (EQL) values based on method performance have been established for each analyte as reporting limits when the analyte is not detected. It should be noted that the specific EQL values reported for individual samples depend on a number of factors and may vary from sample to sample and from analysis to analysis. Therefore, the sample-specific EQL value for a chemical, rather than the generic EQL, must be used in this comparison.

If a 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 due to Laboratory operations. 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 and if the sample data are limited.

3.4 Human Health Assessment

3.4.1 Screening Assessment

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

- Can reported concentrations be attributed solely to positive analytical laboratory or field bias?
- Are site concentration data greater than background values?
- Is the maximum site concentration greater than the screening action level (SAL) value?

The purpose of the screening assessment is to determine if chemicals carried forward to this point in the data assessment process should be retained as COPCs or eliminated from further human health consideration based on comparison with SAL values. 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. SAL values are risk-based, medium-specific concentrations that are calculated using chemical-specific toxicity information and conservative, default exposure assumptions. A summary of the methods used to generate SAL values is provided in *Risk-Based Corrective Action Process* (Environmental Restoration Decision Support Council 1996, 53751). If a chemical does not have a reported concentration greater than its SAL value, 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 (MCE) described below. The decision to identify a chemical as a COPC when a SAL value 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 for which no reported concentration exceeds the SAL value should be retained because of the combined adverse health effects of several chemicals. This possibility is evaluated in the MCE, in which the maximum reported concentration for each chemical at any site location is divided by its respective SAL value, and the resulting normalized values are incorporated into a simple additive model. If the sum of the normalized values (that is, the total normalized value) is less than one, then the chemicals are removed from further consideration. If the total normalized value is greater than one, then chemicals having an individual normalized value greater than or equal to 0.1 are retained as COPCs pending further evaluation.

Only those chemicals carried forward to the screening assessment whose highest detected value is below the SAL value are included in the MCE. When background comparisons are performed for two or more geologic units or when multiple analytical methods are used to generate the data set, it is possible that the highest absolute value measured at a site may be below the UTL for that particular sample. In these cases, the highest detected concentration above the sample-specific UTL is used in the MCE calculation. If only one background UTL is identified for a data set, the highest measured value will always be used in the MCE if that value is above the UTL and below the SAL. If an inorganic chemical having no UTL is measured above detection limits, the highest value will also be used in the MCE calculation.

Chemicals are divided into two classes for the MCE calculation: noncarcinogens and chemical carcinogens. 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* (Environmental Restoration Decision Support Council 1996, 53751).

3.4.2 Risk Assessment

The human health risk assessments presented in Chapter 5.0 of this RFI report follow the guidance document *Risk-Based Corrective Action Process* (Environmental Restoration Decision Support Council 1996, 53751). A quantitative human health risk assessment process generally consists of the following four steps:

- identification of COPCs,
- exposure assessment,
- toxicity assessment, and
- risk characterization.

Although COPCs were identified at several PRSs described in this RFI report, quantitative risk assessments have not been performed. When risk assessments were performed, the nature and extent of contamination were such that a qualitative evaluation of the data formed a sufficient basis for a recommendation of NFA.

3.5 Ecological Risk Assessment Methodology

In accordance with conversations among Laboratory ER Project personnel, personnel from the Los Alamos Area Office of the Department of Energy, and the regulators, discussion of ecological risk assessment methodology will be deferred until the Ecological Exposure Unit (Ecozone) methodology, which is being developed by the Laboratory in conjunction with EPA Region 6 and the NMED, has been approved by the regulators.

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4.0 RESULTS OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

The objective of the Technical Area (TA) -35 Phase I Resource Conservation and Recovery Act facility investigation (RFI) is to determine if any chemicals of potential concern (COPCs) are present at a potential release site (PRS) decision set. To meet this objective, the analytical methods that are summarized in Table 3.1.1-1 in Chapter 3.0 of this RFI report were applied. Quality control (QC) procedures were implemented in the analytical laboratory to provide estimates of the bias and precision of the analytical measurements. The following specific QC samples and procedures were used to assess bias: laboratory blank samples, system monitoring compound (surrogate) recovery, matrix spike recovery, and laboratory control samples (LCSs). The specific QC samples and procedures used to assess precision were laboratory duplicate samples and matrix spike duplicate samples. In addition, technical holding time criteria were applied to ensure that the analytical results were not biased because of sample degradation or loss.

QC samples were also collected in the field to provide information regarding sampling procedure bias. Field QC samples included the following: bottle blanks, equipment rinsate blanks, and trip blanks (for volatile organic compound [VOC] analysis only). The results of analysis of the field QC samples indicated that no bias or false positive results were introduced because of field sampling procedures.

In the following sections, estimates of the precision and bias of the main analyte suites are presented by evaluating the specific quality indicators listed above, based on the QC data available for all samples collected at TA-35. The effectiveness of the analytical methods for detecting COPCs in soil matrices is also assessed. Potential limitations in the analytical data that may impact their intended use are noted. A subset of the TA-35 sample results were evaluated for this RFI report, and a specific discussion of the sample results presented in this report appears at the end of each section. The results for individual samples were qualified by evaluation of the above listed QC parameters as described in Section 3.1.2 in Chapter 3.0 of this RFI report. Qualifiers resulting from the validation process are defined in Table 3.1.2-1 in Chapter 3.0 of this RFI report and are shown in the analytical tables in Chapter 5.0 of this RFI report. Details regarding the qualification of analytical results for individual samples reported in this RFI report are given in Appendix B of this RFI report.

4.1 Inorganic Analyses

Trace metals in soil samples collected at TA-35 were analyzed by either SW-846 methods (EPA 1986, 31732) (or the Contract Laboratory Program equivalent) or energy dispersive x-ray fluorescence (XRF), as summarized in Table 4.1-1. The four SW-846 methods chosen were inductively coupled plasma emission spectroscopy (ICPES), inductively coupled plasma mass spectrometry (ICPMS), graphite furnace atomic absorption (GFAA), and cold vapor atomic absorption. The XRF protocol chosen is described in the Laboratory internal method EI-732 (LANL 1993, 31794). All XRF analyses were carried out in a mobile laboratory facility. The SW-846 analyses were performed by either internal or external fixed-site laboratories. Technical holding times were met for all analyses.

Of the 354 soil samples collected at TA-35 that were analyzed for trace metals, 278 (79%) were analyzed by XRF; the remaining 76 (21%) were analyzed by SW-846 methods. To provide confirmation of the XRF results, 12% of the soil samples (34 of 278) that were analyzed by XRF were also submitted for SW-846 analysis. In the screening assessment of inorganic chemicals, the SW-846 results are reported when results by both XRF and SW-846 methods are available. For the PRSs evaluated in this RFI report, 38 soil samples were analyzed by XRF, and 7 confirmatory samples (18%) were analyzed by SW-846 methods.

TABLE 4.1-1

ANALYTICAL METHODS FOR TRACE METAL ANALYSIS

Analytical Protocol	Analytical Method	Analyte Suite
LANL EI-732	EDXRF	As, Ba, Ca, Cd, Cr, Cu, Fe, Hg, K, Mn, Ni, Pb, Sb, Se, Th, Ti, U, and Zn
SW-846 Method 6010	ICPES	Al, Sb, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Li*, Mg, Mn, Mo*, Ni, K, Ag, Na, Sr*, V, and Zn
SW-846 Method 6020	ICPMS	Pb, Sb, and Tl
SW-846 Method 7000-series	GFAA	As, Pb, Se, and Tl
SW-846 Method 7470	CVAA	Hg

* Analyte reported by internal fixed-site laboratory only

4.1.1 Comparison of SW-846 and XRF Methods

The SW-846 methods employed for soil sample analysis require acid digestion of the sample before the instrumental analysis. Sample digestion was not required for the XRF method because of the nature of the physical phenomenon on which the measurement is based. The only sample preparation required for soils using the XRF method is drying followed by milling and sieving. Therefore, trace metal analysis of soils using this method is faster, less labor-intensive, and less expensive than using the SW-846 methods. For these reasons, the use of XRF for Phase I sample analysis was an attractive alternative to the SW-846 methods.

As discussed in Section 3.1.4 in Chapter 3.0 of this RFI report, analytical results obtained by both XRF and SW-846 methods are not directly comparable. The XRF results are generally significantly higher than SW-846 results, particularly for barium, calcium, chromium, copper, iron, lead, potassium, and zinc. The higher levels measured for certain analytes by XRF are a consequence of the penetrating nature of x-rays. Fluorescence is observed from soil matrix analytes, such as mineral crystals, as well as surface-adsorbed analytes. The acid digestion procedure used in sample preparation for SW-846 methods dissolves surface-adsorbed compounds but does not efficiently dissolve the mineral compounds that compose the soil matrix. Therefore, site-specific background levels determined using SW-846 methods of analysis cannot be compared with the XRF results. Rather, the XRF results are more nearly comparable to the "whole rock" background measurements obtained when the sample is completely digested using hydrofluoric acid.

The estimated detection limits (EDLs) for both SW-846 and XRF methods are compared with the analyte-specific upper tolerance limits (UTLs) and screening action levels (SALs) for soil samples in Table 4.1.1-1. For SW-846 methods, both the mixed soil and Qbt3 UTL values are given because soil samples collected at TA-35 were predominantly from one of these two background units. For the XRF method, the UTL value listed is that presented in Section 3.1.4 in Chapter 3.0 of this RFI report. For the XRF analytes arsenic, nickel, antimony, thorium, and uranium, the "whole rock" UTL value is used as a surrogate background level. As discussed in Section 3.1.4, the "whole rock" UTL value is based on the ICPES or GFAA analysis of samples that underwent complete digestion using hydrofluoric acid.

TABLE 4.1.1-1

COMPARISON OF ESTIMATED DETECTION LIMITS WITH UPPER TOLERANCE LIMITS AND SCREENING ACTION LEVELS FOR INORGANIC ANALYTES

Analyte	SW-846 Method (mg/kg)			XRF Method (mg/kg)		Soil SAL (mg/kg)
	EDL	Mixed-Soil UTL	Qbt3 UTL	EDL	XRF UTL	
Aluminum	40	38700	3700	NA	N/A	77000
Antimony	12	1	0.4	4	1.45*	31
Arsenic	2.0	7.82	5	4	18.1*	N/A
Barium	40	315	28	10	561	5300
Beryllium	1	1.95	1.53	NA	N/A	N/A
Cadmium	1	2.7	N.A.	3	N.A.	38
Calcium	1000	6120	1520	100	10900	N.A.
Chromium	2	19.3	2.1	12	45.1	210
Cobalt	10	19.2	27.4	NA	N/A	4600
Copper	5	15.5	2	8	16.7	2800
Iron	20	21300	9040	10	27400	N.A.
Lead	0.2	23.3	16.2	7	28.4	400
Magnesium	1000	4610	628	NA	N/A	N.A.
Manganese	3	714	426	16	681	N/A
Mercury	0.1	0.1	N.A.	5	N.A.	23
Nickel	8	15.2	2.6	13	22.5*	1500
Potassium	1000	3410	735	100	38700	N.A.
Selenium	1.0	1.7	N.A.	4	N.A.	380
Silver	2	N.A.	1.9	NA	N/A	383
Sodium	1000	915	1940	NA	N/A	N.A.
Strontium	2	317	N.A.	NA	N/A	46000
Thallium	2.0	1	1.7	NA	N/A	N.A.
Thorium	NA	14.6	9.29	8	22.1*	N.A.
Titanium	NA	N.A.	N.A.	30	N.A.	N.A.
Uranium	NA	1.87	1.64	8	5.33*	230
Vanadium	10	41.9	4.01	NA	N/A	540
Zinc	4	50.8	55.5	5	76.6	23000

* "Whole rock" UTL used as a surrogate for XRF UTL. See Section 3.1.4 in Chapter 3.0 of this RFI report.

The target analyte list for the SW-846 methods, as implemented by the Environmental Restoration (ER) Project, differs from the analyte list for the XRF method. The following six analytes were not determined by XRF but were determined by ICPES or ICPMS: beryllium, cobalt, magnesium, silver, sodium, and thallium. The XRF technique is not sensitive to elements with an atomic number of 11 (sodium) or less; therefore, detecting beryllium or sodium by the XRF method is not possible.

The analytes thorium, titanium, and uranium were not determined by SW-846 but were determined by XRF. Isotopic uranium measurements were also performed by alpha spectrometry. Neither a SAL value nor a UTL background level has been established for titanium. The "whole rock" UTL value is used as a surrogate background level for thorium, but a SAL value is not available. The decision to identify a chemical as a COPC in the screening assessment when a SAL value is not available is made on a case-by-case basis, taking into account the availability of process knowledge and toxicological information.
The SW-846 analyte EDLs are element-dependent and range from 0.1 mg/kg to 1,000 mg/kg. The XRF analyte EDLs are also element-dependent and generally greater than the corresponding SW-846 EDLs, ranging from 3 mg/kg to 100 mg/kg. Sample-specific EDLs may be higher or lower than the contract-required EDLs listed in Table 4.1.1-1, depending on sample-specific matrix effects. Generally, the sensitivity of either method is sufficient to detect trace metals in soil samples at levels below the background UTLs for those chemicals for which UTL values are available, with the following exceptions: antimony (SW-846 and XRF), thallium (SW-846), and uranium (XRF). If the EDL for an analyte exceeds its UTL but the analyte is not detected at a PRS or PRS decision set, the analyte does not appear in the data tables in Chapter 5.0 of this RFI report. XRF UTL values are not available for cadmium, mercury, or selenium; however, the XRF method can readily detect concentrations of these analytes well below their respective SAL values.

4.1.2 Evaluation of Quality Control Data for SW-846 Analyses

The accuracy of the SW-846 measurements was monitored by the concurrent analysis of aqueous and solid LCSs. Results for individual soil samples were qualified on the basis of the LCS that was analyzed in the same batch, according to the criteria given in the national functional guidelines for data review (EPA 1994, 48639).

The bias of the SW-846 measurements was assessed by the analysis of matrix spike samples. The results for 22 soil matrix spike samples (11 mercury spike samples) were reported with the TA-35 data set and are summarized in Table 4.1.2-1. The average recovery and the 1-sigma standard error indicate acceptable recovery with no apparent bias for all trace metal analytes that were spiked into soil matrices. The analytical results for individual samples were qualified according to Environmental Protection Agency (EPA) guidelines if the individual matrix spike recoveries indicated an unacceptable bias in the measurement of individual analytes.

TABLE 4.1.2-1

SW-846 RESULTS FOR MATRIX SPIKE SAMPLES

Analyte	Average Percent Recovery*
Arsenic	106 ± 12
Barium	102 ± 8
Beryllium	103 ± 19
Cadmium	99 ± 8
Chromium	113 ± 32
Cobalt	102 ± 4
Copper	99 ± 14
Mercury	86 ± 17
Potassium	97 ± 5
Manganese	105 ± 43
Nickel	108 ± 22
Lead	86 ± 21
Antimony	79 ± 18
Selenium	90 ± 23
Silver	98 ± 9
Thallium	99 ± 5
Vanadium	102 ± 6
Zinc	113 ± 23

* Average percent recovery and 1-sigma standard error are based on analysis of 22 soil matrix spike samples (11 mercury spike samples).

The precision of the SW-846 measurements was assessed by the analysis of laboratory duplicate samples. The results for 24 laboratory duplicate soil samples were reported with the TA-35 data set. The relative percent differences (RPDs) for duplicate measurements of the target analytes are summarized in Table 4.1.2-2. The average RPD values do not exceed 26%, which indicates acceptable method precision. The EPA guidelines suggest a control criteria of ±35% RPD for the assessment of duplicate sample results because laboratory variability arising from the subsampling of heterogeneous soil samples is a common occurrence. The analytical results for individual samples were qualified according EPA guidelines if duplicate sample analysis indicated precision control problems with the measurement.

TABLE 4.1.2-2

SW-846 RESULTS FOR DUPLICATE SAMPLES

Analyte	Average Percent Difference*
Aluminum	16 ± 14
Arsenic	21 ± 18
Barium	14 ± 11
Beryllium	12 ± 13
Cadmium	24 ± 30
Calcium	14 ± 14
Chromium	23 ± 19
Cobalt	13 ± 16
Copper	26 ± 33
Iron	24 ± 41
Mercury	6 ± 9
Potassium	13 ± 12
Magnesium	16 ± 14
Manganese	17 ± 16
Sodium	12 ± 11
Nickel	22 ± 21
Lead	15 ± 12
Antimony	1 ± 2
Selenium	2 ± 10
Silver	23 ± 45
Thallium	9 ± 22
Vanadium	15 ± 11
Zinc	14 ± 9

* Average percent difference and 1-sigma standard error are based on analysis of 24 laboratory duplicate soil samples.

4.1.3 Evaluation of Quality Control Data for XRF Analyses

Initial calibration of the XRF instrument was accomplished using the following seven Canadian Certified Reference Material Program (CCRMP) and National Institute of Standards and Technology (NIST) standard reference materials (SRMs): CCRMP-SY-2, CCRMP-BL-4, and NIST-SRMs1648 (urban particulate); 2704 (Buffalo River sediment); 2709 (San Joaquin soil); 2710 (Montana soil); and 2711 (Montana soil). This number of calibration standards was required to bracket a reasonable range of concentrations for all the analytes. The accuracy of the XRF measurements was monitored daily by the analysis of at least one solid LCS sample with each analytical batch. The following CCRMP or NIST SRMs were used to check the instrument performance: CCRMP-SO-1, CCRMP-SO-2, CCRM-SO-4, CCRM-SY-3, and NIST-SRM-1646 (estuarine sediment).

The XRF results for the daily LCS measurements performed for the TA-35 RFI are summarized in Table 4.1.3-1. The average recovery and the 1-sigma standard error based on 26 measurements are presented. The results indicate that the instrument control status of cadmium, mercury, antimony, selenium, and uranium was not adequately monitored during sample measurement. Consequently, the XRF results for these analytes should be regarded as estimates, although the direction of any possible bias is unknown. The results for nickel indicate a low bias for this analyte. The results for the remaining analytes indicate no apparent or slightly high biases in the measurements.

TABLE 4.1.3-1

XRF RESULTS FOR SOLID LABORATORY CONTROL SAMPLES

Analyte	Average Percent Recovery*
Arsenic	108 ± 60
Barium	111 ± 11
Calcium	111 ± 29
Cadmium	<EDL
Chromium	102 ± 10
Copper	113 ± 29
Iron	105 ± 7
Mercury	<EDL
Potassium	97 ± 5
Manganese	106 ± 12
Nickel	74 ± 9
Lead	90 ± 16
Antimony	<EDL
Selenium	<EDL
Thorium	121 ± 24
Titanium	98 ± 7
Uranium	<EDL
Zinc	102 ± 7

* Average percent recovery and 1-sigma standard error are based on 26 measurements of laboratory control samples.

4.2 Organic Analyses

Soil samples collected at TA-35 were analyzed for VOCs, semivolatile organic compounds (SVOCs), polychlorinated biphenyl compounds (PCBs), polycyclic aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH) using the methods described in Table 3.1.1-1 in Chapter 3.0 of this RFI report. Samples were analyzed at either internal or external fixed-site laboratories or at a mobile laboratory facility. In the following sections, which focus on the laboratory QC activities, the differences between the fixed-site and mobile laboratory methods are also discussed. The mobile laboratory methods generally used less effective extraction methods and abbreviated QC procedures to save time and costs. Consequently, the mobile laboratory sample results should be considered screening level data with a possible low bias (compared with SW-846 methods) and are qualified with an "S" flag in the tables in Chapter 5.0 of this RFI report. Samples collected at the PRSs evaluated in this RFI report were analyzed for VOCs, SVOCs, PCBs, and PAHs. No TPH analyses were performed.

4.2.1 Volatile Organic Compound Analysis

Soil samples were analyzed for VOCs at either fixed-site or mobile laboratory facilities. Sample analyses performed at fixed-site laboratories used either SW-846 Method 8260 or the Contract Laboratory Program OLM01.8 protocol to detect low-level contamination. Samples were extracted using the SW-5030 purge and trap method. The ER Project analytical services statement of work (LANL 1995, 49738) contains the detailed analyte lists, estimated quantitation limits (EQLs), required QC procedures, and the acceptance criteria for analyses performed by external laboratories. The required QC procedures for the analyses performed by the internal laboratory are described in the Laboratory health and environmental chemistry manual (LANL 1993, 31794). The required QC procedures are based on guidelines given in the EPA SW-846 laboratory manuals. The sample EQLs reported by the internal laboratory were not corrected for dry weight and therefore exhibited low bias. The EQLs for soil samples are less than the soil SALs for all VOC analytes.

Soil samples were analyzed in the mobile laboratory facility according to Laboratory Method No. MLO720, which is a modification of the SW-846 Method 8260 gas chromatography/mass spectrometry (GC/MS) procedure. Samples were extracted using the SW-5030 purge and trap method. Tier 1 QC procedures were implemented, where Tier 1 requirements consist of a daily 1-point calibration check and a daily method blank analysis. System performance was monitored by the addition of three surrogate compounds. Sample results were reported on a wet weight basis and therefore are biased low. The EQLs for this method are generally the same as for the fixed-site laboratory method.

Of the 173 VOC analyses requested for the TA-35 RFI, 128 samples (74%) were analyzed at the mobile laboratory facility and 45 samples (26%) at fixed-site laboratories. Of the samples analyzed at the mobile laboratory facility, 19 (15%) were also submitted for analysis to a fixed-site laboratory. If sample results are available by both fixed-site and mobile laboratory analysis, the higher result has been used for screening purposes.

Average surrogate recoveries for four surrogate compounds, which are reported in Table 4.2.1-1, indicate acceptable method accuracy for both the fixed-site and mobile laboratory measurements. Only two soil matrix spike and matrix spike duplicate pairs were analyzed for this RFI. The average recoveries of the five spike compounds, reported in Table 4.2.1-2, indicated acceptable method bias. The average relative percent differences between recoveries of all five spike compounds from the soil duplicate pairs did not exceed 14%, which indicates acceptable method precision.

For the PRSs evaluated in this RFI report, 38 soil samples were analyzed for VOCs at the mobile laboratory facility, and 7 confirmatory samples (18%) were submitted for fixed-site laboratory analysis. No target analytes were detected in any samples. The results for the method blank sample were not reported for the mobile laboratory measurements, but there is no impact on data usability because no target analytes were detected in the soil samples.

All technical holding times for analysis were met for the samples evaluated in this RFI report.

TABLE 4.2.1-1

RECOVERY OF VOLATILE ORGANIC SURROGATE COMPOUNDS FROM SOIL SAMPLES

Surrogate Compound	Average Percent Recovery	
	Fixed-Site Laboratory	Mobile Laboratory
4-Bromofluorobenzene	101 ± 17	107 ± 28
Dibromofluoromethane	104 ± 9	NA
1,2-Dichloroethane-d4	103 ± 14	116 ± 15
Toluene-d8	98 ± 7	101 ± 8

TABLE 4.2.1-2

RECOVERY OF VOLATILE ORGANIC MATRIX SPIKE COMPOUNDS FROM SOIL SAMPLES

Spike Compound	Average Percent Recovery	Average Relative Percent Difference*
Benzene	106 ± 11	12
Chlorobenzene	113 ± 12	6
1,1-Dichloroethane	87 ± 21	14
Toluene	124 ± 19	11
Trichloroethene	95 ± 2	2

* Relative percent difference is calculated based on the recovery of spike compound from matrix spike and matrix spike duplicate sample pair.

4.2.2 Semivolatile Organic Compound Analysis

Soil samples were analyzed for SVOCs at either fixed-site or mobile laboratory facilities. Sample analyses performed at fixed-site laboratories used either SW-846 Method 8270 or the Contract Laboratory Program OLM01.8 protocol to detect low-level contamination. The ER Project analytical services statement of work (LANL 1995, 49738) contains the detailed analyte lists, EQLs, required QC procedures, and the acceptance criteria for analyses performed by external laboratories. The required QC procedures for the analyses performed by the internal laboratory are described in the Laboratory health and environmental chemistry manual (LANL 1993, 31794). The required QC procedures are based on guidelines given in the EPA SW-846 laboratory manuals. The sample EQLs reported by the internal laboratory were not corrected for dry weight and therefore exhibited low bias.

Seven SVOC analytes have soil EQLs for the fixed-site laboratory analysis (0.330 mg/kg) that are greater than the soil SAL: m-benzidine (0.0019 mg/kg), benzo[a]pyrene (0.061 mg/kg), bis(2-chloroethyl) ether (0.074 mg/kg), dibenzo[a,h]anthracene (0.061 mg/kg), hexachlorobenzene (0.280 mg/kg), N-nitrosodi-n-propylamine (0.063 mg/kg), and N-nitrosodimethylamine (0.0087 mg/kg). No standard, readily available method exists that could achieve EQLs as low as several parts per billion in soil for these compounds.

Soil samples were analyzed in the mobile laboratory facility according to Laboratory Method No. MLO500, which is a modification of the SW-846 Method 8270 GC/MS procedure. The samples were extracted into methylene chloride using rotary table agitation according to the procedure described in Laboratory

Method No. MLO510. Tier 1 QC procedures were implemented, where Tier 1 requirements consist of a daily 1-point calibration check and a daily method blank analysis. System performance was monitored by the addition of surrogate compounds. Sample results were reported on a wet weight basis and are therefore biased low. A nominal EQL of 1.0 mg/kg is cited for this method. In addition to the seven SVOC analytes listed above, the soil EQL exceeds the SAL value for the following four compounds: benzo[a]anthracene (0.610 mg/kg), benzo[b]fluoranthene (0.610 mg/kg), indeno[1,2,3-cd]pyrene (0.610 mg/kg), and 3,3'-dichlorobenzidine (0.990 mg/kg).

Of the 420 SVOC analyses requested for the TA-35 RFI, 283 samples (67%) were analyzed at the mobile laboratory facility and 137 samples (33%) at fixed-site laboratories. Of the samples analyzed at the mobile laboratory facility, 33 (12%) were also submitted for analysis to a fixed-site laboratory. If sample results are available for both fixed-site and mobile laboratory analysis, the higher result has been used for screening purposes.

Average surrogate recoveries for six surrogate compounds (three base/neutral and three acid) are reported in Table 4.2.2-1 for both the fixed-site and mobile laboratory measurements. There are no significant differences in the surrogate recoveries between the fixed-site and the mobile laboratory facilities. The recovery of all six surrogates from soil matrices is biased low. However, either method was adequate for the detection and reliable quantitation at concentrations near or above the SAL of those compounds for which the EQL is less than the SAL.

TABLE 4.2.2-1

RECOVERY OF SEMIVOLATILE ORGANIC SURROGATE COMPOUNDS FROM SOIL SAMPLES

Surrogate Compound	Average Percent Recovery	
	Fixed-Site Laboratory	Mobile Laboratory
Base/Neutral		
2-Fluorobiphenyl	73 ± 13	71 ± 14
Nitrobenzene-d5	67 ± 17	61 ± 15
Terphenyl-d14	77 ± 15	84 ± 15
Acid		
2-Fluorophenol	69 ± 17	55 ± 12
Phenol-d6	69 ± 15	61 ± 13
2,4,6-Tribromophenol	77 ± 15	77 ± 11

Ten soil matrix spike and matrix spike duplicate pairs were analyzed for this RFI. The average recoveries of the 11 spike compounds, reported in Table 4.2.2-2, generally indicated the same low method bias seen in the surrogate recovery measurements. The average relative percent differences between recoveries of the 11 spike compounds from the soil duplicate pairs did not exceed 18%, which indicates acceptable method precision.

TABLE 4.2.2-2

RECOVERY OF SEMIVOLATILE ORGANIC MATRIX SPIKE COMPOUNDS FROM SOIL SAMPLES

Spike Compound	Average Percent Recovery	Average Relative Percent Difference*
Base/Neutral		
Acenaphthene	73 ± 16	11
1,4-Dichlorobenzene	63 ± 21	16
2,4-Dinitrotoluene	71 ± 12	10
N-Nitrosodi-n-propylamine	65 ± 13	17
Pyrene	84 ± 18	9
1,2,4-Trichlorobenzene	69 ± 20	13
Acid		
4-Chloro-3-methylphenol	84 ± 35	9
o-Chlorophenol	76 ± 32	17
4-Nitrophenol	78 ± 25	11
Pentachlorophenol	93 ± 30	10
Phenol	77 ± 36	18

* Relative percent difference is calculated based on the recovery of spike compound from matrix spike and matrix spike duplicate sample pair.

For the PRSs evaluated in this RFI report, no samples were analyzed for SVOCs at the mobile laboratory facility. Instead, 39 samples were screened only for PAH compounds according to the method described in Section 4.2.4. Seven soil samples (18%) were submitted to a fixed-site laboratory for the full-suite SVOC analysis. Laboratory-introduced phthalate contamination was detected in one soil sample collected at PRS No. 35-004(h), and the sample result has been qualified according to EPA guidelines (see Appendix B of this RFI report). Numerous unknown organic compounds and unsaturated hydrocarbons were reported as tentatively identified compounds in a soil sample collected at Location ID No. 35-2102 in PRS No. 35-004(g). All technical holding times were met for the fixed-site laboratory analyses.

4.2.3 Polychlorinated Binephenyl Compound Analysis

Soil samples were analyzed for PCBs at either fixed-site or mobile laboratory facilities. Sample analyses performed by external fixed-site laboratories used either the SW-8081 gas chromatography/electron capture detection (GC/ECD) method (dual column option) or the Contract Laboratory Program OLM01.8 protocol. The ER Project analytical services statement of work (LANL 1995, 49738) contains the detailed analyte lists, EQLs, required QC procedures, and the acceptance criteria for analyses performed by external laboratories. The statement of work requires analysis for Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260. The QC requirements include external calibration, monitoring of the recovery of either of two surrogate compounds (decachlorobiphenyl or tetrachloro-m-xylene), and second-column confirmation of any detected aroclors. The required EQL is 0.033 mg/kg for soil samples, which is less than the soil SAL of 1 mg/kg for mixed PCBs.

Samples were analyzed by the internal laboratory using the Laboratory protocol EO-430 (LANL 1993, 31794), which is a single-column GC/ECD method. Internal calibration methods were used. Surrogate compounds were not added to the samples; therefore, no statement regarding the accuracy of the method can be made. Samples were analyzed for Aroclors 1242, 1254, and 1260. The method EQL is 0.050 mg/kg for soil samples, which is less than the soil SAL of 1 mg/kg for mixed PCBs. The sample EQLs reported by the internal laboratory were not corrected for dry weight and therefore exhibited low bias.

Soil samples were analyzed in the mobile laboratory facility according to Laboratory Method No. MLO410, which is a modification of the SW-846 Method 8081 GC/ECD (single column option) procedure. The samples were extracted into hexane using rotary table agitation according to the procedure described in Laboratory Method No. MLO510. Tier 1 QC procedures were implemented, where Tier 1 requirements consist of a daily 1-point calibration check and a daily method blank analysis. System performance was monitored by the addition of a surrogate compound (2,4,5-tribromobiphenyl), but surrogate recovery was not consistently monitored. Samples were analyzed for Aroclors 1242, 1254, and 1260. The soil EQL is 1 mg/kg, which is equivalent to the SAL value for mixed PCBs. Sample results were reported on a wet weight basis and are therefore biased low.

Of the 327 PCB analyses requested for the TA-35 RFI, 216 samples (66%) were analyzed by the mobile laboratory facility and 111 (34%) at fixed-site laboratories. Of the samples analyzed at the mobile laboratory facility, 18 (8%) were also submitted to a fixed-site laboratory for analysis. If sample results are available by both fixed-site and mobile laboratory analysis, the higher result has been used for screening purposes. The only PCBs that were detected at TA-35 were Aroclors 1254 and 1260.

Table 4.2.3-1 summarizes the average recovery of surrogate compounds by both external fixed-site and mobile laboratory facilities. In the fixed-site laboratory analyses, the recovery of tetrachloro-*m*-xylene exhibited a low, but acceptable, bias; the recovery of decachlorobiphenyl exhibited no apparent bias. The recovery of 2,4,5-tribromobiphenyl in the mobile laboratory analyses exhibited no apparent bias.

TABLE 4.2.3-1

AVERAGE SURROGATE RECOVERIES FOR ANALYSIS OF POLYCHLORINATED BIPHENYL COMPOUNDS IN SOIL SAMPLES

	Average Percent Recovery	
Surrogate Compound	**Fixed-Site Laboratory**	**Mobile Laboratory**
Decachlorobiphenyl	99 ± 38	NA
Tetrachloro-*m*-xylene	77 ± 12	NA
2,4,5-Tribromobiphenyl	NA	104 ± 21

For the PRSs evaluated in this RFI report, 30 samples were analyzed at the mobile laboratory facility, and 5 confirmatory samples (17%) were submitted to a fixed-site laboratory. No PCB target analytes were detected in samples analyzed at the fixed-site laboratory. Four of the 5 samples submitted to the fixed-site laboratory were also analyzed for pesticides; no pesticide target analytes were detected. The mobile laboratory facility detected PCB target analytes in samples collected at PRS Nos. 35-004(a and g), 35-009(e), 35-014(g_1), and 35-016(n). All technical holding times were met for both the mobile laboratory facility and the fixed-site laboratory analyses.

4.2.4 Polycyclic Aromatic Hydrocarbon Analysis

To screen for the presence of SVOCs, 39 soil samples collected from the PRSs evaluated in this RFI report were analyzed for PAH compounds at the mobile laboratory facility. The gas chromatography/flame ionization detector method used is a modification of SW-846 Method 8100. The samples were extracted into methylene chloride using rotary table agitation according to the procedure described in Laboratory Method No. MLO510. Tier 1 QC procedures were implemented, where Tier 1 requirements consist of a daily 1-point calibration check and a daily method blank analysis. Sample results were reported on a wet weight basis and are therefore biased low.

The analyte list consisted of the 14 PAHs listed in Table 4.2.4-1. Benzo[b]fluoranthene and benzo[k]fluoranthene are not resolved. Dibenzo[a,h]anthracene was also included as a target analyte for some analyses. A nominal EQL of 0.1 mg/kg is cited for this method, which is less than the soil SALs for all the target analytes (for which SALs are available) except benzo[a]pyrene. Other extractable organic compounds present in the sample, but not identified as target analytes, are quantitated to an EQL of 5 mg/kg using the response factor for naphthalene and reported as "Total Extractable Organic Compounds."

TABLE 4.2.4-1

ANALYTE LIST FOR POLYCYCLIC AROMATIC HYDROCARBON ANALYSIS USING MODIFIED SW-8100 METHOD

Analyte	EQL (mg/kg)	SAL (mg/kg)
Naphthalene	0.1	800
Acenaphthylene	0.1	N.A.
Acenaphthene	0.1	360
Fluorene	0.1	300
Phenanthrene	0.1	N.A.
Fluoranthene	0.1	2600
Anthracene	0.1	19
Pyrene	0.1	2000
Benz[a]anthracene	0.1	0.61
Chrysene	0.1	24
Benzo[b]fluoranthene/Benzo[k]fluoranthene	0.1	0.61/6.1
Benzo[a]pyrene	0.1	0.061
Indeno[1,2,3-cd]pyrene	0.1	0.61
Benzo[g,h,i]perylene	0.1	N.A.

System performance was monitored by the addition of a surrogate compound, tetradecane; however, the surrogate recovery was not consistently reported. The average surrogate recovery (based on reported results) was 89 ± 13%, which indicates acceptable method bias. In several of the samples, the surrogate recovery could not be determined because the presence of petroleum hydrocarbon interference required sample dilution.

Of the 39 samples analyzed in the mobile laboratory facility, target analytes were detected only in samples collected at PRS No. 35-016(q). No confirmatory samples were analyzed from PRS No. 35-016(q). PAHs were also detected at low levels in confirmatory samples collected at PRS Nos. 35-014(g_1), 35-016(n), and 35-016(j). Total extractable organic compounds were reported in a soil sample collected at Location ID No. 35-2190 in PRS No. 35-016(b). The result of 63 mg/kg (quantitated as naphthalene) should be regarded as estimated. Petroleum hydrocarbons (C_{10} to C_{20} range) were detected and quantitated using the tetradecane response factor in two soil samples collected at Location ID No. 35-2192 in PRS No. 35-016(j). The results reported in Section 5.7.6 in Chapter 5.0 of this RFI report should be regarded as estimated. A large peak consistent with oil was reported for the sample collected at Location ID No. 35-2114 in PRS No. 35-016(q); however, the peak was not quantitated.

All technical holding times were met for both the mobile laboratory facility and the fixed-site laboratory analyses.

5.0 SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 PRS Nos. 35-004(a) and 35-009(e)

Potential Release Site (PRS) No. 35-004(a) is a container storage area located at the southeast corner of the Sodium Building (TA-35-25). PRS No. 35-009(e) is a drain line from TA-35-25 that discharges to an outfall in Ten Site Canyon. These PRSs are included in the same decision set because they are located in such close proximity that contaminants associated with the container storage area, if any, would intermingle with contaminants below the outfall discharge area. Therefore, they cannot be evaluated independently.

Aroclor 1260 was the only chemical of potential concern (COPC) identified during the screening assessment. Aroclor 1260 is evaluated in the risk assessment in Section 5.1.7.2. In addition, chromium, copper, lead, thorium, uranium, and zinc were measured in one or more samples above background upper tolerance limit (UTL) values.

PRS Nos. 35-004(a) and 35-009(e) are recommended for no further action (NFA) based on NFA criterion number 4 (LANL 1995, 53863).

Radiological sample results are neither presented nor discussed for these PRSs and will be provided later as an addendum to this Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) report. A summary of samples submitted for radiological analyses is shown in Section 5.1.4.3.

5.1.1 History

PRS Nos. 35-004(a) and 35-009(e) are discussed in detail in Section 3.3.2 of the work plan and Section 7.24 of the June 1994 addendum to the work plan (LANL 1992, 7666; Pratt 1994, 43475).

PRS No. 35-004(a) reportedly stored solvents (including Stoddard solvent) and oil (LANL 1990, 7511). Releases were apparent during the 1990 site inspection; however, it has been reported that this area was cleaned up (LANL 1992, 7666).

PRS No. 35-009(e) is a drain line from TA-35-25 that discharges to an outfall in Ten Site Canyon, which is located 30 ft south of the building (LANL 1990, 7511). However, the location of the outfall is covered with asphalt, and the outfall status is unknown.

The contaminants that were potentially present (and therefore investigated during the RFI) include radionuclides, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, and polychlorinated biphenyls (PCBs).

5.1.2 Description

Several obvious oil spills are present on the asphalt. At the time of the RFI, no storage containers were present; however, a temporary, metal, hazardous storage building (TA-35-386) was present. Oil stains on the asphalt protrude from beneath TA-35-386, which is probably located at the site of PRS No. 35-004(a).

Engineering drawings show that the drain line exited southward from the center of TA-35-25 perpendicular to the building. The area south of TA-35-25 is now completely paved for a distance of 50 ft with asphalt that serves as a small parking area and access road. At a distance of 30 ft south of TA-35-25, a 3-ft vertical slope separates the parking area from the access road. This slope may have been the area of the outfall.

A natural drainage is present at the edge of the asphalt-paved access road approximately 50 ft south of TA-35-25. The drainage handles storm-water runoff from the parking area and container storage area, which is discharged southward into Ten Site Canyon. Flow through the drainage is intermittent and sourced by natural precipitation. The area is heavily vegetated with thick shrubs, a few pine trees, pine needles, and leaves. The vegetation appears to be normal and healthy.

5.1.3 Previous Investigations

No previous investigations have been performed at this site.

5.1.4 Field Investigation

The objective of the Phase I RFI was to characterize the nature of potential contamination associated with the container storage area and outfall.

The conceptual model for the RFI predicted that (1) spilled material would have flowed downslope on the asphalt pad and infiltrated surface soils at the edge of the storage area through cracks in the asphalt and (2) the outfall discharge would have flowed southward over surface soils and into the bedrock tuff. Potential contaminants present could be mobilized by surface runoff into the drainage toward the edge of the mesa.

A judgmental sampling approach was used, and the sampling activities were biased toward areas where residual contamination was expected to collect. One hand-auger hole was drilled, and two surface samples were collected in stained areas at discontinuities in the asphalt near PRS No. 35-004(a). One hand-auger hole was situated to sample beneath the asphalt at PRS No. 35-009(e), and two surface samples were collected within the drainage channel located south of the asphalt-paved access road in the pathway of storm-water runoff.

Field activities included a health and safety (H&S) radiation survey, engineering surveys, and environmental surveys including a radiation grid survey.

Field screening during site surveys and sample collection activities was performed using a Foxboro 128 GC organic vapor analyzer (OVA), a Ludlum Model 139 alpha meter, and an Eberline ESP-1 beta/gamma meter. Using this instrumentation, background radiation measurements at Technical Area (TA) -35 range from 200 to 500 counts per minute (cpm) beta/gamma radiation depending on the location and substrate rock type. Field screening measurements greater than 500 cpm beta/gamma radiation were generally considered to be above background levels. No beta/gamma radiation measurements above background levels were obtained during field screening at this site, and no alpha radiation or organic vapors were detected.

5.1.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed on June 2, 1994. Beta/gamma radiation measurements ranged from 215 to 247 cpm, and the average was 231 cpm, which is within background levels.

Engineering surveys were performed on June 2, 1994, June 8, 1994, and January 18, 1995. The surveys consisted of reviews of archival information and engineering drawings of TA-35 as well as field site inspections. The container storage area and the suspected location of the outfall were located, and the conditions at the sites were documented. During the site inspection, several oil stains were noted at the container storage area. A surface drainage pathway from the outfall area and container storage area was located. Sample sites were staked in the surface drainage pathways at the edge of the asphalt, at the suspected location of the outfall, and within stained areas at the container storage area.

The radiation grid survey was performed on September 7, 1994. The radiation grid locations included Location ID Nos. 35-7614 through 35-7636, which were spaced at approximately 20-ft intervals. Beta/gamma radiation measurements ranged from 169 to 279 cpm, and the average was 212 cpm, which is within background levels.

5.1.4.2 Deviations from the Sampling and Analysis Plan

Sampling activities for PRS No. 35-004(a) followed the original sampling and analysis plan (SAP), which is described in the June 1994 addendum to the work plan (Pratt 1994, 43475). The SAP for PRS No. 35-009(e), also described in the June 1994 addendum to the work plan (Pratt 1994, 43475), specifies that one hand-auger hole and two surface samples would be collected. However, the SAP does not specify sample locations. The hand-auger hole was located in the former outfall area, and the two surface samples were located in the drainage area beneath the former outfall.

5.1.4.3 Sampling Activities

Phase I sampling was performed on March 3, 1995. A total of 6 locations were sampled, and 10 soil samples were collected (not including duplicate quality assurance/quality control [QA/QC] samples). Four surface samples were collected (Location ID Nos. 35-2097, 35-2098, 35-2103, and 35-2104), and two hand-auger holes were drilled to a depth of 3 ft (Location ID Nos. 35-2099 and 35-2105). The sample collection intervals are shown in Table 5.1.4-1. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 190 to 255 cpm, which are within background levels.

Table 5.1.4-1 summarizes all sampling for PRS Nos. 35-004(a) and 35-009(e); Figure 5.1.4-1 shows the sample locations.

5.1.5 Background Comparisons

Background comparisons were performed for inorganic chemicals for which UTL values are available, as discussed in Section 3.2 in Chapter 3.0 of this RFI report. For inorganic chemicals analyzed by x-ray fluorescence (XRF) in the mobile laboratory facility, the UTL values have been corrected for some analytes to account for method differences that generally result in higher measured background concentrations by XRF. Derivation of corrected UTL values for XRF data is discussed in Section 3.1.3 in Chapter 3.0 of this RFI report. If data are available by both methods, the data reported by the fixed-site laboratory will be given precedence because more confidence is placed in the fixed-site laboratory data than in the XRF analyses.

Ten samples from six locations were analyzed by XRF in the mobile laboratory facility for an analyte suite that included antimony, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, manganese, mercury, nickel, potassium, selenium, thorium, titanium, uranium, and zinc. As discussed in Section 4.1.3 in Chapter 4.0 of this RFI report, the TA-35 XRF data set is qualified such that the data for antimony, cadmium, mercury, selenium, and uranium should be regarded as estimated, and nickel data may have a low bias. Individual XRF samples were not qualified. One soil sample was also analyzed in a fixed-site laboratory for an inorganic chemical analyte suite that included aluminum, antimony, arsenic, barium,

TABLE 5.1.4-1

SUMMARY OF SAMPLES TAKEN AT PRS Nos. 35-004(a) AND 35-009(e)

Part 1

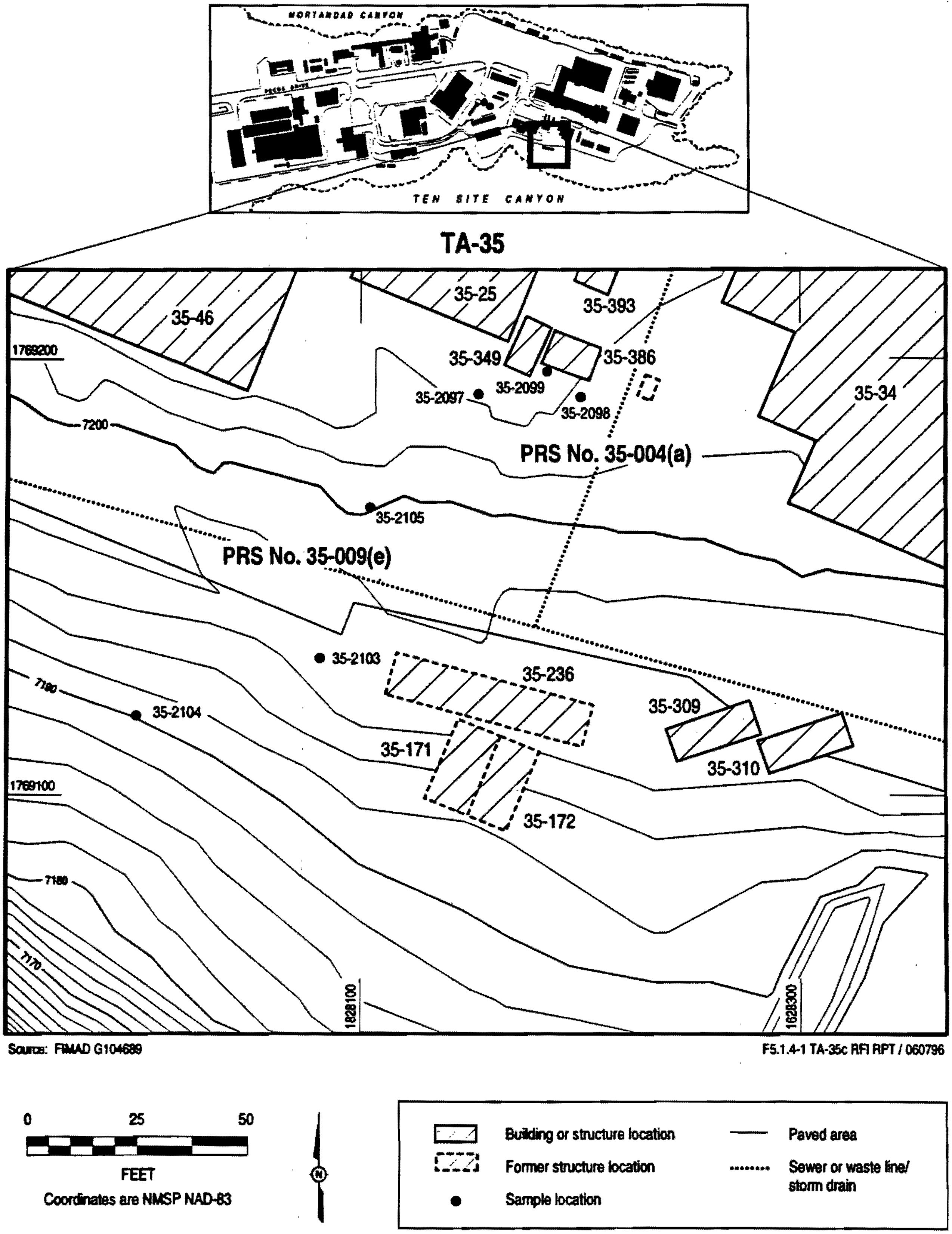
Location ID	Sample ID	Depth (ft)	Matrix	VOC Mobile Lab	VOC Fixed Lab	PAH Mobile Lab	SVOC Fixed Lab	PCB Mobile Lab
35-2097	AAC1153	0–0.5	Mixed soil	21483	NR	21483	NR	21483
35-2098	AAC1154	0–0.5	Mixed soil	21483	NR	21483	NR	21483
35-2099	AAC1155	0–1	Mixed soil	21483	NR	21483	NR	21483
35-2099	AAC1156	1–2	Mixed soil	21483	NR	21483	NR	21483
35-2099	AAC1157	2–3	Mixed soil	21483	NR	21483	NR	21483
35-2103	AAC1158	0–0.5	Mixed soil	21483	21466	21483	NR	21483
35-2104	AAC1159	0–0.5	Mixed soil	21483	NR	21483	NR	21483
35-2105	AAC1160	0–1	Mixed soil	21483	NR	21483	NR	21483
35-2105	AAC1161	1–2	Mixed soil	21483	NR	21483	NR	21483
35-2105	AAC1162	2–3	Mixed soil	21483	NR	21483	21466	21483

Part 2

Location ID	Sample ID	Depth (ft)	Matrix	Pesticide/ PCB Fixed Lab	INORG Mobile Lab	INORG Fixed Lab	RAD Mobile Lab	RAD Fixed Lab
35-2097	AAC1153	0–0.5	Mixed soil	NR	21484	NR	21482	21468
35-2098	AAC1154	0–0.5	Mixed soil	NR	21484	NR	21482	21468
35-2099	AAC1155	0–1	Mixed soil	NR	21484	NR	21482	NR
35-2099	AAC1156	1–2	Mixed soil	NR	21484	NR	21482	NR
35-2099	AAC1157	2–3	Mixed soil	NR	21484	NR	21482	NR
35-2103	AAC1158	0–0.5	Mixed soil	NR	21484	NR	21482	21468
35-2104	AAC1159	0–0.5	Mixed soil	NR	21484	NR	21482	21468
35-2105	AAC1160	0–1	Mixed soil	NR	21484	21467	21482	NR
35-2105	AAC1161	1–2	Mixed soil	NR	21484	NR	21482	NR
35-2105	AAC1162	2–3	Mixed soil	21466	21484	NR	21482	NR

beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc using the Environmental Protection Agency (EPA) methods described in Section 3.1.1 in Chapter 3.0 of this RFI report. The surface samples were collected in 0.5-ft vertical intervals, and the samples from the hand-auger hole were collected in 1-ft vertical intervals.

The mixed-soil UTL values were used for background comparison for samples analyzed by SW-846 methods (EPA 1986, 31732). The XRF UTL values were used for XRF data, as discussed in Section 3.1.3 in



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F5.1.4-1 TA-35c RFI RPT / 060796

Figure 5.1.4-1. Locations of samples at PRS Nos. 35-004(a) and 35-009(e).

Chapter 3.0 of this RFI report. In Table 5.1.5-1, the values in the boxes indicate inorganic chemical measurements at concentrations greater than or equal to their respective UTL values. Table 5.1.5-1 also shows inorganic chemicals for which there are no UTL values for comparison. The concentrations above background levels at each location are shown in Figure 5.1.5-1. Detected inorganic chemicals with one or more measured concentrations equal to or exceeding UTL values, or for which UTL values are unavailable, are summarized in the following list.

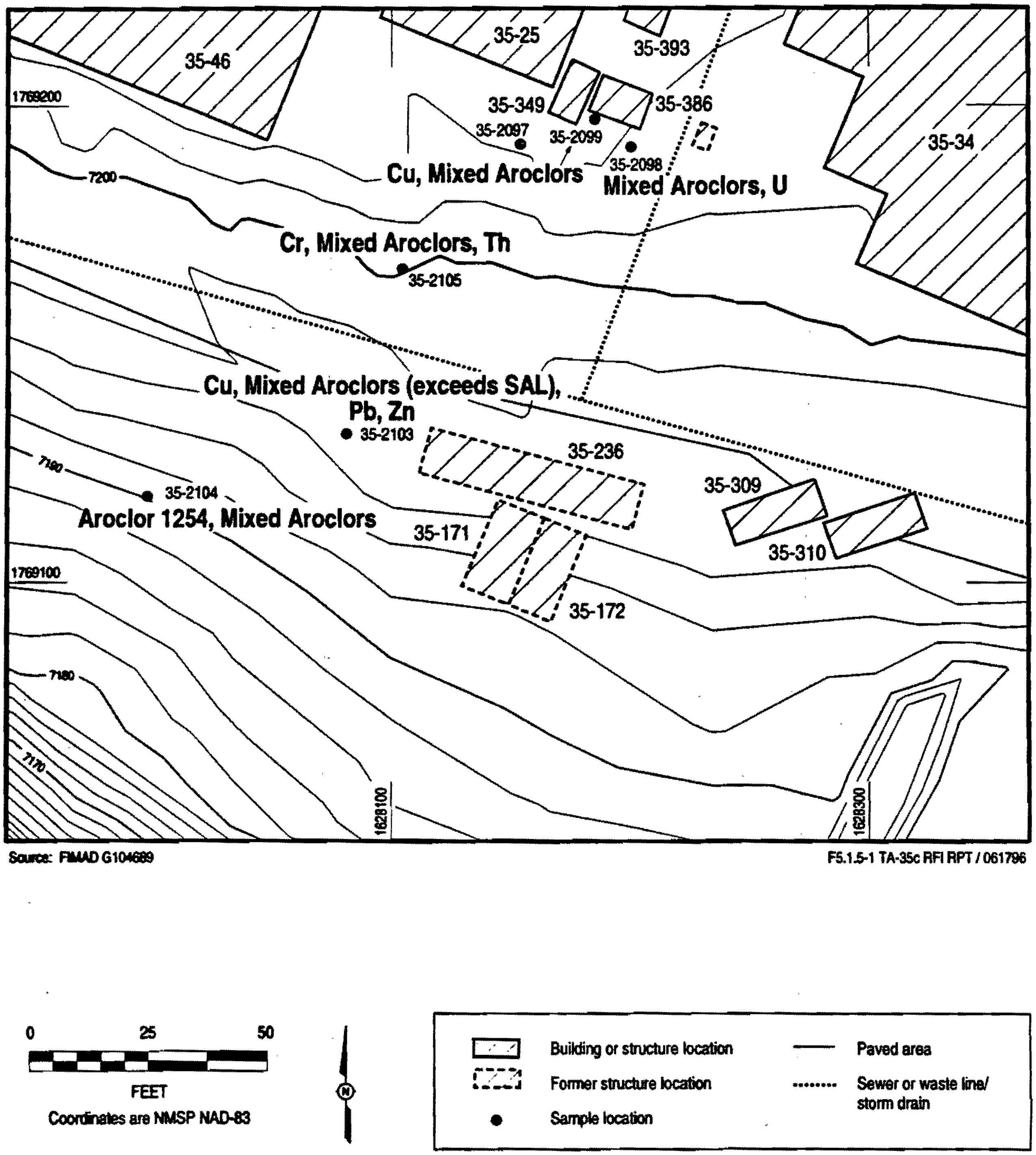
- Chromium was detected in 1 sample at a concentration of 51.07 mg/kg, which is above the XRF UTL of 45.1 mg/kg.
- Copper was detected in 2 samples at two different locations at a maximum concentration of 24.5 mg/kg, which is above the XRF UTL of 16.7 mg/kg.
- Lead was detected in 1 sample at a concentration of 44.7 mg/kg, which is above the XRF UTL of 28.4 mg/kg.
- Silver was detected in 1 sample at a concentration of 0.56 mg/kg. No UTL value exists for silver.
- Thorium was detected in 1 sample at a concentration of 24.3 mg/kg, which is above the XRF UTL of 22.1 mg/kg.
- Titanium was detected in all 10 samples at a maximum concentration of 32,312 mg/kg. No UTL value exists for titanium.
- Uranium was detected in 1 sample at a concentration of 9.56 mg/kg, which is above the XRF UTL of 5.33 mg/kg.
- Zinc was detected in 1 sample at a concentration of 195 mg/kg, which is above the XRF UTL of 76.6 mg/kg.

TABLE 5.1.5-1

INORGANIC CHEMICALS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTLs FOR PRS Nos. 35-004(a) AND 35-009(e)

Location ID	Sample ID	Depth (ft)	Ag	Cr	Cu	Pb	Th	Ti	U	Zn
SAL	N/A	N/A	383	210	2800	400	N.A.	N.A.	230	23000
Mixed-soil UTL	N/A	N/A	N.A.	19.3	15.5	23.3	N/A	N/A	N/A	50.8
XRF UTL	N/A	N/A	N/A	45.1	16.7	28.4	22.1	N.A.	5.33	76.6
35-2097	AAC1153	0–0.5	NA	<12	12.9	22.5	<8	1728	<8	67.2
35-2098	AAC1154	0–0.5	NA	<12	<8	26.8	14.6	1781	9.56	54.1
35-2099	AAC1155	0–1	NA	<12	9.33	17.8	<8	1720	<8	41.1
35-2099	AAC1156	1–2	NA	5.04	13.5	22.4	12.5	2568	<8	44.4
35-2099	AAC1157	2–3	NA	<12	16.7	22	<8	32312	<8	43.1
35-2103	AAC1158	0–0.5	NA	<12	24.5	44.7	13.1	1982	<8	195
35-2104	AAC1159	0–0.5	NA	<12	12.4	24.5	<8	1499	<8	55.1
35-2105	AAC1160	0–1	0.56	12	9.2	19.9	24.3	3002	<8	37.2
35-2105	AAC1161	1–2	NA	31.3	<8	15.4	19.9	691	<8	37.8
35-2105	AAC1162	2–3	NA	51.07	13.7	14.4	14.2	642	<8	35.1

* mg/kg



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F5.1.5-1 TA-35c RFI RPT / 061796

Figure 5.1.5-1. Locations of detected organic chemicals and analytes that exceed UTLs and SALs at PRS Nos. 35-004(a) and 35-009(e).

5.1.6 Evaluation of Organic Chemicals

The organic chemicals analyzed for at these PRSs include VOCs, SVOCs, PCBs, and polycyclic aromatic hydrocarbon (PAH) compounds. Ten soil samples from six locations were analyzed for VOCs, PCBs, and PAHs in the mobile laboratory facility. One sample was analyzed for SVOCs, and one sample was analyzed for PCBs/pesticides in a fixed-site laboratory.

As discussed in Section 4.2.4 in Chapter 4.0 of this RFI report, the presence of SVOCs was screened in the mobile laboratory facility by analyzing PAH compounds. Any extractable organic compounds present in the sample, but not identified as target analytes (that is, PAHs) were quantitated to an EQL of 5 mg/kg using the response factor for naphthalene and reported as "Total Extractable Organic Compounds." The sample results are qualified with an "S" flag and may be biased low because of less effective extraction methods.

Organic chemicals detected in soil are shown in Table 5.1.6-1 and are summarized below. The locations of these organic chemicals are shown in Figure 5.1.5-1.

- Aroclor 1254 was detected in one sample at a concentration of 0.136(S) mg/kg.
- Aroclor 1260 (evaluated as mixed aroclor) was detected in five samples at five different locations at a maximum concentration of 3.188(S) mg/kg.

The sum of individual aroclor concentrations in each sample is evaluated for carcinogenic effects as "mixed aroclors."

TABLE 5.1.6-1

SOIL CONCENTRATIONS* FOR DETECTED ORGANIC CHEMICALS AT PRS Nos. 35-004(a) AND 35-009(e)

Location ID	Sample ID	Depth (ft)	Aroclor 1254	Mixed Aroclors
SAL	N/A	N/A	1.4	1
CRQL	N/A	N/A	0.05	0.05
35-2098	AAC1154	0-0.5	ND	0.111 S
35-2099	AAC1155	0-1	ND	0.091 S
35-2103	AAC1158	0-0.5	ND	3.188 S
35-2104	AAC1159	0-0.5	0.136 S	0.315 S
35-2105	AAC1160	0-1	ND	0.091 S

* mg/kg

5.1.7 Human Health Assessment

5.1.7.1 Screening Assessment

Eight inorganic and two organic chemicals were carried forward from the background comparison and organic constituent evaluation. As described in Section 3.4.1 in Chapter 3.0 of this RFI report, analytes are divided into two classes (noncarcinogens and chemical carcinogens) for the screening assessment, depending on which toxicological effect forms the basis of their screening action level (SAL), to evaluate possible additive effects within each class of chemical.

Aroclor 1260 (evaluated as mixed aroclor) exceeded the SAL value in the 0 to 0.5-ft interval at Location ID No. 35-2103. The sample result that exceeded the SAL value is highlighted with black in Table 5.1.7-1. The location of the sample that exceeded the SAL value is shown in Figure 5.1.5-1. This COPC is further evaluated in Section 5.1.7.2. The multiple chemical evaluation (MCE) result for noncarcinogens was 0.270. An MCE for chemical carcinogens was not performed because only one chemical carcinogen (chromium) below its SAL value was carried forward to the screening assessment.

All the inorganic chemicals identified in the background comparison in Section 5.1.5 and the detected organic chemicals identified in the evaluation of organic chemicals in Section 5.1.6 except thorium and titanium have soil SALs for comparison. Thorium was measured above its XRF UTL in 1 of 10 samples at a concentration approximately 10% higher than the UTL. No EPA toxicity data exist for elemental thorium. Because all isotopes of thorium are radioactive, thorium will be evaluated in the addendum to this RFI report, which will address radioisotopes. The only detected analyte for which neither a UTL nor a SAL value is available is titanium. Titanium is widely used as a food and cosmetics additive to whiten a product. It is generally inert in its common form as titanium dioxide (Amdur et al. 1991, 53961). Therefore, further evaluation of titanium is not proposed.

TABLE 5.1.7-1

CARCINOGENIC CHEMICALS WITH CONCENTRATIONS* THAT EXCEED SALs FOR PRS Nos. 35-004(a) AND 35-009(e)

Location ID	Sample ID	Depth (ft)	Mixed Aroclors
SAL	N/A	N/A	1
35-2103	AAC1158	0-0.5	3.188 S

* mg/kg

5.1.7.2 Risk Assessment

A quantitative human health risk assessment was not performed for these PRSs. A qualitative evaluation of potential human health risk is presented below.

5.1.7.2.1 Review of Chemicals of Potential Concern and Extent of Contamination

Although six inorganic chemicals were identified above UTL values and two organic chemicals were detected at these PRSs, as shown in Figure 5.1.5-1, only one risk-based COPC was identified in the screening assessment. The concentration of Aroclor 1260 in this sample was approximately three times higher than its SAL value. Exceeding a residential soil SAL by a factor of three in one of ten samples does not suggest a potential human health concern at an industrial facility such as TA-35. The area of significant aroclor contamination is limited because only one sample exceeded the 1-mg/kg SAL value. Furthermore, the shorter exposure duration and smaller exposure frequency associated with industrial land use (the exposure scenario for TA-35) and the fact that children and infants would be excluded from the exposure scenario reduce the possibility of realizing adverse health impacts from soil exposure. Therefore, additional evaluation of Aroclor 1260 for human health risk will not be pursued.

As described in Section 5.1.4, the sampling sites were selected to identify residual contamination associated with the historical container storage area [35-004(a)] and outfall [35-009(e)]. Because the area of the historical outfall has been covered with asphalt, the precise outfall location could not be determined during the field investigation. The location of the container storage area was positively identified, and biased samples were collected at the points of surface staining described in the work plan (LANL 1992, 7666).

Because samples collected at the container storage area were positively biased toward areas of likely residual contamination, the fact that only one COPC was identified in one sample indicates that residual contamination in soils associated with this PRS is limited. However, the extent of contamination associated with the outfall cannot be defined with certainty because the outfall location could not be visually confirmed. Nevertheless, additional sampling for the outfall is not proposed because there is no basis for selecting additional sample locations to identify residual contamination. The existing sample locations at the outfall were placed at the most likely locations to contain residual contamination based on historical drawings and current site drainage. Therefore, any additional samples would be collected in locations where the probability of observing contamination is less than was the case at the original sample locations. Furthermore, it is highly unlikely that an unacceptable human health risk will be identified because existing data indicate that any residual mesa-top contamination in this area must be very limited in areal extent.

The general pattern of contamination observed at these PRSs (several metals near to or a factor of two to three times higher than background UTL values) is similar to that seen at several other PRSs at TA-35 where no specific release has been identified. This level of soil contamination is not unexpected at an industrial facility such as TA-35 and is not associated with adverse human health risks.

5.1.8 Ecological Assessment

In accordance with conversations among Laboratory Environmental Restoration (ER) Project personnel, the Los Alamos Area Office of the Department of Energy (DOE/LAAO), and the regulators, further ecological risk assessment at this site will be deferred until the site can be assessed as part of the new Ecological Exposure Unit (Ecozone) methodology that is being developed by the Laboratory in conjunction with EPA Region 6 and the New Mexico Environment Department (NMED).

5.1.9 Conclusions and Recommendations

This site is not likely to pose a significant human health risk.

The objective of the Phase I RFI at PRS Nos. 35-004(a) and 35-009(e) was to determine the presence or absence of contamination associated with a former container storage area and drain line near TA-35-25. Only one COPC was identified in the human health screening assessment. The potential adverse human health impacts associated with soil contamination at these PRSs was qualitatively evaluated in Section 5.1.7.2. Based on the observed soil concentrations, frequency of detection, and other considerations, soil contamination was determined to have a negligible impact on human health under exposure conditions associated with an industrial facility such as TA-35.

Samples for specific analytes were collected from two 3-ft hand-auger holes and four surface samples. The nature and extent of contamination associated with the container storage area have been adequately determined relative to potential human health risk. The extent of contamination associated with the outfall cannot be conclusively determined because the exact location of the outfall is unknown, but the data collected at the suspected outfall location and at the location of present-day storm-water runoff suggest that widespread contamination of human health concern has not occurred.

Based on NFA criterion number 4 (LANL 1995, 53863), a Class III permit modification is requested to remove PRS Nos. 35-004(a) and 35-009(e) from the Hazardous and Solid Waste Amendments (HSWA) Module of the Laboratory's RCRA operating permit. The sample data indicate that this site is not likely to pose a significant human health risk now or in the foreseeable future. Further ecological risk assessment at this site will be deferred as stated in Section 5.1.8.

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5.2 PRS No. 35-004(g)

PRS No. 35-004(g) is a container storage area located at the south wall of warehouse TA-35-67, which is situated near the southern edge of Ten Site Mesa.

No COPCs were identified during the screening assessment. Antimony, calcium, copper, nickel, thorium, and zinc were measured above background UTL values. Aroclors 1254 and 1260 were detected above the organic chemical EQL values.

PRS No. 35-004(g) is recommended for NFA based on NFA criterion number 4 (LANL 1995, 53863).

Radiological sample results are neither presented nor discussed for these PRSs and will be provided later as an addendum to this RFI report. A summary of samples submitted for radiological analyses is shown in Section 5.2.4.3.

5.2.1 History

PRS No. 35-004(g) is discussed in detail in Section 3.3.2 of the work plan and Section 7.24 of the June 1994 addendum to the work plan (LANL 1992, 7666; Pratt 1994, 43475).

This PRS reportedly stored oils, solvents, Freon, and vacuum pumps (LANL 1990, 7511). Staining was observed during an ER Program site reconnaissance in 1988 (LANL 1992, 7666).

The contaminants that were potentially present (and therefore investigated during the RFI) include radionuclides, VOCs, SVOCs, metals, and PCBs.

5.2.2 Description

The site is an asphalt-paved container storage area adjacent to a concrete pad that houses an air filter structure. Several small oil spills and stains are present on the asphalt. At the corner of TA-35-67 and the concrete pad is a small spill of what appears to be iron pellets. At the time of the RFI, no storage containers were present; however, several piles of debris were present, which contained electrical cables, pallets, and other scrap. The asphalt-paved area extends southward approximately 20 ft. The asphalt then slopes abruptly 5 to 6 ft onto another flat asphalt-paved area that extends approximately 40 ft toward the southern edge of Ten Site Mesa.

5.2.3 Previous Investigation

PRS No. 35-004(g) was investigated as part of "Environmental Problem 19" in the DOE Environmental Survey (DOE 1987, 5622). Three soil samples were collected and analyzed for alpha and gamma activities, metals, pesticides/PCBs, and VOCs. The samples had low alpha and gamma activities; the only chemicals detected were some unspecified metals and acetone.

5.2.4 Field Investigation

The objective of the Phase I RFI was to characterize the nature of potential contamination associated with the container storage area.

The conceptual model for the RFI predicted that spilled material could potentially infiltrate surface soils through discontinuities in the asphalt at the location of the container storage area. Potential contaminants released onto the asphalt could also be mobilized by surface water runoff southward toward Ten Site Canyon.

A judgmental sampling approach was used, and the sampling activities were biased toward areas where residual contamination was expected to be observed. A hand-auger hole was drilled in a stained area at a discontinuity in the asphalt, and three samples were collected in 1-ft vertical intervals. One surface sample was collected beneath the asphalt just south of the location of the hand-auger hole, and a second surface sample was collected beneath the asphalt approximately 20 ft southeast of the container storage area and just above the steep drop-off described in Section 5.2.2.

Field activities included an H&S radiation survey, engineering surveys, and environmental surveys including a radiation grid survey.

Field screening during site surveys and sample collection activities was performed using a Foxboro 128 GC OVA, a Ludlum Model 139 alpha meter, and an Eberline ESP-1 beta/gamma meter. Using this instrumentation, background radiation measurements at TA-35 range from 200 to 500 cpm beta/gamma radiation depending on the location and substrate rock type. Field screening measurements greater than 500 cpm beta/gamma radiation were generally considered to be above background levels. No beta/gamma radiation measurements above background levels were obtained during field screening at this site, and no alpha radiation or organic vapors were detected.

5.2.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed on June 2, 1994. Beta/gamma radiation measurements ranged from 121 to 199 cpm, and the average was 160 cpm, which is within background levels.

Engineering surveys were performed on June 2, 1994, and January 18, 1995. The surveys consisted of reviews of archival information and field site inspections. The container storage area was located, and the conditions at the site were documented. During the site inspection, several oil stains were noted at the container storage area. Sample sites were staked within the stained areas at the container storage area and in the path of surface water runoff from the area.

The radiation grid survey was performed on September 21, 1993. The radiation grid locations included Location ID Nos. 35-6077 through 35-6098, which were spaced at approximately 20-ft intervals. Beta/-gamma radiation measurements ranged from 180 to 300 cpm, and the average was 232 cpm, which is within background levels.

5.2.4.2 Deviations from the Sampling and Analysis Plan

The SAP for PRS No. 35-004(g), which is described in the June 1994 addendum to the work plan (Pratt 1994, 43475), specifies that one hand-auger hole would be drilled at the container storage area and two surface samples would be collected at the edge of the asphalt in the drainage area below the container storage area. However, the two surface samples were collected from the revised locations described in Section 5.2.4.

The asphalt-paved area was found to extend near the edge of the mesa. Samples associated with PRS No. 35-009(b) have been collected in the lower asphalt-paved area below the drop-off, and samples associated with PRS No. 35-016(c) were collected at and below the mesa edge where surface water runoff from PRS No. 35-004(g) drains into Ten Site Canyon. Because these areas had already been sampled as part of other investigations, the two surface samples were relocated.

5.2.4.3 Sampling Activities

Phase I sampling was performed on March 3, 1995. A total of three locations were sampled, and five soil samples were collected (not including duplicate QA/QC samples).Two surface samples were collected (Location ID Nos. 35-2100 and 35-2101), and one hand-auger hole was drilled to a depth of 3 ft (Location ID No. 35-2102). The sample collection intervals are shown in Table 5.2.4-1. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 184 to 243 cpm, which are within background levels.

Table 5.2.4-1 summarizes all sampling for PRS No. 35-004(g); Figure 5.2.4-1 shows the sample locations.

TABLE 5.2.4-1

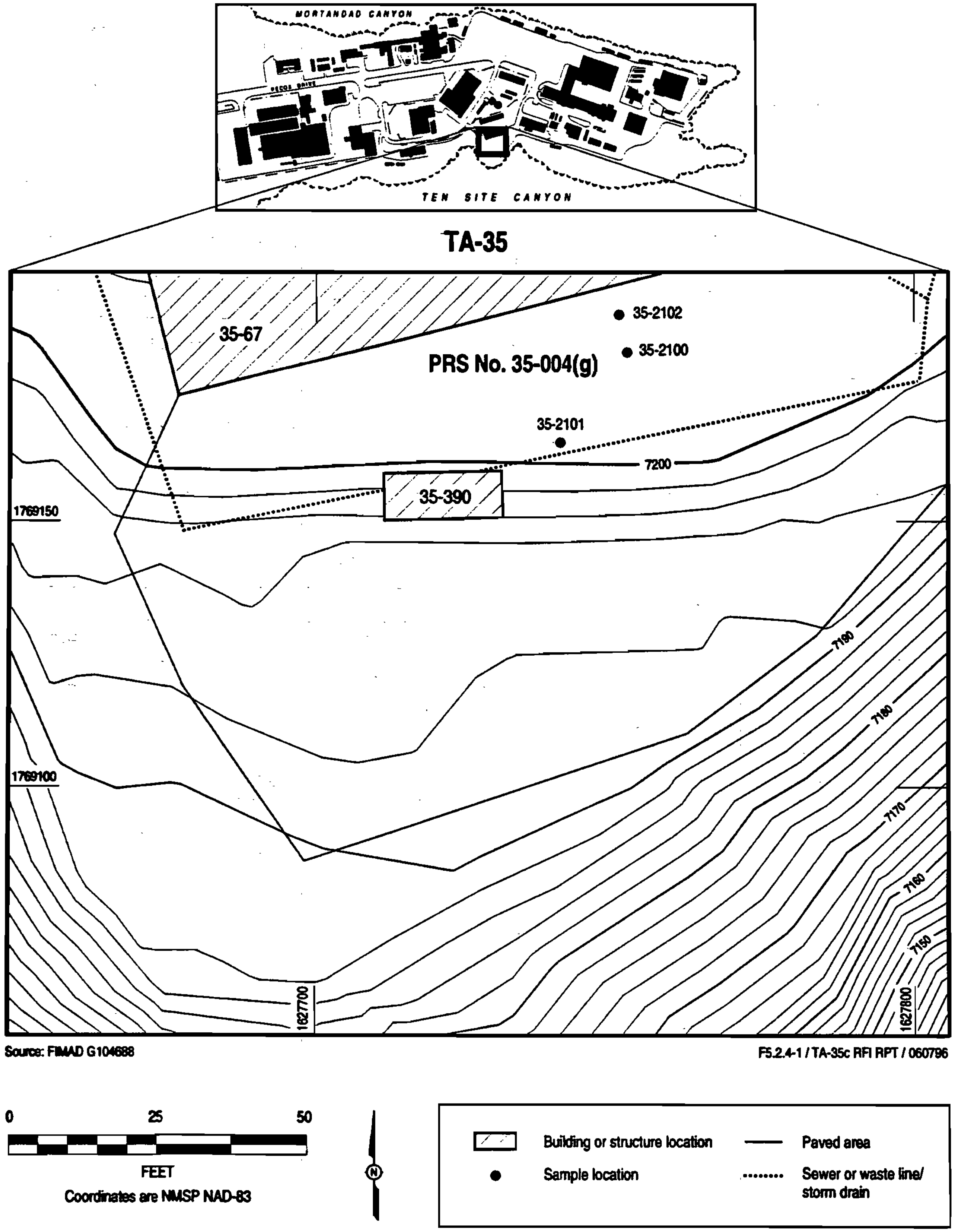
SUMMARY OF SAMPLES TAKEN AT PRS No. 35-004(g)

Part 1

Location ID	Sample ID	Depth (ft)	Matrix	VOC Mobile Lab	VOC Fixed Lab	PAH Mobile Lab	SVOC Fixed Lab	PCB Mobile Lab
35-2100	AAC1177	0–0.5	Mixed soil	21500	21476	21500	NR	21500
35-2101	AAC1178	0–0.5	Mixed soil	21500	NR	21500	NR	21500
35-2102	AAC1179	0–1	Mixed soil	21500	NR	21500	21476	21500
35-2102	AAC1180	1–2	Mixed soil	21500	NR	21500	NR	21500
35-2102	AAC1181	2–3	Mixed soil	21500	NR	21500	NR	21500

Part 2

Location ID	Sample ID	Depth (ft)	Matrix	Pesticide/ PCB Fixed Lab	INORG Mobile Lab	INORG Fixed Lab	RAD Mobile Lab	RAD Fixed Lab
35-2100	AAC1177	0–0.5	Mixed soil	NR	21503	NR	21499	21478
35-2101	AAC1178	0–0.5	Mixed soil	NR	21503	NR	21499	21478
35-2102	AAC1179	0–1	Mixed soil	21476	21503	21477	21499	NR
35-2102	AAC1180	1–2	Mixed soil	NR	21503	NR	21499	NR
35-2102	AAC1181	2–3	Mixed soil	NR	21503	NR	21499	NR



Source: FIMAD G104688

F5.2.4-1 / TA-35c RFI RPT / 060796

Figure 5.2.4-1. Locations of samples at PRS No. 35-004(g).

5.2.5 Background Comparisons

Background comparisons were performed for inorganic chemicals for which UTL values are available, as discussed in Section 3.2 in Chapter 3.0 of this RFI report. For inorganic chemicals analyzed by XRF in the mobile laboratory facility, the UTL values have been corrected for some analytes to account for method differences that generally result in higher measured background concentrations by XRF. Derivation of corrected UTL values for XRF data is discussed in Section 3.1.3 in Chapter 3.0 of this RFI report. If data are available by both methods, the data reported by the fixed-site laboratory will be given precedence because more confidence is placed in the fixed-site laboratory data than in the XRF analyses.

Five samples from three locations were analyzed by XRF in the mobile laboratory facility for an analyte suite that included antimony, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, manganese, mercury, nickel, potassium, selenium, thorium, titanium, uranium, and zinc. As discussed in Section 4.1.3 in Chapter 4.0 of this RFI report, the TA-35 XRF data set is qualified such that antimony, cadmium, mercury, selenium, and uranium data should be regarded as estimated, and nickel data may have a low bias. Individual XRF samples were not qualified. One soil sample was also analyzed in a fixed-site laboratory for an inorganic chemical analyte suite that included aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc using the EPA methods described in Section 3.1.1 in Chapter 3.0 of this RFI report. The surface samples were collected in 0.5-ft vertical intervals, and the samples from the hand-auger hole were collected in 1-ft vertical intervals.

The mixed-soil UTL values were used for background comparison for samples analyzed by SW-846 methods (EPA 1986, 31732). The XRF UTL values were used for XRF data, as discussed in Section 3.1.3 in Chapter 3.0 of this RFI report. In Table 5.2.5-1, the values in the boxes indicate inorganic chemical measurements at concentrations greater than or equal to their respective UTL values. Table 5.2.5-1 also shows inorganic chemicals for which there are no UTL values for comparison. The concentrations above background levels at each location are shown in Figure 5.2.5-1. Detected inorganic chemicals with one or more measured concentrations equal to or exceeding UTL values, or for which UTL values are unavailable, are summarized in the following list.

- Antimony was detected in one sample at a concentration of 5.03 mg/kg, which is above the XRF UTL of 1.45 mg/kg.
- Calcium was detected in one sample at a concentration of 19,100 mg/kg, which is above the XRF UTL of 10,900 mg/kg.
- Copper was detected in one sample at a concentration of 26.4 mg/kg, which is above the XRF UTL of 16.7 mg/kg.
- Nickel was detected in one sample at a concentration of 22.6 mg/kg, which is slightly above the XRF UTL of 22.5 mg/kg.
- Silver was detected in one sample at a concentration of 0.47 mg/kg. No UTL value exists for silver.

- Thorium was detected in four samples at two different locations at a maximum concentration of 35.9 mg/kg, which is above the XRF UTL of 22.1 mg/kg.

- Titanium was detected in five samples at a maximum concentration of 2,275 mg/kg. No UTL values exist for titanium.

- Zinc was detected in one sample at a concentration of 68.5 mg/kg, which is above the mixed-soil UTL of 50.8 mg/kg.

TABLE 5.2.5-1

INORGANIC CHEMICALS WITH CONCENTRATIONS*
GREATER THAN BACKGROUND UTLs FOR PRS No. 35-004(g)

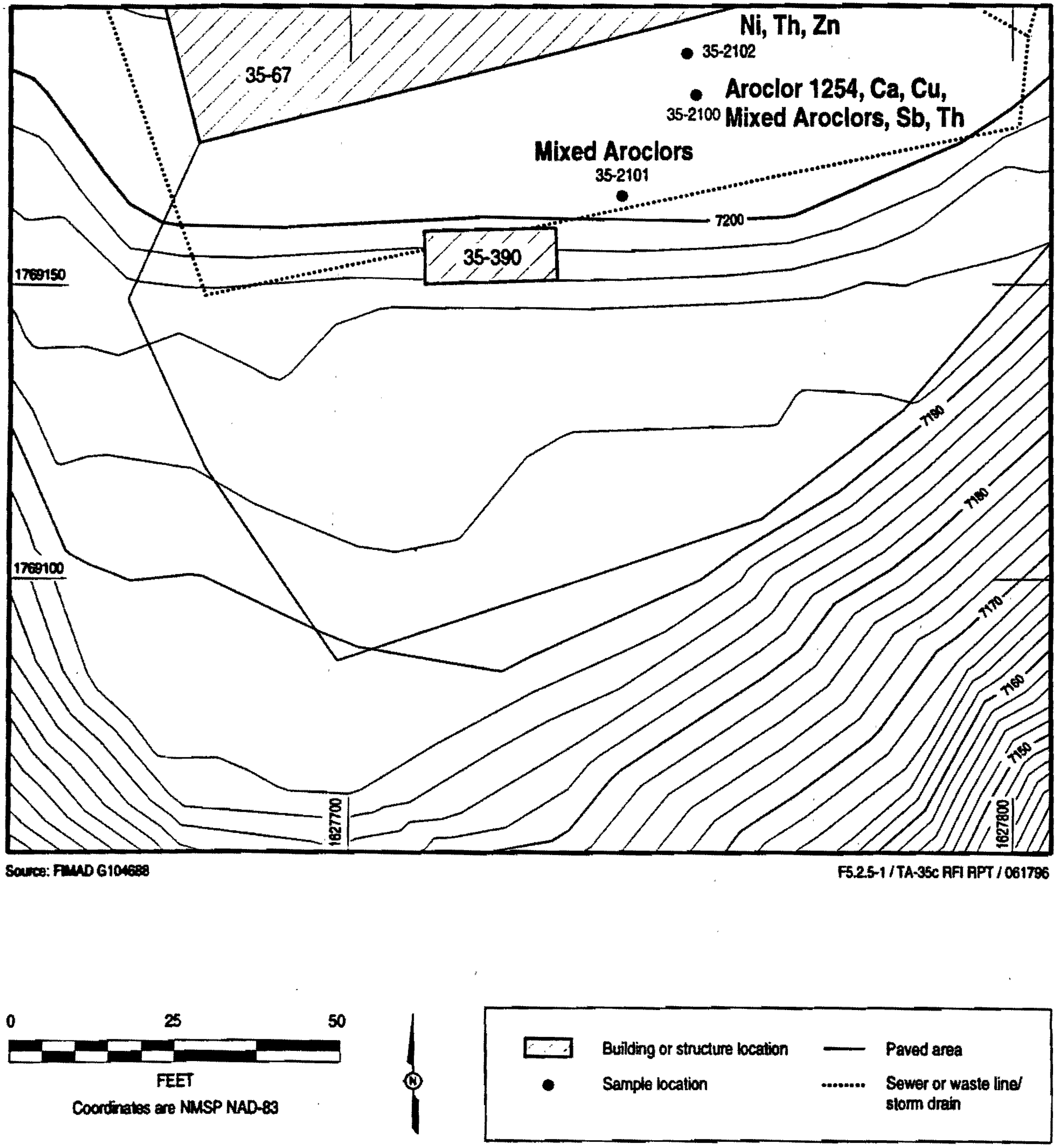
Location ID	Sample ID	Depth (ft)	Ag	Ca	Cu	Ni	Sb	Th	Ti	Zn
SAL	N/A	N/A	383	N.A.	2800	1500	31	N.A.	N.A.	23000
Mixed-soil UTL	N/A	N/A	N.A.	6120	15.5	15.2	1	N/A	N/A	50.8
XRF UTL	N/A	N/A	N/A	10900	16.7	22.5	1.45	22.1	N.A.	76.6
35-2100	AAC1177	0–0.5	NA	19100	26.4	15.4	5.03	22.9	2275	64.7
35-2101	AAC1178	0–0.5	NA	1680	<8	<13	<4	19.4	576	34.1
35-2102	AAC1179	0–1	0.47	2910	<4.6	5.7	<.49	34.1	916	68.5
35-2102	AAC1180	1–2	NA	1760	<8	18.7	<4	35.9	655	61
35-2102	AAC1181	2–3	NA	1880	<8	22.6	<4	23.1	653	59.7

*mg/kg

5.2.6 Evaluation of Organic Chemicals

The organic chemicals analyzed for at these PRSs include VOCs, SVOCs, PCBs, and PAH compounds. Five soil samples from three locations were analyzed for VOCs, PCBs, and PAHs in the mobile laboratory facility. In a fixed-site laboratory, one sample was also analyzed for VOCs, and another sample was analyzed for SVOCs and PCBs/pesticides.

As discussed in Section 4.2.4 in Chapter 4.0 of this RFI report, the presence of SVOCs was screened in the mobile laboratory facility by analyzing PAH compounds. Any extractable organic compounds present in the sample, but not identified as target analytes (that is, PAHs) were quantitated to an EQL of 5 mg/kg using the response factor for naphthalene and reported as "Total Extractable Organic Compounds."



Source: FIMAD G104688

F5.2.5-1 / TA-35c RFI RPT / 061796

Figure 5.2.5-1. Locations of detected organic chemicals and analytes that exceed UTLs at PRS No. 35-004(g).

Organic chemicals detected in soil are shown in Table 5.2.6-1 and are summarized below. The locations of these organic chemicals are shown in Figure 5.2.5-1.

- Aroclor 1254 was detected in one sample at a concentration of 0.132(S) mg/kg.
- Aroclor 1260 (evaluated as mixed aroclor) was detected in two samples at two different locations at concentrations of 0.132(S) and 0.053 mg/kg.

The fixed-site laboratory reported numerous unknown organic compounds and unsaturated hydrocarbons as tentatively identified compounds (TICs) in the 0 to 1-ft interval at Location ID No. 35-2102. Because no organic chemicals were detected in the 1- to 2- and 2- to 3-ft intervals and because this sample location is covered with asphalt, it is assumed that the TICs are associated with the asphalt cover at the site rather than PRS-specific contamination.

TABLE 5.2.6-1

SOIL CONCENTRATIONS* FOR DETECTED ORGANIC CHEMICALS AT PRS No. 35-004(g)

Location ID	Sample ID	Depth (ft)	Aroclor 1254	Mixed Aroclors
SAL	N/A	N/A	1.4	1
CRQL	N/A	N/A	0.05	0.05
35-2100	AAC1177	0-0.5	0.132 S	0.132 S
35-2101	AAC1178	0-0.5	ND	0.053 S

*mg/kg

5.2.7 Human Health Assessment

5.2.7.1 Screening Assessment

Eight inorganic chemicals and two organic chemicals were carried forward from the background comparison and the organic constituent evaluation. As described in Section 3.4.1 in Chapter 3.0 of this RFI report, analytes are divided into two classes (noncarcinogens and chemical carcinogens) for the screening assessment, depending on which toxicological effect forms the basis of their SAL, to evaluate possible additive effects within each class of chemical.

No sample results for any chemical exceeded SAL values at this PRS. The MCE result for noncarcinogens was 0.28. An MCE for chemical carcinogens was not performed because the only chemical carcinogen identified by the background comparison and the evaluation of organic chemicals was Aroclor 1260.

No COPCs are identified in the human health screening assessment. All the inorganic chemicals identified in the background comparison in Section 5.2.5 and the detected organic chemicals identified in the evaluation of organic chemicals in Section 5.2.6, except calcium, thorium, and titanium, have soil SALs for comparison.

Calcium was measured at a concentration approximately twice that of its UTL value in one sample. However, calcium is an essential element that is present in a wide variety of foods and in relatively high concentrations in many drinking water sources. It is also among those elements that may be eliminated from a risk assessment based on professional judgment (EPA 1989, 8021). Because it was detected in only one of five samples and has no significant adverse toxicological effects, additional investigation of calcium is not proposed.

Thorium was measured above its XRF UTL in four of five samples at a maximum concentration approximately 60% higher than the UTL. No EPA toxicity data exist for elemental thorium. Because all isotopes of thorium are radioactive, thorium will be evaluated in the addendum to this RFI report, which will address radioisotopes.

The only detected analyte for which neither a UTL nor a SAL value is available is titanium. Titanium is widely used as a food and cosmetics additive to whiten a product. It is generally considered to be physiologically inert in its common form as titanium dioxide (Amdur et al. 1991, 53961). Therefore, further evaluation of titanium is not proposed.

5.2.7.2 Risk Assessment

A human health risk assessment was not performed for this PRS because no COPCs were identified in the screening assessment.

5.2.7.2.1 Review of Chemicals of Potential Concern and Extent of Contamination

Although six inorganic chemicals were identified above UTL values at this PRS and two organic chemicals were detected, as shown in Figure 5.2.5-1, no risk-based COPCs were identified in the screening assessment. TICs, which are attributed to surficial asphalt-related organic chemicals, were reported in the 0 to 1-ft interval at Location ID No. 35-2102. The location of the container storage area was positively identified, and two biased sample locations were identified at points of surface staining on the asphalt. Additionally, the asphalt was penetrated to obtain a surface sample approximately 20 ft from the container storage area in the path of surface water runoff.

Because samples collected at the container storage area were positively biased toward areas of likely residual contamination, the fact that no COPCs were identified indicates that no significant residual contamination in soils associated with this PRS exists. However, it is possible that contamination released onto the asphalt has been mobilized by surface water and carried into Ten Site Canyon. Although this is unlikely (because some contamination would be expected to penetrate cracks in the asphalt where samples were taken) any contamination that might have migrated into Ten Site Canyon will be identified and evaluated as part of the investigation for PRS No. 35-016(c).

The pattern of contamination observed at this PRS (several metals near to or a factor of two to three times higher than background UTL values) is similar to that seen at several other PRSs at TA-35 where no specific release has been identified. This level of soil contamination is not unexpected at an industrial facility such as TA-35 and is not associated with adverse human health risks at this PRS.

5.2.8 Ecological Assessment

In accordance with conversations among Laboratory ER Project personnel, DOE/LAAO, and the regulators, further ecological risk assessment at this site will be deferred until the site can be assessed as part of the new Ecological Exposure Unit (Ecozone) methodology that is being developed by the Laboratory in conjunction with EPA Region 6 and NMED.

5.2.9 Conclusions and Recommendations

This site is not likely to pose a significant human health risk.

The objective of the Phase I RFI at PRS No. 35-004(g) was to determine the presence or absence of contamination associated with a former container storage area on the south side of TA-35-67. No COPCs were identified in the human health screening assessment.

Samples for specific analytes were collected from one 3-ft hand-auger hole and two surface samples. The nature and extent of contamination at container storage area have been adequately determined relative to potential human health risk. Contamination beyond the container storage area is unlikely because of the absence of COPCs in the source area. However, samples associated with PRS No. 35-016(c) will also capture any contamination that may have migrated from PRS No. 35-004(g).

Based on NFA criterion number 4 (LANL 1995, 53863), a Class III permit modification is requested to remove PRS No. 35-004(g) from the HSWA Module of the Laboratory's RCRA operating permit. The sample data indicate that this site is not likely to pose a significant human health risk now or in the foreseeable future. Further ecological risk assessment at this site will be deferred as stated in Section 5.2.8.

5.3 PRS No. 35-004(h)

PRS No. 35-004(h) is an inactive container storage area located at the northeast corner of the Air Filter Building (TA-35-7) at the eastern end of Ten Site Mesa.

No COPCs were identified in the screening assessment. Thorium was measured above the background UTL value. No organic chemicals were detected above EQL values. A human health risk was not identified at this PRS.

PRS No. 35-004(h) is recommended for NFA based on NFA criterion number 4 (LANL 1995, 53863).

Radiological sample results are neither presented nor discussed for this PRS and will be provided later as an addendum to this RFI report. A summary of samples submitted for radiological analyses is shown in Section 5.3.4.3.

5.3.1 History

PRS No. 35-004(h) is discussed in detail in Section 3.3.2 of the work plan and Section 7.24 of the June 1994 addendum to the work plan (LANL 1992, 7666; Pratt 1994, 43475).

This PRS reportedly handled oils, capacitors, solvents, and Freon (LANL 1990, 7511). The PRS is located near a manhole (TA-35-11) at the northeast corner of TA-35-7. TA-35-7 was associated with the former TA-35 wastewater treatment plant that was operated during the 1950s and early 1960s. Oblique photographs from 1979 show what appears to be a small storage container located on asphalt pavement adjacent to the north end of the east wall of TA-35-7. Oblique photographs from 1983 show that the container was removed and replaced by a small rectangular storage cabinet, which appears to be similar to a file cabinet.

In 1985, decontamination and decommissioning (D&D) activities at the TA-35 wastewater treatment plant included the removal of underground liquid waste lines during the Radioactive Liquid Waste Lines Removal Project (Elder et al. 1986, 3089). Line 90-A, located in the subsurface and oriented north-south along the east wall of TA-35-7, was removed in January 1985. TA-35-11, an access manhole to a storm drain system located near the north end of Line 90-A, was also removed at this time. Before it was removed, storm-water runoff from PRS No. 35-004(h) entered the storm drain system at TA-35-11. TA-35-11 was surrounded by a surface storm-water drainage berm that emptied into a 12-in.-diameter corrugated metal pipe (CMP), which extended 80 ft southeast and discharged into a storm-water diversion channel. During the removal of Line 90-A, soil was excavated to approximately 9 ft east of TA-35-7 and to a depth of 8 ft (Cox 1985, 781). After Line 90-A was removed, the excavation was filled with clean backfill material, and the surface was repaved with asphalt. No evidence exists to suggest that a container storage area has occupied this site since the 1985 D&D activities.

A second phase of decommissioning activities is now underway at the TA-35 wastewater treatment plant, which includes the removal of the structure and foundation of TA-35-7.

The contaminants that were potentially present (and therefore investigated during the RFI) include radionuclides, VOCs, SVOCs, metals, and PCBs.

5.3.2 Description

At the time of the RFI, no containers were present at the site. An asphalt cutout was visible, which denotes the areal extent of excavation conducted during the 1985 D&D activities. Current decommissioning activities are resulting in site disturbance and soil excavation as additional structures associated with the TA-35 wastewater treatment plant are removed.

The topography of the site is relatively flat with a gentle southeastem slope toward the edge of the mesa.

5.3.3 Previous Investigations

No previous investigations have been performed at this site.

5.3.4 Field Investigation

The objective of the Phase I RFI was to characterize the nature of potential contamination associated with the container storage area.

The conceptual model for the RFI did not predict that hazardous chemicals were released to the environment. However, if hazardous materials were present, the conceptual model shows that the most likely mechanism of movement beyond the PRS boundary is associated with hydrologic movement in the soil and surface water transport of contaminants infiltrating into the bedrock tuff.

A judgmental sampling approach was used, and the sampling activities were biased toward areas where residual contamination would likely be found. To sample potential contamination, a subsurface sample was collected at the northeast comer of TA-35-7.

Field activities included an H&S radiation survey, engineering surveys, and environmental surveys including a radiation grid survey and an organic vapor survey.

Field screening during site surveys and sample collection activities was performed using a Foxboro 128 GC OVA, a Ludlum Model 139 alpha meter, and an Eberline ESP-1 beta/gamma meter. Using this instrumentation, background radiation measurements at TA-35 range from 200 to 500 cpm beta/gamma radiation depending on the location and substrate rock type. Field screening measurements greater than 500 cpm beta/gamma radiation were generally considered to be above background levels. No beta/gamma radiation measurements above background levels were obtained during field screening at this site, and no alpha radiation or organic vapors were detected.

5.3.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed on January 6, 1994, and January 12, 1994. Beta/gamma radiation measurements ranged from 200 to 270 cpm, which are within background levels.

Engineering surveys were performed on January 6, 1994, January 13, 1994, January 24, 1994, and June 2, 1994. The surveys consisted of reviews of archival information, oblique photographs, aerial photographs, and engineering drawings of TA-35 as well as a field site inspection and a description of the PRS. The PRS site was located, and the condition of the site was described.

Based on the results of the engineering surveys and on the SAP, the sample point was located at the northeast corner of TA-35-7. Based on the history of PRS No. 35-004(h), clean backfill was the anticipated sample material.

The radiation grid survey was performed on January 12, 1994. The radiation grid locations included Location ID Nos. 35-6263 through 35-6265 and 35-6280 through 35-6282, which were spaced at approximately 20-ft intervals. Beta/gamma radiation measurements ranged from 200 to 270 cpm, and the average was 243 cpm, which is within background levels.

5.3.4.2 Deviations from the Sampling and Analysis Plan

The SAP for PRS No. 35-004(h), which is described in the June 1994 addendum to the work plan (Pratt 1994, 43475), specifies that the sampling effort be incorporated with Aggregate D (see Section 7.8 of the work plan [LANL 1992, 7666]). Therefore, the first interval from Location ID No. 35-2024 (associated with the investigation of PRS Nos. 35-003[e, f, g, m, and o]) was collected to satisfy the requirements for sampling PRS No. 35-004(h). The analytical suite planned for Location ID No. 35-2024 is appropriate for PRS No. 35-004(h). The SAP for PRS No. 35-004(h) states that additional samples in the discharge area would be collected during the investigation in Aggregate D; therefore, the borehole at Location ID No. 35-2010 was drilled near the former storm drain system discharge point in association with the investigation of PRS Nos. 35-003(e, f, g, m, and o) (LANL 1996, 54422).

These changes to the SAP did not adversely impact the success of the field activities.

5.3.4.3 Sampling Activities

Phase I sampling was performed on March 21, 1994. One soil sample was collected (not including duplicate QA/QC samples) to satisfy the requirements for PRS No. 35-004(h). One subsurface soil sample was collected from the first interval of Location ID No. 35-2024 to satisfy the SAP requirements for this PRS. The sample collection intervals are shown in Table 5.3.4-1. A beta/gamma radiation measurement obtained during field screening of the PRS No. 35-004(h) sample was 190 cpm, which is within background levels.

Table 5.3.4-1 summarizes all sampling for PRS No. 35-004(h); Figure 5.3.4-1 shows the sample location.

TABLE 5.3.4-1

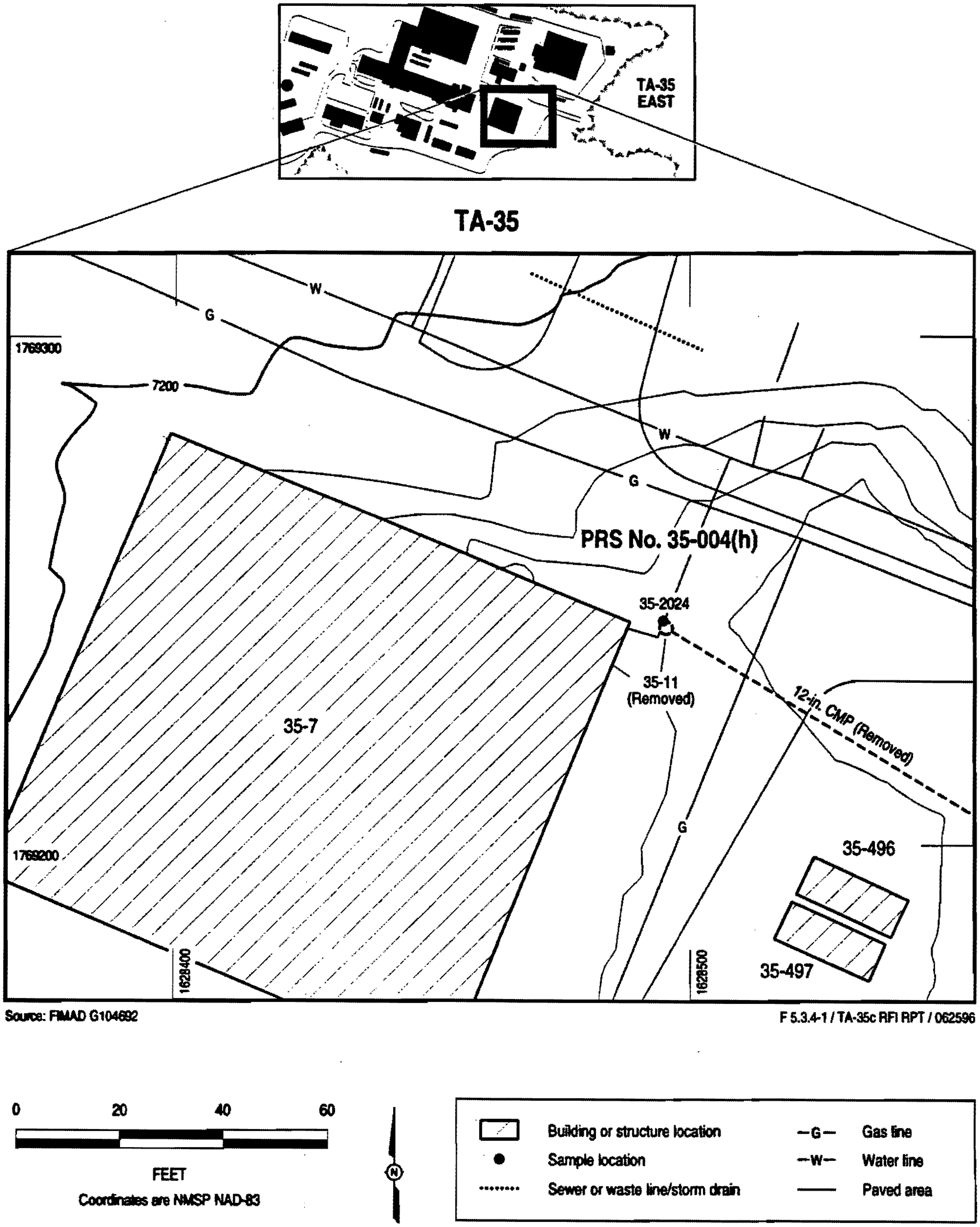
SUMMARY OF SAMPLES TAKEN AT PRS No. 35-004(h)

Part 1

Location ID	Sample ID	Depth (ft)	Matrix	PAH Mobile Lab	SVOC Fixed Lab	PCB Mobile Lab	PCB Fixed Lab
35-2024	AAA6601	1–2	Mixed soil	17051	17052	17051	17052

Part 2

Location ID	Sample ID	Depth (ft)	Matrix	INORG Mobile Lab	RAD Mobile Lab	RAD Fixed Lab
35-2024	AAA6601	1–2	Mixed soil	17231	18033	17293



Source: FIMAD G104692

F 5.3.4-1 / TA-35c RFI RPT / 062596

Figure 5.3.4-1. Location of sample at PRS No. 35-004(h).

5.3.5 Background Comparisons

Background comparisons were performed for inorganic chemicals for which UTL values are available, as discussed in Section 3.2 in Chapter 3.0 of this RFI report. For inorganic chemicals analyzed by XRF in the mobile laboratory facility, the UTL values have been corrected for some analytes to account for method differences that generally result in higher measured background concentrations by XRF. Derivation of corrected UTL values for XRF data is discussed in Section 3.1.3 in Chapter 3.0 of this RFI report.

One soil sample from a depth of 1 to 2 ft was analyzed by XRF in the mobile laboratory facility for an analyte suite that included antimony, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, manganese, mercury, nickel, potassium, selenium, thorium, titanium, uranium, and zinc. As discussed in Section 4.1.3 in Chapter 4.0 of this RFI report, the TA-35 XRF data set is qualified such that the data for antimony, cadmium, mercury, selenium, and uranium should be regarded as estimated, and nickel data may have a low bias. Individual XRF samples were not qualified.

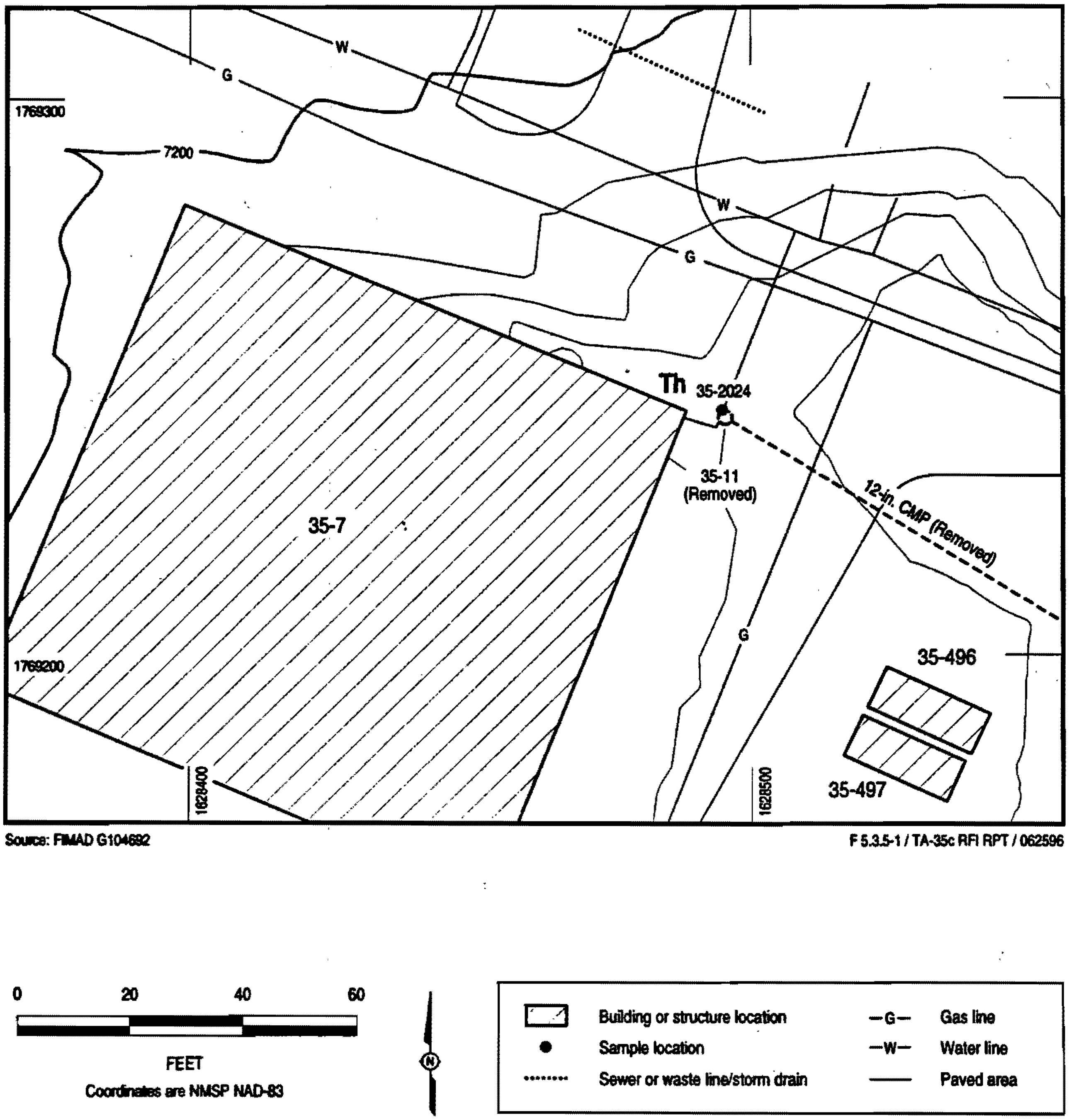
The XRF UTL values were used for background comparison of XRF data, as discussed in Section 3.1.3 in Chapter 3.0 of this RFI report. In Table 5.3.5-1, the value in the box indicates the inorganic chemical that was detected in soil at a concentration greater than the UTL value. Table 5.3.5-1 also shows inorganic chemicals for which there are no UTL values for comparison. The concentrations above background levels at each location are shown in Figure 5.3.5-1. Detected inorganic chemicals with one or more measured concentrations equal to or exceeding UTL values, or for which UTL values are unavailable, are summarized below.

- Thorium was detected in one sample at a concentration of 28 mg/kg, which is above the XRF UTL of 22.1 mg/kg.
- Titanium was detected in one sample at a concentration of 1,170 mg/kg. No UTL values exist for titanium.

TABLE 5.3.5-1

INORGANIC CHEMICALS WITH CONCENTRATIONS*
GREATER THAN BACKGROUND UTLs FOR PRS No. 35-004(h)

Location ID	Sample ID	Depth (ft)	Th	Ti
SAL	N/A	N/A	N.A.	N.A.
XRF UTL	N/A	N/A	22.1	N.A.
35-2024	AAA6601	1-2	28	1170
*mg/kg				



Source: FIMAD G104692

F 5.3.5-1 / TA-35c RFI RPT / 062596

Figure 5.3.5-1. Location of analytes that exceed UTLs at PRS No. 35-004(h).

5.3.6 Evaluation of Organic Chemicals

The organic chemicals analyzed for at this PRS include SVOCs, PCBs, and PAH compounds. PCBs and PAHs were analyzed for in the mobile laboratory facility, and PCBs and SVOCs were analyzed for in a fixed-site laboratory.

As discussed in Section 4.2.4 in Chapter 4.0 of this RFI report, the presence of SVOCs was screened in the mobile laboratory facility by analyzing PAH compounds. Any extractable organic compounds present in the sample, but not identified as target analytes (that is, PAHs) were quantitated to an EQL of 5 mg/kg using the response factor for naphthalene and reported as "Total Extractable Organic Compounds."

No organic chemicals were detected in any sample.

5.3.7 Human Health Assessment

5.3.7.1 Screening Assessment

Two inorganic chemicals were carried forward from the background comparison. As described in Section 3.4.1 in Chapter 3.0 of this RFI report, analytes are divided into two classes (noncarcinogens and chemical carcinogens) for the screening assessment, depending on which toxicological effect forms the basis of their SAL, to evaluate possible additive effects within each class of chemical.

No sample results for any chemical exceeded SAL values at this PRS. Because no chemicals having a SAL value were carried forward from Sections 5.3.5 and 5.3.6, MCE calculations were not performed. No COPCs are identified in the human health screening assessment.

Thorium was measured above its UTL at a concentration approximately 20% higher than its UTL. Because thorium is only slightly elevated above background, additional investigation of thorium is not proposed.

Neither a UTL nor a SAL value is available for titanium. Titanium is widely used as a food and cosmetics additive to whiten a product. It is generally considered to be physiologically inert in its common form as titanium dioxide (Amdur et al. 1991, 53961). Therefore, further evaluation of titanium is not proposed.

5.3.7.2 Risk Assessment

A human health risk assessment was not performed for this PRS because no COPCs were identified in the screening assessment.

5.3.7.2.1 Review of Chemicals of Potential Concern and Extent of Contamination

No inorganic chemicals were identified above UTL values, and no organic chemicals were measured above EQL values. As described in Section 5.3.1, 1985 D&D activities resulted in the removal of soil to a depth of 8 ft in the container storage area. Therefore, possible soil contamination from activities before this date has been largely or entirely removed. The area was backfilled after the 1985 D&D activities and was subsequently covered with asphalt. Although no evidence exists to suggest that the area was used for container storage after 1985, any liquid contamination associated with such activities would be expected to be carried with surface water runoff into Pratt Canyon. The area north and east of TA-35-7 is the subject of an ongoing RFI investigation associated with PRS No. 35-003(misc.). Further sampling will also be conducted in areas associated with PRS Nos. 35-003(d, e, l, o, q, and r), which will investigate Pratt Canyon and the area of surface water drainage (LANL 1996, 54422). Therefore, if significant quantities of contamination were mobilized from PRS No. 35-004(h), it is likely that such contamination will be addressed during the ongoing investigations.

The nature and extent of contamination cannot be described with certainty because the precise location, or locations, of container storage associated with this PRS cannot be defined in the present day. Also, the existing sample was taken in backfill material dating from 1985 and cannot provide information on potential releases before that date. However, it is highly unlikely that leakage from portable storage container could have contaminated historical soils beyond a depth of 8 ft because such containers are necessarily limited in size, and leakage would have been sporadic.

Additional sampling is not proposed because (1) the limited sample data indicate that the backfill material is not contaminated, (2) historical records do not exist to show that container storage activities occurred since the backfill has been in place, (3) contamination at a depth below the backfill is highly unlikely, and (4) any contamination that may have migrated from the site will be identified and evaluated in another investigation.

5.3.8 Ecological Assessment

In accordance with conversations among Laboratory ER Project personnel, DOE/LAAO, and the regulators, further ecological risk assessment at this site will be deferred until the site can be assessed as part of the new Ecological Exposure Unit (Ecozone) methodology that is being developed by the Laboratory in conjunction with EPA Region 6 and NMED.

5.3.9 Conclusions and Recommendations

This site is not likely to pose a significant human health risk.

The objective of the Phase I RFI at PRS No. 35-004(h) was to determine the presence or absence of contamination associated with a former container storage area. No COPCs were identified in the human health screening assessment.

Samples for specific analytes were collected from the 1- to 2-ft interval of a single borehole. The nature of contamination associated with the container storage area has been adequately determined relative to potential human health risk. The extent of contamination associated with the container storage area cannot be conclusively determined, but the weight of evidence suggests that contaminated soil does not exist at the site. Sample activities associated with ongoing RFI activities for other PRSs will address possible migration of historical contamination.

Based on NFA criterion number 4 (LANL 1995, 53863), a Class III permit modification is requested to remove PRS No. 35-004(h) from the HSWA Module of the Laboratory's RCRA operating permit. The sample data indicate that this site is not likely to pose a significant human health risk now or in the foreseeable future. Further ecological risk assessment at this site will be deferred as stated in Section 5.3.8.

5.4 PRS Nos. 35-004(m) and 35-014(g_2)

PRS No. 35-004(m) is an inactive container storage area located along the fence on the south side of the Carbon Dioxide Laser Building (TA-35-86). PRS No. 35-014(g_2) is an oil-stained asphalt area that resulted from leaking containers stored at PRS No. 35-004(m).

Antimony, cadmium, and lead were identified as COPCs during the screening assessment. These COPCs are evaluated in the risk assessment in Section 5.4.7.2. In addition, calcium, chromium, copper, uranium, and zinc were measured above background UTL values. No organic chemicals were detected above EQL values.

PRS Nos. 35-004(m) and 35-014(g_2) are recommended for NFA based on NFA criterion number 4 (LANL 1995, 53863).

Radiological sample results are neither presented nor discussed for these PRSs and will be provided later as an addendum to this RFI report. A summary of samples for radiological analysis is shown in Section 5.4.4.3.

5.4.1 History

PRS Nos. 35-004(m) and 35-014(g_2) are discussed in detail in Section 3.3.2 of the work plan and Section 7.26 of the June 1994 addendum to the work plan (LANL 1992, 7666; Pratt 1994, 43475).

PRS No. 35-004(m) was used to store solvents, Freon, oil, and rags. The PRS probably became active in 1977 when TA-35-86 was constructed.

PRS No. 35-014(g_2) consists of several small oil stains on asphalt that resulted from leaking containers at PRS No. 35-004(m).

The contaminants that were potentially present (and therefore investigated during the RFI) include radionuclides, VOCs, SVOCs, metals, and PCBs.

5.4.2 Description

The asphalt-paved area is approximately 8 ft wide and 25 ft long and is located near the southern edge of Ten Site Mesa. The site is bound to the north by a curb that separates the container storage area and oil stains from an asphalt-paved road that accesses the south side of TA-35-86; the site is bordered to the south by a chain link fence. At the time of the RFI, no containers were present; however, a metal chemical storage building (TA-35-457) and a trash dumpster were present at the site. Since the RFI sampling activities, TA-35-457 has been moved to a new location along the south wall of building TA-35-256. Two metal storage units (TA-35-359 and TA-35-360) now occupy the former location of TA-35-457. The trash dumpster has been removed.

The topography of the area is relatively flat and drains northward to the access road and southward toward the discharge area associated with PRS No. 35-016(n) and into Ten Site Canyon.

5.4.3 Previous Investigations

No previous investigations have been performed at this site.

5.4.4 Field Investigation

The objective of the Phase I RFI was to characterize the nature of potential contamination associated with the container storage area.

The conceptual model for the RFI predicted that spilled material would have flowed downgradient on the asphalt pad and infiltrated surface soils at the edge of the storage area. Potential contaminants present could be mobilized by surface runoff toward the edge of the mesa.

A judgmental sampling approach was used, and the sampling activities were biased toward areas where residual contamination was expected to collect. One surface sample was collected, and one hand-auger hole was drilled in soil at discontinuities in the asphalt in the path of the surface storm-water runoff.

Field activities included an H&S radiation survey, engineering surveys, and environmental surveys including a radiation grid survey.

Field screening during site surveys and sample collection activities was performed using a Foxboro 128 GC OVA, a Ludlum Model 139 alpha meter, and an Eberline ESP-1 beta/gamma meter. Using this instrumentation, background radiation measurements at TA-35 range from 200 to 500 cpm beta/gamma radiation depending on the location and substrate rock type. Field screening measurements greater than 500 cpm beta/gamma radiation were generally considered to be above background levels. No beta/gamma radiation measurements above background levels were obtained during field screening at this site, and no alpha radiation or organic vapors were detected.

5.4.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed on September 14, 1994. Beta/gamma radiation measurements ranged from 190 to 198 cpm, and the average was 194 cpm, which is within background levels.

Engineering surveys were performed on September 14, 1994, and March 27, 1995. The surveys consisted of reviews of archival information and engineering drawings of TA-35 as well as field site inspections. The container storage area was located, and the conditions at the site were documented. During the site inspection, several oil stains were observed on the asphalt, and a clay absorbent had recently been applied to absorb one spill. At the time of the RFI sampling activities, TA-35-457 and a trash dumpster were present and partially obscured the oil stains. Samples were located at the northwest and southeast corners of TA-35-457 in soil adjacent to the oil-stained asphalt.

The radiation grid survey was performed on September 23, 1994. The radiation grid locations included Location ID Nos. 35-7953 through 35-7984, which were spaced at approximately 5-ft intervals. Beta/gamma radiation measurements ranged from 155 to 241 cpm, and the average was 202 cpm, which is within background levels.

5.4.4.2 Deviations from the Sampling and Analysis Plan

Sampling activities followed the original SAP, which is described in the June 1994 addendum to the work plan (Pratt 1994, 43475).

5.4.4.3 Sampling Activities

Phase I sampling was performed on April 12, 1995. Two locations were sampled, and four samples were collected (not including duplicate QA/QC samples). One surface sample was collected (Location ID No. 35-2167), and one hand-auger hole was drilled to a depth of 3 ft (Location ID No. 35-2168). Three samples were collected from the hand-auger hole, one from each 1-ft interval. The samples collection intervals are shown in Table 5.4.4-1. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 157 to 241 cpm, which are within background levels.

Table 5.4.4-1 summarizes all sampling for PRS Nos. 35-004(m) and 35-014(g_2); Figure 5.4.4-1 shows the sample locations.

TABLE 5.4.4-1

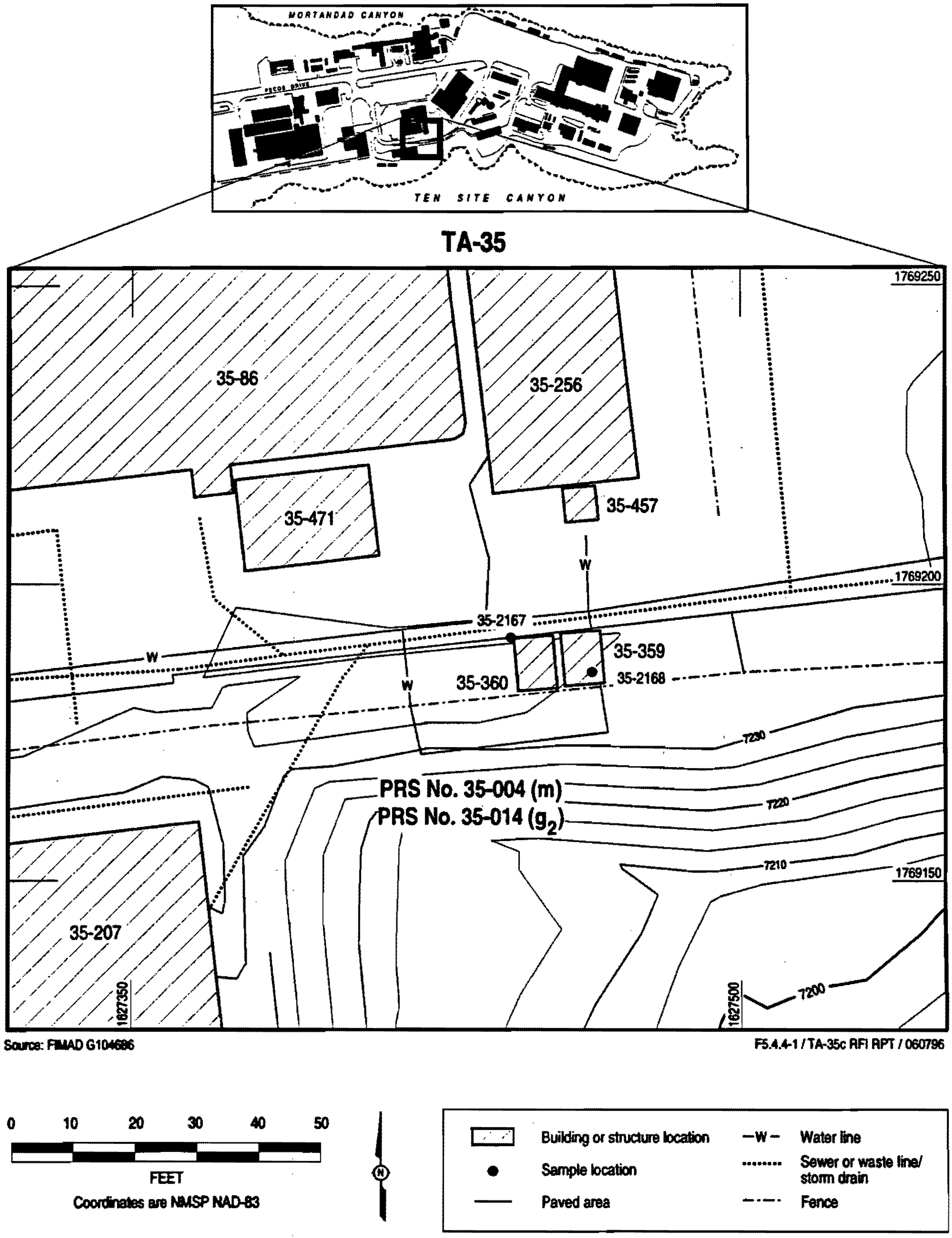
SUMMARY OF SAMPLES TAKEN AT PRS Nos. 35-004(m) AND 35-014(g_2)

Part 1

Location ID	Sample ID	Depth (ft)	Matrix	VOC Mobile Lab	VOC Fixed Lab	PAH Mobile Lab	SVOC Fixed Lab	PCB Mobile Lab
35-2167	0435-95-0011	0–0.5	Mixed soil	34	NR	34	NR	34
35-2168	0435-95-0013	0–1	Mixed soil	34	NR	34	NR	NR
35-2168	0435-95-0015	1–2	Mixed soil	34	34	34	34	34
35-2168	0435-95-0019	2–3	Mixed soil	34	NR	34	NR	34

Part 2

Location ID	Sample ID	Depth (ft)	Matrix	Pesticide/ PCB Fixed Lab	INORG Mobile Lab	INORG Fixed Lab	RAD Mobile Lab	RAD Fixed Lab
35-2167	0435-95-0011	0–0.5	Mixed soil	NR	49	NR	51	51
35-2168	0435-95-0013	0–1	Mixed soil	NR	49	NR	51	51
35-2168	0435-95-0015	1–2	Mixed soil	NR	49	49	51	NR
35-2168	0435-95-0019	2–3	Mixed soil	34	34	NR	51	NR



Source: FIMAD G104686

F5.4.4-1 / TA-35c RFI RPT / 060796

Figure 5.4.4-1. Locations of samples at PRS Nos. 35-004(m) and 35-014(g_2).

5.4.5 Background Comparisons

Background comparisons were performed for inorganic chemicals for which UTL values are available, as discussed in Section 3.2 in Chapter 3.0 of this RFI report. One soil sample from one location was analyzed in a fixed-site laboratory and four soil samples from two locations were analyzed by XRF in the mobile laboratory facility for inorganic chemicals. For inorganic chemicals analyzed by XRF in the mobile laboratory facility, the UTL values have been corrected to account for method differences that generally result in higher measured background concentrations by XRF. Derivation of corrected UTL values for XRF data is discussed in Section 3.1.3 in Chapter 3.0 of this RFI report. If data are available by both methods, the data reported by the fixed-site laboratory will be given precedence because more confidence is placed in the fixed-site laboratory data than in the XRF analyses.

Three samples from one hand-auger hole and one surface sample were analyzed by XRF in the mobile laboratory facility for an analyte suite that included antimony, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, manganese, mercury, nickel, potassium, selenium, thorium, titanium, uranium, and zinc. As discussed in Section 4.1.3 in Chapter 4.0 of this RFI report, the TA-35 XRF data set is qualified such that the data for antimony, cadmium, mercury, selenium, and uranium should be regarded as estimated, and nickel data may have a low bias. Individual XRF samples were not qualified. The sample that was collected in the 1- to 2-ft interval was also analyzed in a fixed-site laboratory for an inorganic chemical analyte suite that included aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc using the EPA methods described in Section 3.1.1 in Chapter 3.0 of this RFI report.

The highest detected value for each analyte was used for the background comparison. The mixed-soil UTL values were used for background comparison for analytes in the fixed-site laboratory suite. XRF UTL values were used for background comparison for analytes in the mobile laboratory suite. In Table 5.4.5-1, the values in the boxes indicate inorganic chemical measurements at concentrations greater than or equal to their respective UTL values. Table 5.4.5-1 also shows inorganic chemicals for which there are no UTL values for comparison. Inorganic chemicals that exceed background UTL values are shown on Figure 5.4.5-1. Inorganic chemicals with one or more measured concentrations exceeding UTL values, or for which UTL values are unavailable, are summarized below.

- Antimony was detected in one sample at a concentration of 4.23 4.02 mg/kg, which is above the XRF UTL of 1.45 mg/kg.
- Cadmium was detected in one sample a concentration of 9.52 mg/kg. Cadmium has no XRF UTL for comparison.
- Calcium was detected in one sample at a concentration of 17,600 mg/kg, which is above the XRF UTL of 10,900 mg/kg.
- Chromium was detected in two samples at two different locations at concentrations of 75.4 and 45.6 mg/kg, which are above the XRF UTL of 45.1 mg/kg.
- Copper was detected in one sample at a concentration of 149 mg/kg, which is above the XRF UTL of 16.7 mg/kg.
- Lead was detected in one sample at a concentration of 282 mg/kg, which is above the XRF UTL of 28.4 mg/kg.

- Titanium was detected in all four samples at a maximum concentration of 2,519 mg/kg. Titanium has no XRF UTL for comparison.

- Uranium was detected in one sample at a concentration of 8.18 mg/kg, which is above the XRF UTL of 5.33 mg/kg.

- Zinc was detected in one sample at a concentration of 294 mg/kg, which is above the XRF UTL of 76.6 mg/kg.

No mixed-soil UTLs for fixed-site laboratory analyses were exceeded.

TABLE 5.4.5-1

INORGANIC CHEMICALS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTLs FOR PRS Nos. 35-004(m) AND 35-014(g_2)

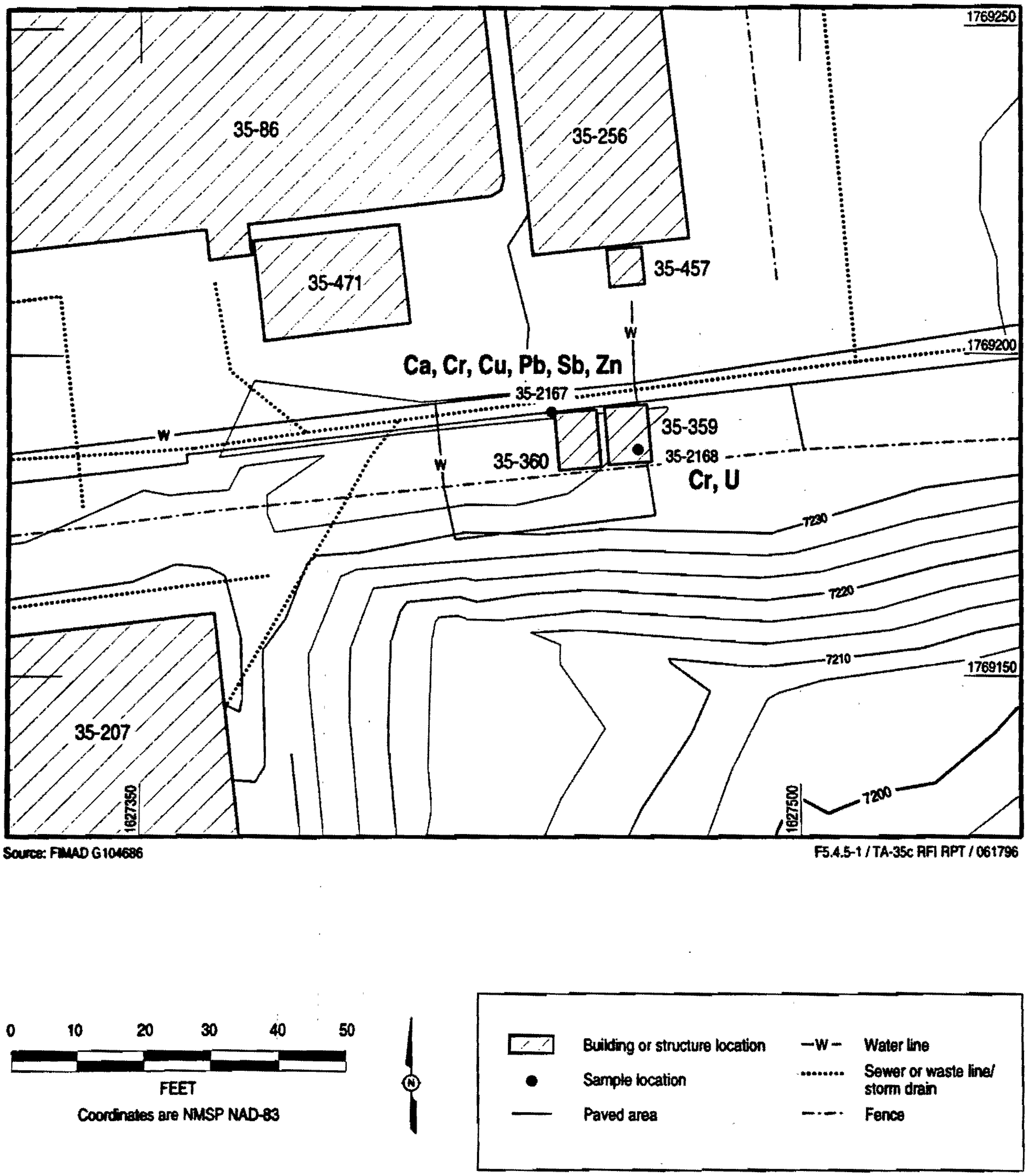
Location ID	Sample ID	Depth (ft)	Ca	Cd	Cr	Cu	Pb	Sb	Ti	U	Zn
SAL	N/A	N/A	N.A.	38	210	2800	400	31	N.A.	230	23000
Mixed-soil UTL	N/A	N/A	6120	2.7	19.3	15.5	23.3	1	N/A	N/A	50.8
XRF UTL	N/A	N/A	10900	N.A.	45.1	16.7	28.4	1.45	N.A.	5.33	76.6
35-2167	0435-95-0011	0–0.5	17600	9.52	75.4	149	282	4.23	2068	<8	294
35-2168	0435-95-0013	0–1	6330	<3	45.6	12.1	19.4	<4	2519	8.18	51.4
35-2168	0435-95-0015	1–2	3620	0.12 J	10.5	5.6612 J	11	<.64 U	2073	<8	31.3576
35-2168	0435-95-0019	2–3	5110	<3	34.6	9.96	23.5	<4	1719	<8	51

*mg/kg

5.4.6 Evaluation of Organic Chemicals

The organic chemicals analyzed for at these PRSs include VOCs, SVOCs, PCBs, PAHs, and pesticides. One soil sample was analyzed for SVOCs. Five soil samples from two locations were analyzed for VOCs; one sample was submitted for fixed-site laboratory analysis, and the other four were analyzed in the mobile laboratory facility. Four soil samples from two locations were analyzed for PCBs; one sample was submitted for fixed-site laboratory analysis, and the other three were analyzed in the mobile laboratory facility. The fixed-site laboratory analysis for PCBs included the following Aroclors: 1016, 1221, 1232, 1242, 1248, 1254, and 1260. The mobile laboratory analysis for PCBs included Aroclors 1242, 1254, and 1260.

No organic chemicals were detected in any sample.



Source: FIMAD G104686

F5.4.5-1 / TA-35c RFI RPT / 061796

Figure 5.4.5-1. Locations of analytes that exceed UTLs at PRS Nos. 35-004(m) and 35-014(g_2).

5.4.7 Human Health Assessment

5.4.7.1 Screening Assessment

Nine inorganic chemicals were carried forward from the background comparison. All were detected at concentrations below their respective SALs. As described in Section 3.4.1 in Chapter 3.0 of this RFI report, analytes are divided into two classes (noncarcinogens and chemical carcinogens) for the MCE, depending on which toxicological effect forms the basis of their SAL, to evaluate possible additive effects within each class of chemical.

The MCE result for noncarcinogens was 1.2. The COPCs that have a normalized value of more than 0.1 at this PRS are antimony (0.14), cadmium (0.25), and lead (0.71). Noncarcinogenic COPCs are identified in Table 5.4.7-1 and shown in Figure 5.4.7-1. These three inorganic chemicals are retained as COPCs for further evaluation and are discussed in Section 5.4.7.2. In Table 5.4.7-1 the values in the boxes indicate measurements that result in the identification of COPCs based on the results of the MCE.

<u>TABLE 5.4.7-1</u>

NONCARCINOGENIC COPCs IDENTIFIED IN MCE FOR PRS Nos. 35-004(m) AND 35-014(g_2)*

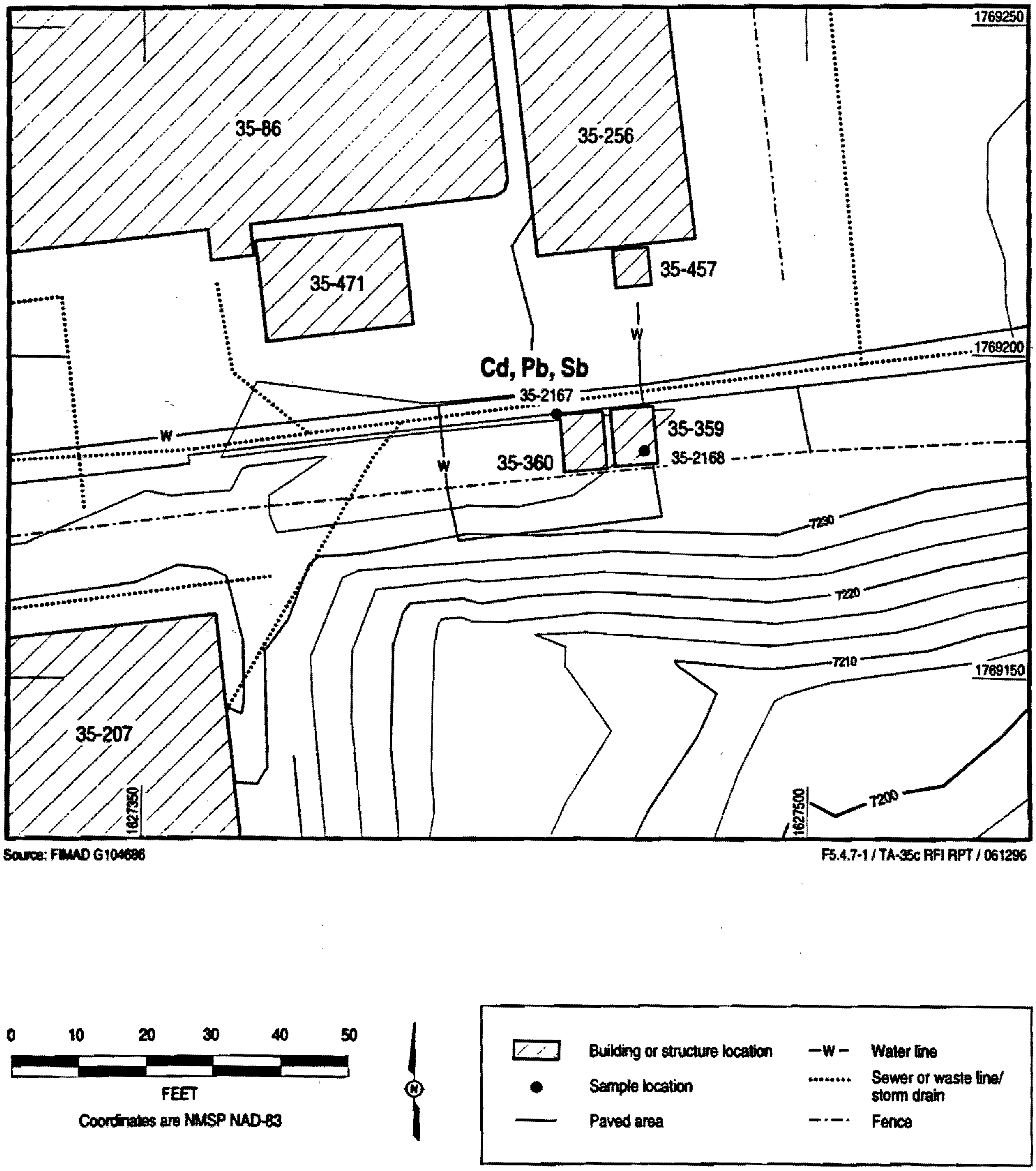
Location ID	Sample ID	Depth (ft)	Cd	Pb	Sb
SAL	N/A	N/A	38	400	31
35-2167	0435-95-0011	0-0.5	9.52	282	4.23
MCE = 1.2 *mg/kg					

Chromium is the only chemical carcinogen COPC identified for which carcinogenesis forms the basis of the SAL value. Cadmium is recognized by EPA as a Group B1 probable human carcinogen, although the SAL value is derived for a noncancer effect because this endpoint is limiting for a risk-based concentration in soil. Adding the noncancer normalized sum for cadmium (0.25) to the cancer normalized sum for chromium (0.36) yields a value of 0.61, which is less than unity. Because the cancer normalized sum for cadmium would be less than the noncancer normalized sum, it is evident that a potential human health cancer risk based on additive effects for chromium does not exist.

Among the inorganic chemicals above UTL values that are identified in Section 5.4.5, calcium and titanium do not have soil SALs for comparison. Calcium is an essential nutrient that is generally recognized as nontoxic and can be eliminated on the basis of professional judgment (EPA 1989, 8021). Titanium is widely used as a food and cosmetics additive to whiten a product. It is generally considered to be physiologically inert in its common form as titanium dioxide (Amdur et al. 1991, 53961). Therefore, further evaluation of calcium and titanium is not proposed.

5.4.7.2 Risk Assessment

A quantitative human health risk assessment was not performed for these PRSs. However, a qualitative evaluation of COPCs is presented below.



Source: FIMAD G104686

F5.4.7-1 / TA-35c RFI RPT / 061296

Figure 5.4.7-1. Location of COPCs identified in MCE at PRS Nos. 35-004(m) and 35-014(g_2).

5.4.7.2.1 Review of Chemicals of Potential Concern and Extent of Contamination

The data collected at these PRSs are insufficient to conclusively determine the extent of contamination. However, these data (and supporting data from other PRSs in the vicinity) do support the conclusion that a widespread release of contaminants at concentrations of concern for adverse human health effects is unlikely to have occurred.

The pattern of contamination observed at Location ID No. 35-2167 (several metals near to or a factor of two to four times higher than background UTL values) is similar to that seen at several other PRSs in TA-35 where no specific releases have been identified. Only lead, detected at a concentration ten times higher than its UTL in one sample, was significantly higher than the generally elevated concentrations observed elsewhere. These elevated concentrations are probably a function of the numerous undifferentiated sources typical of an industrial facility such as TA-35. At these PRSs the pattern may be associated primarily with storm-water runoff from the parking area south of TA-35-86.

Location ID Nos. 35-2171, 35-2287, and 35-2170, which are associated with PRS Nos. 35-014(g_1) and 35-016(n), are located southwest of these PRSs. A significant release of contamination at these PRSs could be expected to impact those three sample locations because they lie downgradient of the western portion of these PRSs. In fact, the pattern of contamination at Location ID Nos. 35-2171, 35-2287, and 35-2170 is similar to the pattern at these PRSs, although the concentrations of cadmium and lead are maximally only one-half as high. The generally lower chemical concentrations downgradient of the mesa top indicate that chemical concentrations are decreasing with distance, which is expected. Therefore, conclusions based on observed concentrations at Location ID No. 35-2167 are conservative because concentrations on the hillside below the asphalt-covered mesa top, where exposure to large areas of soil might occur, are likely to be lower.

The six inorganic chemicals analyzed in the MCE had a normalized sum of 1.2. The COPCs that have a normalized value of more than 0.1 at these PRSs are antimony (0.14), cadmium (0.25), and lead (0.71). These values are based on XRF analyses, which measure the total metal concentration in soil and not the acid soluble portion (as in method SW-846), which is generally assumed to be comparable to the fraction that would be dissolved in the acidic contents of the gastrointestinal tract. Antimony has an SW-846 total digestion (hydrofluoric acid) UTL of 1.45 mg/kg, which is used as a surrogate for an XRF UTL. This value is 31% higher than the maximum detected value for antimony analyzed by the standard SW-846 nitric acid digestion (1.0 mg/kg). Lead has an XRF UTL (28.4 mg/kg) that is 18% higher than the SW-846 UTL (23.3 mg/kg). Cadmium has neither an XRF nor a total digestion UTL value for comparison. As discussed in Section 3.1.3 in Chapter 3.0 of this RFI report, the SW-846 analyses more accurately represent the fraction of an element in soil available for uptake. Accounting for the positive bias associated with the XRF and total digestion analyses, the MCE value would likely be unity or below.

The MCE calculations assume additivity of toxicity endpoints; that is, the toxicological effects on which the toxicity values are based are identical among the chemicals. Although each of the three chemicals identified as COPCs in the screening assessment may impact multiple target organs or organ systems, the specific toxicity values derived by EPA are based on one or more particular toxic endpoints. The particular toxicity endpoints for antimony include longevity and alteration of blood glucose and cholesterol levels. For cadmium, the toxicity endpoint is proteinuria, an excess of serum proteins in the urine. Although an EPA toxicity value has not been developed for lead, neurobehavioral effects are known to be the primary adverse consequences of lead exposure. Because glucose and cholesterol metabolism, kidney effects (proteinuria), and neurotoxicity are associated with separate body systems, the assumption of endpoint additivity for the MCE calculation cannot be supported. However, it must be noted that increased respiratory tract tumors are potentially associated with lead (an EPA Group B2 carcinogen) as well as cadmium (an EPA Group B1 carcinogen). Additionally, kidney effects have been associated with both lead and cadmium. Nevertheless, these secondary effects are associated with significantly higher intake of these chemicals than the primary effects on which the EPA toxicity values are based so that an MCE calculated on these bases would certainly be less than unity.

Based on the information presented for likely extent of contamination, analytical method bias, and MCE additivity, it is proposed that no further investigation of the COPCs identified in the screening assessment be performed.

5.4.8 Ecological Assessment

In accordance with conversations among Laboratory ER Project personnel, DOE/LAAO, and the regulators, further ecological risk assessment at this site will be deferred until the site can be assessed as part of the new Ecological Exposure Unit (Ecozone) methodology that is being developed by the Laboratory in conjunction with EPA Region 6 and NMED.

5.4.9 Conclusions and Recommendations

This site is not likely to pose a significant human health risk.

The objective of the Phase I RFI at PRS Nos. 35-004(m) and 35-014(g_2) was to determine the presence or absence of contamination associated with the former container storage area. COPCs identified in the human health screening assessment were eliminated in a qualitative risk assessment.

The extent of contamination has been determined to the degree that is feasible from limited judgmental sampling. Samples for specific analytes were collected from a 3-ft hand-auger hole and a surface sample located where contaminants are most likely to occur.

Based on NFA criterion number 4 (LANL 1995, 53863), a Class III permit modification is requested to remove PRS Nos. 35-004(m) and 35-014(g_2) from the HSWA Module of the Laboratory's RCRA operating permit. The sample data indicate that this site it not likely to pose a significant human health risk now or in the foreseeable future. Further ecological risk assessment at this site will be deferred as stated in Section 5.4.8.

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5.5 PRS Nos. 35-014(g_1) and 35-016(n)

PRS No. 35-014(g_1) is an oil-stained area in the vicinity of a storm-water outfall near the northeast corner of an experimental support laboratory (TA-35-207). PRS No. 35-016(n) is an outfall established to handle storm-water runoff from the Carbon Dioxide Laser Building (TA-35-86). Three areas stained by oil spills (PRS Nos. 35-014[g_1, g_2, and g_3]) are present near a daylight drainage channel that contributes to the outfall. PRS No. 35-014(g_2) comprises a separate decision set, which is addressed in Section 5.4, and PRS No. 35-014(g_3) will be addressed in a future RFI report. PRS No. 35-014(g_1) is located at the point of discharge from the storm drains associated with PRS No. 35-016(n). These PRSs are included in the same decision set because they are located in such close proximity that contaminants associated with the dielectric oil spill would intermingle with contaminants in the discharge area. Therefore, they cannot be evaluated independently.

The only COPC identified as a result of the screening assessment is benzo[a]pyrene. This COPC is evaluated in Section 5.5.7.2. In addition, antimony, chromium, copper, lead, nickel, uranium, and zinc were measured above background UTL values.

PRS Nos. 35-014(g_1) and 35-016(n) are recommended for NFA based on NFA criterion number 4 (LANL 1995, 53863).

Radiological sample results are neither presented nor discussed for these PRSs and will be provided later as an addendum to this RFI report. A summary of samples submitted for radiological analysis is shown in Section 5.5.4.3.

5.5.1 History

PRS Nos. 35-014(g_1) and 35-016(n) are discussed in detail in Section 3.3.2 of the work plan and Section 7.26 of the June 1994 addendum to the work plan (LANL 1992, 7666; Pratt 1994, 43475).

PRS No. 35-016(n) was installed around 1977 to handle storm-water runoff from the roof and parking lot of TA-35-86. The discharge area below the outfall also receives surface runoff from PRS No. 35-014(g_1) and may have provided a pathway for contaminant migration associated with the dielectric oil spill.

The contaminants that were potentially present (and therefore investigated during this RFI) include radionuclides, VOCs, SVOCs, metals, and pesticides/PCBs.

5.5.2 Description

These PRSs are located at the southern edge of Ten Site Mesa. PRS No. 35-014(g_1) is an oil-stained area approximately 2 ft by 4 ft located on concrete adjacent to an asphalt-paved catchment basin. A small oil stain is visible on concrete at the northeast corner of TA-35-207; however, no obvious oil staining is apparent in the catchment basin or the outfall.

The outfall associated with PRS No. 35-016(n) is a 10-in.-diameter CMP located approximately 15 ft east of PRS. No. 35-014(g_1) that discharges southward into Ten Site Canyon. The CMP receives flow from the catchment basin via an intake grate. The source of the outfall is a daylight drainage channel that contributes to the catchment basin. Surface runoff and discharge from the outfall are intermittent as a result of natural precipitation. The topography of the site is relatively flat with a gentle slope southward toward the edge of the mesa. Vegetation near the catchment basin and on the side of the mesa below the outfall appears to be normal and healthy.

5.5.3 Previous Investigations

Previous investigations were performed at this site. Samples collected from an oil-stained area contained detectable quantities of metals, pesticides/PCBs, alpha- and gamma-emitting radionuclides, SVOCs, and VOCs (LANL 1990, 7511). Therefore, similar contamination was suspected during the RFI.

5.5.4 Field Investigation

The objective of the Phase I RFI was to characterize the nature of potential contamination associated with the oil spill and the outfall.

The conceptual model for the RFI took into account the known dielectric oil spill adjacent to the catchment basin. The spill material was expected to enter the basin and be mobilized by surface runoff to the edge of the mesa. The conceptual model did not predict that hazardous chemicals were released to the environment from the outfall.

A judgmental sampling approach was used, and the sampling activities were biased toward areas where residual contamination was expected to collect. Samples were collected from sediments accumulated at the intake grate and from the discharge area below the outfall. One shallow hand-auger hole was drilled, and two surface samples were located within the storm-water drainage pathway.

Field activities included an H&S radiation survey, engineering surveys, and environmental surveys including a radiation grid survey.

Field screening during site surveys and sample collection activities was performed using a Foxboro 128 GC OVA, a Ludlum Model 139 alpha meter, and an Eberline ESP-1 beta/gamma meter. Using this instrumentation, background radiation measurements at TA-35 range from 200 to 500 cpm beta/gamma radiation depending on the location and substrate rock type. Field screening measurements greater than 500 cpm beta/gamma radiation were generally considered to be above background levels. No beta/gamma radiation measurements above background levels were obtained during field screening at this site, and no alpha radiation or organic vapors were detected.

5.5.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed on September 14, 1994. Beta/gamma radiation measurements ranged from 173 to 226 cpm, and the average was 198 cpm, which is within background levels.

Engineering surveys were performed on September 14, 1994, and March 27, 1995. The surveys consisted of a review of archival information and engineering drawings of TA-35 as well as field site inspections. After the site inspections were completed, sample locations were selected.

The radiation grid survey was performed on September 23, 1994. A total of 10 radiation measurements were obtained from grid locations northeast and east of TA-35-207. The radiation grid locations included Location ID Nos. 35-7985 through 35-7994, which were spaced at approximately 5-ft intervals. Beta/gamma radiation measurements ranged from 118 to 249 cpm, and the average was 204 cpm, which is within background levels.

5.5.4.2 Deviations from the Sampling and Analysis Plan

Sampling activities followed the original SAP, which is described in the June 1994 addendum to the work plan (Pratt 1994, 43475).

5.5.4.3 Sampling Activities

Phase I sampling was performed on April 12, 1995. Three locations were sampled, and five samples were collected (not including duplicate QA/QC samples). Two surface samples were collected (Location ID Nos. 35-2169 and 35-2170), and one hand-auger hole was drilled to a depth of 3 ft (Location ID No. 35-2171). Three samples were collected from the hand-auger hole. The sample collection intervals are shown in Table 5.5.4-1. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 200 to 224 cpm, which are within background levels.

Supplemental sampling was performed on December 8, 1995, to resample Location ID No. 35-2171 because the original sample material was lost at the analytical laboratory. One hand-auger hole (Location ID No. 35-2287) was drilled, and a subsurface soil sample was collected at the 1- to 2-ft interval. The beta/gamma radiation measurement obtained during field screening of the sample was 90 cpm, which is within background levels.

Table 5.5.4-1 summarizes all sampling for PRS Nos. 35-014(g_1) and 35-016(n); Figure 5.5.4-1 shows the sample locations.

<u>TABLE 5.5.4-1</u>

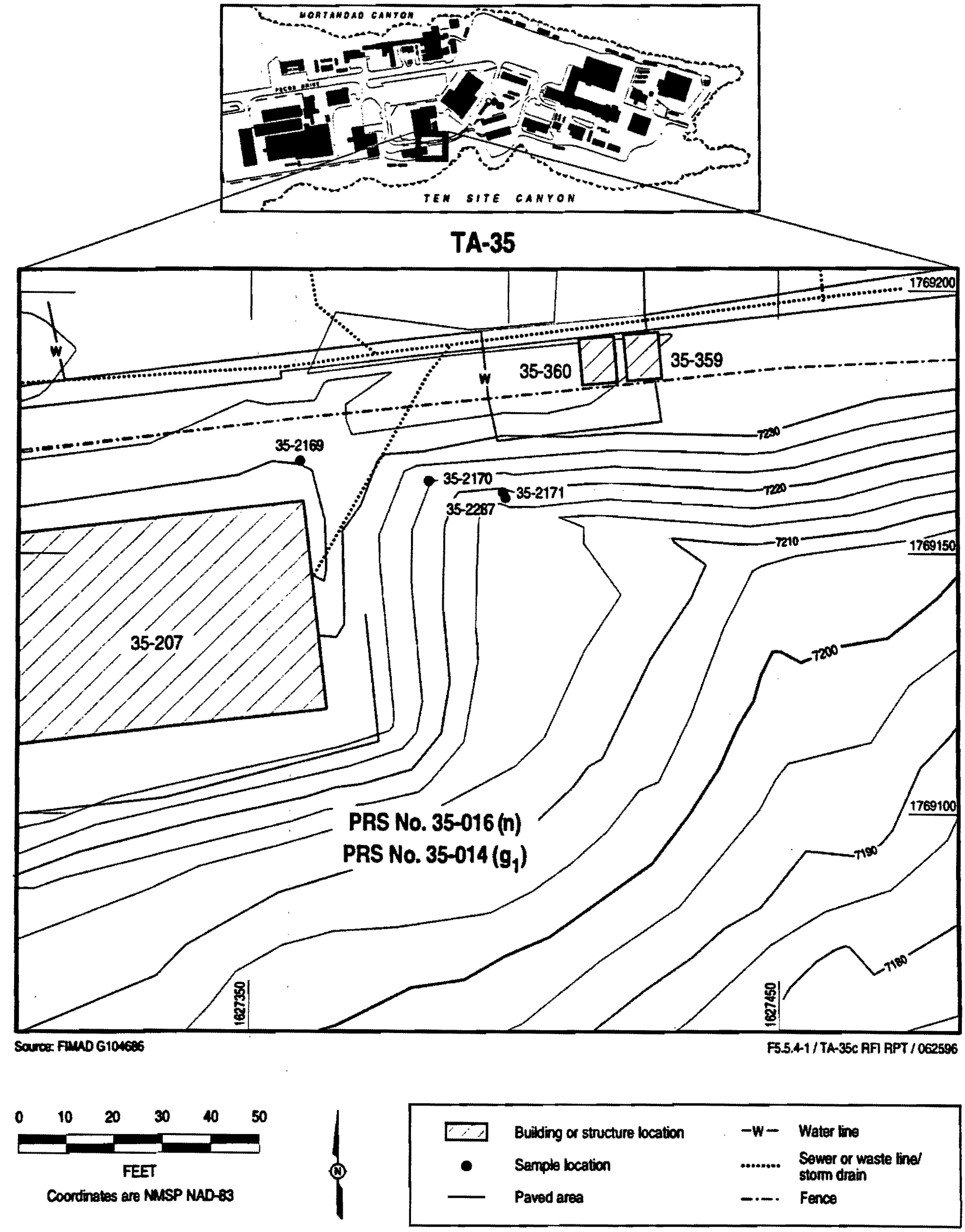
SUMMARY OF SAMPLES TAKEN AT PRS Nos. 35-014(g_1) AND 35-016(n)

Part 1

Location ID	Sample ID	Depth (ft)	Matrix	VOC Mobile Lab	VOC Fixed Lab	PAH Mobile Lab	SVOC Fixed Lab	PCB Mobile Lab
35-2169	0435-95-0021	0–0.5	Mixed soil	34	NR	51	NR	34
35-2170	0435-95-0023	0–0.5	Mixed soil	34	NR	34	34	34
35-2171	0435-95-0027	0–1	Mixed soil	34	NR	34	NR	34
35-2171	0435-95-0028	1–2	Mixed soil	34	NR	34	NR	34
35-2171	0435-95-0030	2–3	Mixed soil	34	34	34	NR	34
35-2287	0435-95-0201	1–2	Mixed soil	NR	NR	NR	NR	NR

Part 2

Location ID	Sample ID	Depth (ft)	Matrix	Pesticide/ PCB Fixed Lab	INORG Mobile Lab	INORG Fixed Lab	RAD Mobile Lab	RAD Fixed Lab
35-2169	0435-95-0021	0–0.5	Mixed soil	NR	49	NR	51	51
35-2170	0435-95-0023	0–0.5	Mixed soil	34	49	49	51	NR
35-2171	0435-95-0027	0–1	Mixed soil	NR	49	NR	51	NR
35-2171	0435-95-0028	1–2	Mixed soil	NR	NR	NR	51	51
35-2171	0435-95-0030	2–3	Mixed soil	NR	34	NR	51	NR
35-2287	0435-95-0201	1–2	Mixed soil	NR	NR	1679	NR	NR



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F5.5.4-1 / TA-35c RFI RPT / 062596

Figure 5.5.4-1. Locations of samples at PRS Nos. 35-014(g_1) and 35-016(n).

5.5.5 Background Comparisons

Background comparisons were performed for inorganic chemicals for which UTL values are available, as discussed in Section 3.2 in Chapter 3.0 of this RFI report. Two soil samples from two locations were analyzed in a fixed-site laboratory and four soil samples from three locations were analyzed by XRF in the mobile laboratory facility. For inorganic chemicals analyzed by XRF in the mobile laboratory facility, the UTL values have been corrected to account for method differences that generally result in higher measured background concentrations by XRF. Derivation of corrected UTL values for XRF data is discussed in Section 3.1.3 in Chapter 3.0 of this RFI report. If data are available by both methods, the data reported by the fixed-site laboratory will be given precedence because more confidence is placed in the fixed-site laboratory data than in the XRF analyses.

Two soil samples from one hand-auger hole and two surface samples were analyzed by XRF in the mobile laboratory facility for an analyte suite that included antimony, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, manganese, mercury, nickel, potassium, selenium, thorium, titanium, uranium, and zinc. As discussed in Section 4.1.3 of Chapter 4.0 of this RFI report, the TA-35 XRF data set is qualified such that antimony, cadmium, mercury, selenium, and uranium data should be regarded as estimated, and nickel data may have a low bias. Individual XRF samples were not qualified. One surface sample and the sample that was collected in the 1- to 2-ft interval were analyzed in a fixed-site laboratory for an inorganic chemical analyte suite that included aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc using the EPA methods described in Section 3.1.1 in Chapter 3.0 of this RFI report. The surface samples were collected in 0.5-ft vertical intervals, and the samples from the hand-auger holes were collected in 1-ft vertical intervals.

The highest detected value for each analyte was used for the background comparison. The mixed-soil UTL values were used for background comparison for analytes in the fixed-site laboratory suite. XRF UTL values were used for background comparison for analytes in the mobile laboratory facility suite. In Table 5.5.5-1, the values in the boxes indicate inorganic chemical measurements at concentrations greater than or equal to their respective UTL values. Table 5.5.5-1 also shows inorganic chemicals for which there are no UTL values for comparison. Inorganic chemicals that exceed background UTL values are shown on Figure 5.5.5-1. Detected inorganic chemicals with one or more measured concentrations exceeding UTL values, or for which UTLs are unavailable, are summarized below.

- Antimony was detected in one sample at a concentration of 1.2 mg/kg, which is above the mixed-soil UTL of 1.0 mg/kg.

- Chromium was detected in one sample at a concentration of 25.7 mg/kg, which is above the mixed-soil UTL of 19.3 mg/kg. It was also detected in one sample at a concentration of 45.8 mg/kg, which is above the XRF UTL of 45.1 mg/kg.

- Copper was detected in one sample at a concentration of 88.3 mg/kg, which is above the mixed-soil UTL of 15.5 mg/kg. It was also detected in one sample at a concentration of 90.8 mg/kg, which is above the XRF UTL of 16.7 mg/kg.

- Lead was detected in one sample at a concentration of 92 mg/kg, which is above the mixed-soil UTL of 23.3 mg/kg.

- Nickel was detected in one sample at a concentration of 23.6 mg/kg, which is above the XRF UTL of 22.5 mg/kg.

- Titanium was detected in four samples at a maximum concentration of 2,624 mg/kg. Titanium has no XRF UTL for comparison.

- Uranium was detected in one sample at a concentration of 13.3 mg/kg, which is above the XRF UTL of 5.33 mg/kg.

- Zinc was detected in one sample at a concentration of 752 mg/kg, which is above the mixed-soil UTL of 50.8 mg/kg. It was also detected in two samples at concentrations of 366 and 244 mg/kg, which are above the XRF UTL of 76.6 mg/kg.

TABLE 5.5.5-1

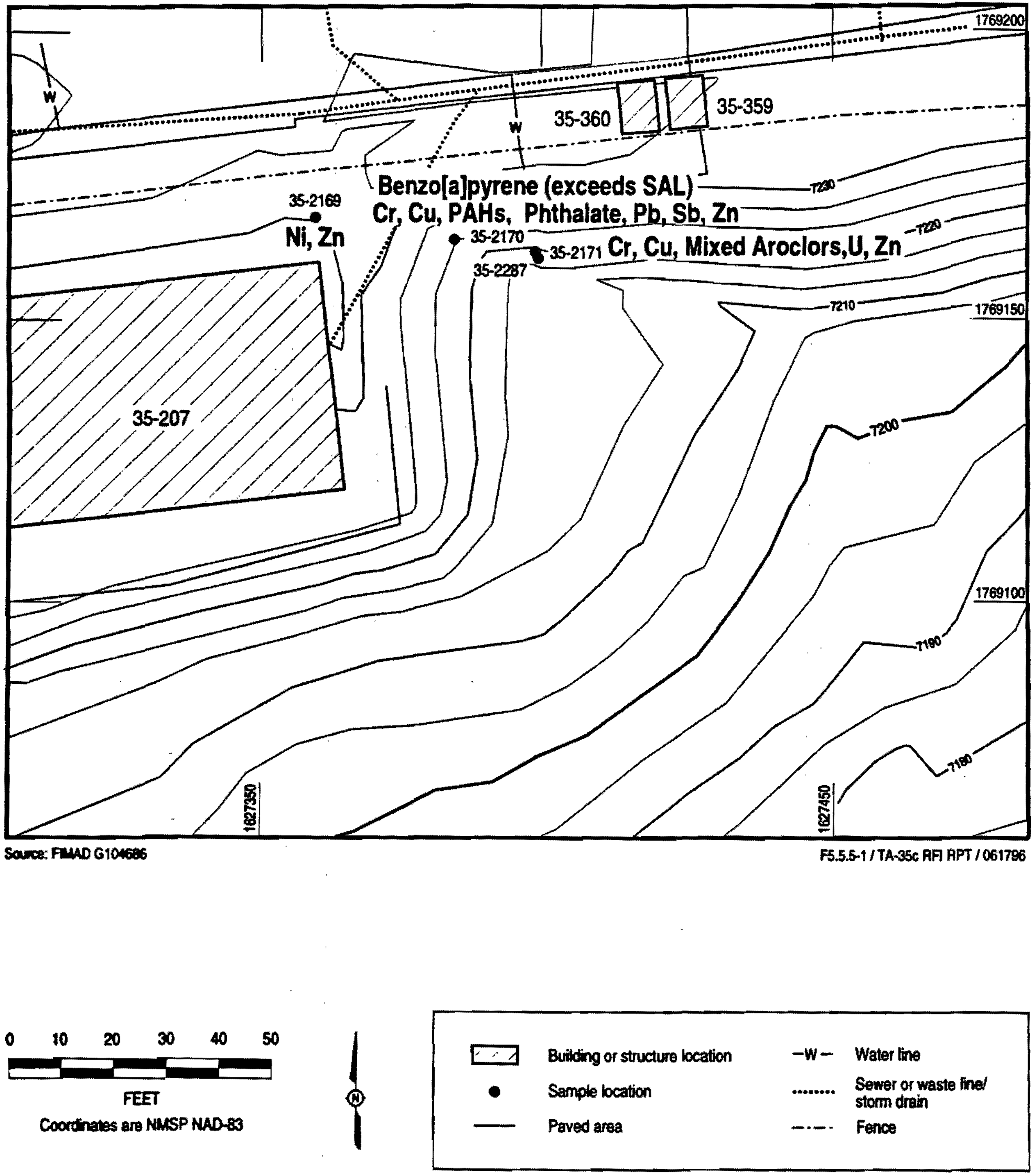
INORGANIC CHEMICALS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTLs FOR PRS Nos. 35-014(g_1) AND 35-016(n)

Location ID	Sample ID	Depth (ft)	Cr	Cu	Ni	Pb	Sb	Ti	U	Zn
SAL	N/A	N/A	210	2800	1500	400	31	N.A.	230	23000
Mixed-soil UTL	N/A	N/A	19.3	15.5	15.2	23.3	1	N/A	N/A	50.8
XRF UTL	N/A	N/A	45.1	16.7	22.5	28.4	1.45	N.A.	5.33	76.6
35-2169	0435-95-0021	0–0.5	37.1	<8	23.6	20.3	<4	1796	<8	366
35-2170	0435-95-0023	0–0.5	25.7	88.3	9.5	92	1.2 J	2166	<8	752
35-2171	0435-95-0027	0–1	38.6	90.8	<13	24.3	<4	2624	13.3	244
35-2171	0435-95-0030	2–3	45.8	9.75	<13	17.9	<4	988	<8	57.5
35-2287	0435-95-0201	1–2	18.9	4.4 J	8.6 J	5.2	<10.4 U	NA	NA	30.8

*mg/kg

5.5.6 Evaluation of Organic Chemicals

The organic chemicals analyzed for at these PRSs include VOCs, SVOCs, PCBs, and PAH compounds. Five soil samples from three locations were analyzed for VOCs, PCBs, and PAHs in the mobile laboratory facility. One sample was also analyzed for VOCs, and one samples was analyzed for SVOCs in a fixed-site laboratory.



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F5.5.5-1 / TA-35c RFI RPT / 061796

Figure 5.5.5-1. Locations of detected organic chemicals and analytes that exceed UTLs and SALs at PRS Nos. 35-014(g_1) and 35-016(n).

No VOCs were detected by either the mobile laboratory facility or the fixed-site laboratory. SVOCs and PAHs were detected in the mobile laboratory facility and the fixed-site laboratory, respectively. Detected organic chemicals are shown in Table 5.5.6-1 and Figure 5.5.5-1 and are summarized below.

- Aroclor 1260 (evaluated as mixed aroclor) was detected as a concentration of 0.064 mg/kg.
- Benzo[a]pyrene was detected at an estimated concentration of 0.17 mg/kg.
- Benzo[b]fluoranthene was detected at an estimated concentration of 0.21 mg/kg.
- Benzo[k]fluoranthene was detected at an estimated concentration of 0.23 mg/kg.
- Bis[2-ethylhexyl]phthalate was detected at a concentration of 0.45 mg/kg.
- Chrysene was detected at an estimated concentration of 0.18 mg/kg.
- Pyrene was detected at an estimated concentration of 0.17 mg/kg.

TABLE 5.5.6-1
SOIL CONCENTRATIONS* FOR DETECTED ORGANIC CHEMICALS AT PRS Nos. 35-014(g_1) AND 35-016(n)

Part 1

Location ID	Sample ID	Depth (ft)	Benzo[a]pyrene	Benzo[b]fluoranthene	Benzo[k]fluoranthene
SAL	N/A	N/A	0.061	0.61	6.1
CRQL	N/A	N/A	0.33	0.33	0.33
35-2170	0435-95-0023	0-0.5	0.17 J	0.21 J	0.23 J
35-2171	0435-95-0027	0-1	ND	ND	ND

Part 2

Location ID	Sample ID	Depth (ft)	Bis[2-ethylhexyl]-phthalate	Chrysene	Mixed Aroclors	Pyrene
SAL	N/A	N/A	32	24	1	2000
CRQL	N/A	N/A	0.33	0.33	0.05	0.33
35-2170	0435-95-0023	0-0.5	0.45	0.18 J	ND	0.17 J
35-2171	0435-95-0027	0-1	ND	ND	0.064 S,J-	ND

*mg/kg

5.5.7 Human Health Assessment

5.5.7.1 Screening Assessment

Eight inorganic chemicals and seven organic chemicals were carried forward from the background and EQL comparisons. As described in Section 3.4.1 in Chapter 3.0 or this RFI report, analytes are divided into two classes (noncarcinogens and chemical carcinogens) for the screening assessment, depending on which toxicological effect forms the basis of their SAL, to evaluate possible additive effects within each class of chemical.

Benzo[a]pyrene exceeded its SAL value in surface sample at Location ID No. 35-2170 (see Table 5.5.7-1 and Figure 5.5.5-1). The sample result that exceeded the SAL value is highlighted with black in Table 5.5.7-1.

TABLE 5.5.7-1

CARCINOGENIC CHEMICAL WITH CONCENTRATION*
IN SOIL THAT EXCEEDS SAL FOR PRS Nos. 35-014(g_1) AND 35-016(n)

Location ID	Sample ID	Depth (ft)	Benzo[a]pyrene
SAL	N/A	N/A	0.061
35-2170	0435-95-0023	0-0.5	0.17 J

*mg/kg

The MCE results for noncarcinogens and chemical carcinogens were 0.41 and 0.61, respectively. The MCE values for noncarcinogens and chemical carcinogens are less than unity; therefore, a potential human health risk based on additive effects is not identified for these classes of chemicals.

Chrysene, a carcinogen, was not included in the MCE because its SAL is not based on health effects. The SAL for chrysene is equivalent to its saturation concentration in soil, calculated according to the equation provided in the EPA Region IX preliminary remidiation goal (PRG) table (EPA 1995, 53970). The PRG values for residential exposure published in this table have been adopted by the ER Project as SALs, as described in *Risk-Based Corrective Action Process* (Environmental Restoration Decision Support Council 1996, 53751). Although a risk-based SAL for chrysene would certainly be higher (that is, less restrictive) than the SAL based on a saturation concentration, a risk-based SAL cannot be calculated using the model in the PRG table for estimating intake of volatile contaminants via inhalation because that model is not applicable beyond the soil saturation concentration. However, if chrysene were included in the MCE calculation using its current SAL, the MCE value for chemical carcinogens would increase only from a value of 0.61 to 0.62.

All the detected inorganic chemicals identified in the background comparison in Section 5.5.5 except titanium have soil SALs for comparison. Titanium has neither a UTL nor a SAL value. Titanium is widely used as a food and cosmetics additive to whiten a product. It is generally considered to be physiologically inert in its common form as titanium dioxide (Amdur et al. 1991, 53961). Therefore, further evaluation of titanium is not proposed.

5.5.7.2 Risk Assessment

One COPC was identified in the screening assessment in Section 5.5.7.1. A quantitative human health risk assessment was not performed for these PRSs. However, a qualitative evaluation of this COPC is presented below.

One PAH, benzo[a]pyrene, was detected above its SAL value in one surface sample. This sample (Sample No. 0435-95-0023) is located in the daylight drainage channel, which receives storm-water runoff from asphalt paved areas directly above the channel. The presence of this PAH and others is not unusual because they are found in asphalt and are also products of incomplete combustion from motor vehicles. The low concentrations of PAHs at this PRS are likely to be associated with runoff from the paved areas rather than PRS-related contamination. In any case, benzo[a]pyrene exceeded its SAL value by a factor of only three, which does not indicate potential adverse human exposure in a hillside drainage channel adjacent to an industrial facility. Therefore, benzo[a]pyrene is eliminated as a COPC.

5.5.7.2.1 Review of Chemicals of Potential Concern and Extent of Contamination

Although eight inorganic chemicals were identified above UTL values at these PRSs and six organic chemicals were measured above EQL values, as shown in Figure 5.5.5-1, no risk-based COPCs were identified in Section 5.5.7.2. As described in Section 5.5.4, the sampling activities were biased toward areas where residual contamination was expected. Samples were collected from sediments accumulated at the intake grate, and from the discharge area below the outfall. However, it is also possible that contamination may have been carried farther down the drainage in a dissolved state and primarily precipitated onto sediments below the outfall or on the floor of Ten Site Canyon. Historical contamination that precipitated onto soils in the discharge area may have been remobilized and deposited below the outfall or on the floor of Ten Site Canyon.

Although the extent of contamination cannot be defined with certainty based on data from the three existing sample locations, additional sampling for these PRSs is not proposed. Contaminant concentrations in the discharge area were not sufficiently high to result in identification of risk-based COPCs in soils. Even if patterns of sediment deposition and chemical precipitation were to result in somewhat higher contaminant concentrations at a specific location farther from the outfalls, it is unlikely that a sufficient quantity of contaminants has been released via this discharge to result in unacceptable human health risks at a remote location. If this were the case, residual contamination in the discharge area might be expected to fail the screening-level evaluation described in Section 5.5.7.1.

The pattern of contamination observed at these PRSs (several metals near to or a factor of two or three times higher than background UTL values and low levels of PAHs and aroclors) is similar to that seen at several other PRSs at TA-35 where no specific release has been identified. This pattern is probably a function of the numerous, undifferentiated sources typical of an industrial facility such as TA-35. At these PRSs the pattern may be associated primarily with storm-water runoff from the paved areas around TA-35-207 and TA-35-86.

5.5.8 Ecological Assessment

In accordance with conversations among Laboratory ER Project personnel, DOE/LAAO, and the regulators, further ecological risk assessment at this site will be deferred until the site can be assessed as part of the new Ecological Exposure Unit (Ecozone) methodology that is being developed by the Laboratory in conjunction with EPA Region 6 and NMED.

5.5.9 Conclusions and Recommendations

This site is not likely to pose a significant human health risk.

The objective of the Phase I RFI at PRS Nos. 35-014(g_1) and 35-016(n) was to characterize the nature of potential contamination associated with the dielectric oil spill site and the storm-water outfall. The COPC identified in the human health screening assessment was eliminated in a qualitative risk assessment.

Samples for specific analytes were collected from a 3-ft hand-auger hole and two surface samples. The extent of contamination cannot be conclusively determined based on these sample data, but the weight of evidence suggests that widespread contamination at concentrations of human health concern has not occurred.

Based on NFA criterion number 4 (LANL 1995, 53863), a Class III permit modification is requested to remove PRS Nos. 35-014(g_1) and 35-016(n) from the HSWA Module of the Laboratory's RCRA operating permit. The sample data indicate that this site is not likely to pose a significant human health risk now or in the foreseeable future. Further ecological risk assessment at this site will be deferred as stated in Section 5.5.8.

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5.6 PRS No. 35-016(b)

PRS No. 35-016(b) is an active outfall (NPDES Permit No. 06A132) located along the southern edge of Ten Site Mesa.

No COPCs were identified during the screening assessment. Chromium, copper, lead, nickel, uranium and zinc were measured above background UTL values. No organic chemicals were detected above EQL values.

PRS No. 35-016(b) is recommended for NFA based on NFA criteria numbers 3 and 4 (LANL1995, 53863).

Radiological sample results are neither presented nor discussed for this PRS and will be provided later as an addendum to this RFI report. A summary of samples submitted for radiological analyses is shown in Section 5.6.4.3.

5.6.1 History

PRS No. 35-016(b) is discussed in detail in Section 3.3.2 of the work plan and Section 7.26 of the June 1994 addendum to the work plan (LANL 1992, 7666; Pratt 1994, 43475).

This PRS was established in 1977 to discharge photographic processing effluents from a Laboratory office building (TA-35-87) into Ten Site Canyon. The waste is passed through a silver and cyanide recovery process before it enters the drain lines of TA-35-87. Effluent is limited to 3,000 gal./day and is sampled for silver and cyanide under NPDES requirements (LANL 1990, 7511).

The contaminants that were potentially present (and therefore investigated during this RFI) include radionuclides, VOCs, SVOCs, and metals.

5.6.2 Description

The outfall consists of a 4-in.-diameter polyvinyl chloride (PVC) pipe that discharges to a drainage channel south of TA-35-87. Adjacent to PRS No. 35-016(b) is an 18-in.-diameter CMP that drains the parking lot south of TA-35-87. Flow from the PVC outfall has been observed during two site inspections and is estimated to be approximately 5 gal. per minute (gpm). Concrete and asphalt riprap have been placed in the drainage channel below the outfall to control erosion. The drainage channel is located on a steep mesa edge with an estimated slope of 70%. Drainage from the outfall flows southward into Ten Site Canyon. The ground surface adjacent to the drainage channel is covered with grasses, shrubs, pine trees, pine needle debris, and leaves. Vegetation along the drainage channel and below the outfall appears to be normal and healthy.

5.6.3 Previous Investigations

No previous investigations have been performed at this site. However, the outfall effluent is sampled according to NPDES permit requirements.

5.6.4 Field Investigation

The objective of the Phase I RFI was to characterize the nature of potential contamination associated with the outfall and discharge area.

The conceptual model for the RFI did not predict that hazardous chemicals were released to the environment. However, if hazardous chemicals were present, the conceptual model shows that the most likely mechanism of movement beyond the PRS boundary is associated with hydrologic movement in the soil and surface water transport of contaminants over and into the bedrock tuff.

A judgmental sampling approach was used, and the sampling activities were biased toward areas where residual contamination would likely be found. To sample potential contamination, samples were collected from the drainage channel below the outfall.

Field activities included an H&S radiation survey, engineering surveys, and environmental surveys including a radiation grid survey and an organic vapor survey.

Field screening during site surveys and sample collection activities was performed using a Foxboro 128 GC OVA, a Ludlum Model 139 alpha meter, and an Eberline ESP-1 beta/gamma meter. Using this instrumentation, background radiation measurements at TA-35 range from 200 to 500 cpm beta/gamma radiation depending on the location and substrate rock type. Field screening measurements greater than 500 cpm beta/gamma radiation were generally considered to be above background levels. No beta/gamma radiation measurements above background levels were obtained during field screening at this site, and no alpha radiation or organic vapors were detected.

5.6.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed on September 14, 1994. A beta/gamma radiation measurement from the opening of the outfall pipe was 155 cpm, which is within background levels.

Engineering surveys were performed on September 14, 1994, and March 27, 1995. The surveys consisted of reviews of archival information, oblique photographs, aerial photographs, and engineering drawings of TA-35 as well as a field site inspection and a description of the PRS. The PRS site was located, and the condition of the site was described.

Based on the results of the engineering surveys and on the SAP, the sample points were located in the drainage channel below the outfall. The surface soil sample was located in sediments 8 ft below the outfall, and the hand-auger hole was located about 20 ft southwest and about 15 ft below the outfall on a relatively flat sediment shelf within the steep drainage channel.

The results of the engineering surveys revealed that the 4-in.-diameter PVC outfall is adjacent to an 18-in.-diameter CMP outfall that drains the parking area south of TA-35-87. During two site inspections, the PVC outfall was observed to be flowing at an estimated rate of 5 gpm. Flow is present in the channel. The radiation grid survey was performed on September 22, 1994. The radiation grid locations included Location ID Nos. 35-7920 through 35-7934, which were spaced at approximately 10-ft intervals. Beta/gamma radiation measurements ranged from 196 to 298 cpm, and the average was 241 cpm, which is within background levels.

5.6.4.2 Deviations from the Sampling and Analysis Plan

Sampling activities followed the original SAP, which is described in the June 1994 addendum to the work plan (Pratt 1994, 43475).

5.6.4.3 Sampling Activities

Phase I sampling was performed on April 18, 1995. Four soil samples were collected (not including duplicate QA/QC samples). One surface sample was collected (Location ID No. 35-2189), and one hand-auger hole was drilled to a depth of 3 ft (Location ID No. 35-2190), and three soil samples were collected. The sample collection intervals are shown in Table 5.6.4-1. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 215 to 261 cpm, which are within background levels.

Table 5.6.4-1 summarizes all sampling for PRS No. 35-016(b); Figure 5.6.4-1 shows the sample locations.

TABLE 5.6.4-1

SUMMARY OF SAMPLES TAKEN AT PRS No. 35-016(b)

Part 1

Location ID	Sample ID	Depth (ft)	Matrix	VOC Mobile Lab	VOC Fixed Lab	PAH Mobile Lab	SVOC Fixed Lab
35-2189	0435-95-0002	0–0.5	Mixed soil	43	43	43	NR
35-2190	0435-95-0005	0–1	Mixed soil	43	NR	43	43
35-2190	0435-95-0008	1–2	Qbt3	43	NR	43	NR
35-2190	0435-95-0009	2–3	Qbt3	59	NR	59	NR

Part 2

Location ID	Sample ID	Depth (ft)	Matrix	INORG Mobile Lab	INORG Fixed Lab	RAD Mobile Lab	RAD Fixed Lab
35-2189	0435-95-0002	0–0.5	Mixed soil	43	NR	62	61
35-2190	0435-95-0005	0–1	Mixed soil	43	NR	62	NR
35-2190	0435-95-0008	1–2	Qbt3	NR	NR	62	NR
35-2190	0435-95-0009	2–3	Qbt3	NR	59	62	NR

5.6.5 Background Comparisons

Background comparisons were performed for inorganic chemicals for which UTL values are available, as discussed in Section 3.2 in Chapter 3.0 of this RFI report. For inorganic chemicals analyzed by XRF in the mobile laboratory facility, the UTL values have been corrected for some analytes to account for method differences that generally result in higher measured background concentrations by XRF. Derivation of corrected UTL values for XRF data is discussed in Section 3.1.3 in Chapter 3.0 of this RFI report. If data are available by both methods, the data reported by the fixed-site laboratory will be given precedence because more confidence is placed in the fixed-site laboratory data than in the XRF analyses.

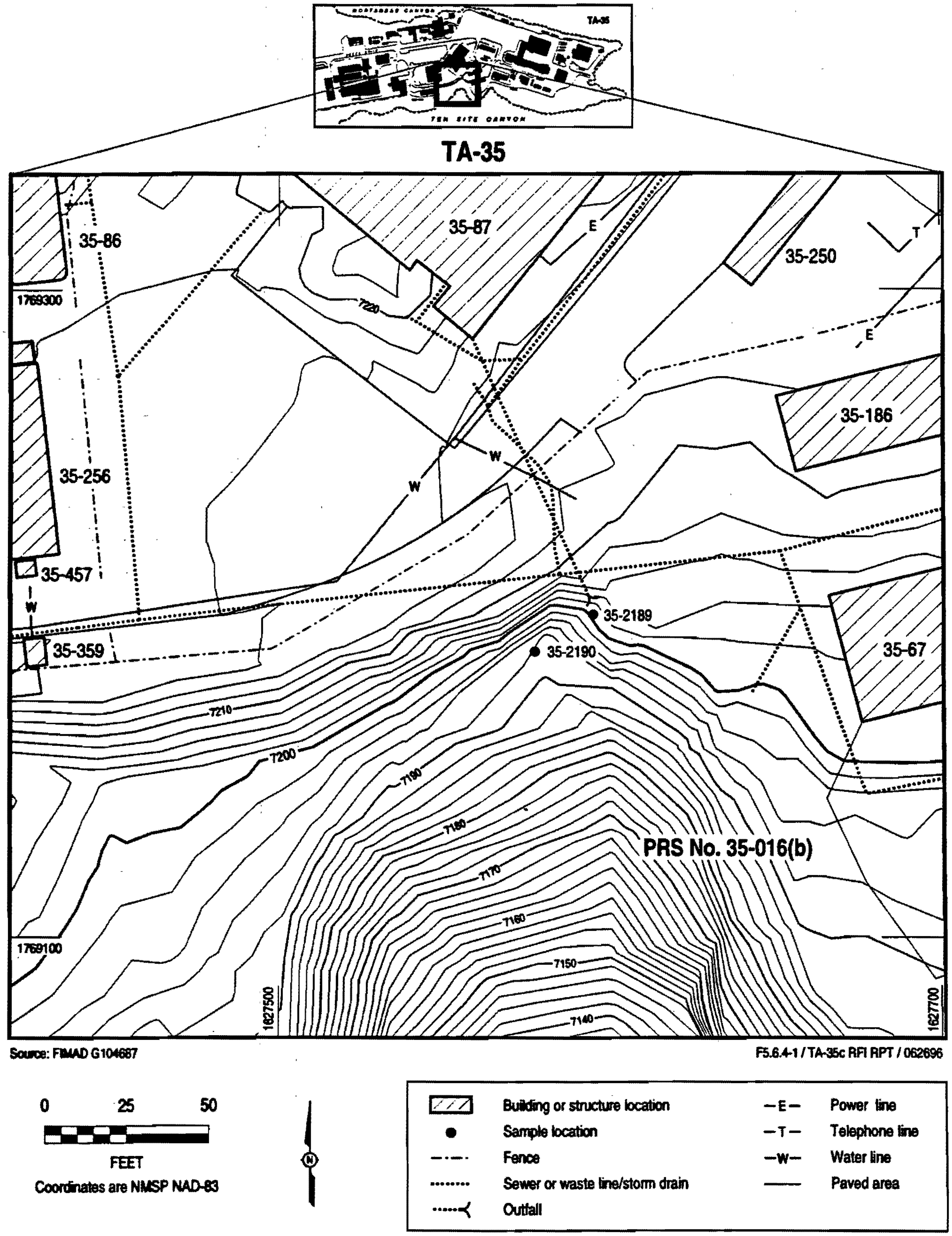

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Figure 5.6.4-1. Locations of samples at PRS No. 35-016(b).

Four samples from two locations were analyzed by XRF in the mobile laboratory facility for an analyte suite that included antimony, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, manganese, mercury, nickel, potassium, selenium, thorium, titanium, uranium, and zinc. As discussed in Section 4.1.3 in Chapter 4.0 of this RFI report, the TA-35 XRF data set is qualified such that the data for antimony, cadmium, mercury, selenium, and uranium should be regarded as estimated, and nickel data may have a low bias. Individual XRF samples were not qualified. One soil sample was also analyzed in a fixed-site laboratory for an inorganic chemical analyte suite that included aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc using the EPA methods described in Section 3.1.1 in Chapter 3.0 of this RFI report. The surface sample was collected in a 0.5-ft vertical interval, and the sample from the hand-auger hole was collected in a 1-ft vertical interval.

Silver and cyanide are the two inorganic chemicals for which outfall discharge water is permitted under NPDES Permit No. 06A132. For this RFI, silver was measured in only one sample, and cyanide was not analyzed for in site samples. However, the objective of this investigation was not to evaluate contamination associated with permitted discharge but to determine whether nonpermitted contaminants may have been released at this PRS in quantities that pose a current potential human health or ecological risk. Silver was not measured above detection limits in the soil sample submitted for fixed-site laboratory analysis.

The mixed-soil UTL values were used for background comparison for the sample intervals that contained any matrix other than, or in addition to, tuff. The UTL for the geologic tuff unit (Qbt3) was used for background comparison when the sample matrix was tuff alone. The XRF UTL values were used for XRF data, as discussed in Section 3.1.3 in Chapter 3.0 of this RFI report. In Table 5.6.5-1, the values in the boxes indicate inorganic chemical measurements at concentrations greater than or equal to their respective UTL values. Table 5.6.5-1 also shows inorganic chemicals for which there are no UTL values for comparison. The concentrations above background levels at each location are shown in Figure 5.6.5-1. Detected inorganic chemicals with one or more measured concentrations equal to or exceeding UTL values, or for which UTL values are unavailable, are summarized below.

- Chromium was detected in one sample at a concentration of 3.8 mg/kg, which is above the Qbt3 UTL of 2.1 mg/kg.
- Copper was detected in one sample at a concentration of 17 mg/kg, which is slightly above the XRF UTL of 16.7 mg/kg.
- Lead was detected in three samples at three different locations at a maximum concentration of 88.6 mg/kg, which is above the XRF UTL of 28.4 mg/kg.
- Nickel was detected in one sample at a concentration of 27.2 mg/kg, which is above the XRF UTL of 22.5 mg/kg.
- Selenium was detected in one Qbt3 sample at a concentration of 1.4 mg/kg. No Qbt3 UTL value exists for selenium.
- Titanium was detected in four samples at a maximum concentration of 942 mg/kg. No UTL values exist for titanium.

- Uranium was detected in one sample at a concentration of 9.52 mg/kg, which is above the XRF UTL of 5.33 mg/kg.

- Zinc was detected in one sample at a concentration of 79.9 mg/kg, which is slightly above the XRF UTL of 76.6 mg/kg.

TABLE 5.6.5-1

INORGANIC CHEMICALS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTLs FOR PRS No. 35-016(b)

Location ID	Sample ID	Depth (ft)	Cr	Cu	Ni	Pb	Se	Ti	U	Zn
SAL	N/A	N/A	210	2800	1500	400	380	N.A.	230	23000
Qbt3 UTL	N/A	N/A	2.1	2	2.6	16.2	N.A.	N/A	N/A	55.5
XRF UTL	N/A	N/A	45.1	16.7	22.5	28.4	N.A.	N.A.	5.33	76.6
35-2189	0435-95-0002	0–0.5	21.5	17	<13	26.7	<4	942	<8	79.9
35-2190	0435-95-0005	0–1	16.5	<8	14.3	88.6	<4	448	9.52	67.6
35-2190	0435-95-0008	1–2	<12	<8	27.2	69	<4	442	<8	66
35-2190	0435-95-0009	2–3	3.8	1.2 J	2.4 J	67.1	1.4	539	<8	38.2802

*mg/kg

5.6.6 Evaluation of Organic Chemicals

The organic chemicals analyzed for at this PRS include VOCs, SVOCs, and PAH compounds. Four soil samples from two locations were analyzed for VOCs and PAHs in the mobile laboratory facility. In a fixed-site laboratory, one sample was analyzed for VOCs, and another sample was analyzed for SVOCs.

As discussed in Section 4.2.4 in Chapter 4.0 of this RFI report, the presence of SVOCs was screened in the mobile laboratory facility by analyzing PAH compounds. Any extractable organic compounds present in the sample, but not identified as target analytes (that is, PAHs) were quantitated to an EQL of 5 mg/kg using the response factor for naphthalene and reported as "Total Extractable Organic Compounds." The sample results are qualified with an "S" flag and may be biased low because of less effective extraction methods.

No specific PAHs were detected in any sample. However, 63 mg/kg of extractable organic compounds was reported in the sample collected from the 0 to 1-ft interval at Location ID No. 35-2190 (Sample No. 0435-95-0005). A sample from this depth and location was also submitted for fixed-site laboratory SVOC analysis, and no target analytes were reported. Unfortunately, tentatively identified compounds were not requested for the fixed-site laboratory sample. The fact that no other sample contained detectable quantities of organic compounds indicates that the material observed in Sample No. 0435-95-0005 is likely to be limited to a small area and volume of soil. It is probable that the material consists of long-chain hydrocarbon compounds because it is not an SVOC, and a VOC would be expected to volatilize relatively quickly from surface soils.

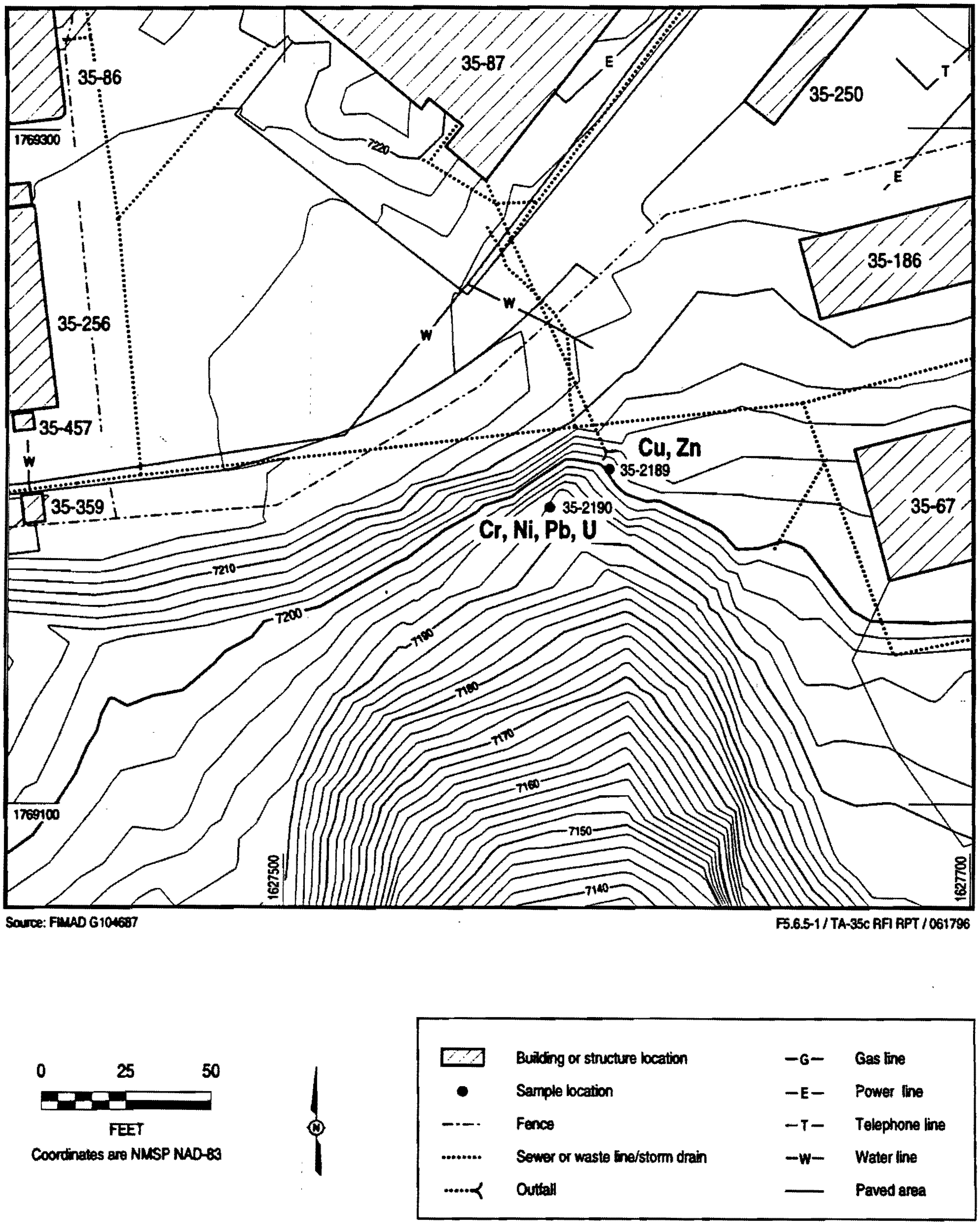

Figure 5.6.5-1. Locations of analytes that exceed UTLs at PRS No. 35-016(b).

5.6.7 Human Health Assessment

5.6.7.1 Screening Assessment

Eight inorganic chemicals were carried forward from the background comparison. As described in Section 3.4.1 in Chapter 3.0 of this RFI report, analytes are divided into two classes (noncarcinogens and chemical carcinogens) for the screening assessment, depending on which toxicological effect forms the basis of their SAL, to evaluate possible additive effects within each class of chemical.

No sample results for any chemical exceeded SAL values at this PRS. The MCE result for noncarcinogens was 0.29. Because the only chemical carcinogen measured above its XRF UTL value was chromium, an MCE calculation for chemical carcinogens was not performed.

No COPCs are identified in the human health screening assessment. All the inorganic chemicals identified in the background comparison in Section 5.6.5 have soil SALs for comparison. The only detected analyte for which neither a UTL nor a SAL value is available is titanium. Titanium is widely used as a food and cosmetics additive to whiten a product. It is generally considered to be physiologically inert in its common form as titanium dioxide (Amdur et al. 1991, 53961). Therefore, further evaluation of titanium is not proposed.

5.6.7.2 Risk Assessment

A human health risk assessment was not performed for this PRS because no COPCs were identified in the screening assessment.

5.6.7.2.1 Review of Chemicals of Potential Concern and Extent of Contamination

Although six chemicals were identified above UTL values at this PRS, as shown in Figure 5.6.5-1, no risk-based COPCs were identified in the screening assessment. As described in Section 5.6.4, the sampling sites were selected based on the assumption that contaminants released with outfall water (or storm-water discharge) would remain in drainage channel sediments. However, it is also possible that contamination may be carried farther down the drainage channel in a dissolved state and primarily precipitated onto sediments on the floor of Ten Site Canyon. It is also possible that over time historical contamination that precipitated onto channel sediments may have been remobilized and deposited on the floor of Ten Site Canyon.

Although the extent of contamination cannot be defined with certainty based on data from the existing two sample locations, additional sampling for this PRS is not proposed. Contaminant concentrations in discharge water were not sufficiently high to result in identification of risk-based COPCs in sediments or tuff in the upper portion of the drainage channel. Even if patterns of sediment deposition and chemical precipitation were to result in somewhat higher contaminant concentrations at a specific location farther from the outfalls, it is unlikely that a sufficient quantity of contaminants has been released into the drainage channel to result in unacceptable human health risks at a remote location. If this were the case, residual contamination in the drainage channel might be expected to fail the screening-level evaluation described in Section 5.6.7.1.

As described in Section 5.6.6, the extractable organic compounds measured in one sample are likely to be long-chain hydrocarbons. The fact that no PAHs were identified indicates that the source material is probably not a petroleum fuel. It is possible that the extractable organic chemicals are associated with a material such as dielectric oil, which was widely used at TA-35 and has been identified at several PRSs. If this is the case, no adverse human health impacts are anticipated because the long-chain hydrocarbon compounds present in such oil are generally toxicologically inert. Based on this argument, and because the organic compounds were limited to only one sample and therefore were not observed to be widespread, further investigation of these organic compounds is not proposed.

The pattern of contamination observed at this PRS (several metals near or a factor of two to three times higher than background UTL values) is similar to that seen at several other PRSs at TA-35 where no specific release has been identified. This pattern is probably a function of the numerous, undifferentiated sources typical of an industrial facility such as TA-35. At this PRS the pattern may be associated primarily with storm-water runoff from the parking area south of TA-35-87.

5.6.8 Ecological Assessment

In accordance with conversations among Laboratory ER Project personnel, DOE/LAAO, and the regulators, further ecological risk assessment at this site will be deferred until the site can be assessed as part of the new Ecological Exposure Unit (Ecozone) methodology that is being developed by the Laboratory in conjunction with EPA Region 6 and NMED.

5.6.9 Conclusions and Recommendations

This site is not likely to pose a significant human health risk.

The objective of the Phase I RFI at PRS No. 35-016(b) was to determine the presence or absence of contamination associated with the active outfall (NPDES Permit No. 06A132) that was established to discharge photographic processing effluents from TA-35-87. No COPCs were identified in the human health screening assessment.

Samples for specific analytes were collected from a 3-ft hand-auger hole and a surface sample. The extent of contamination cannot be conclusively determined based on these sample data, but the weight of evidence suggests that widespread contamination of human health concern has not occurred.

Based on NFA criterion number 4 (and, for silver and cyanide, NFA criterion number 3) (LANL 1995, 53863), a Class III permit modification is requested to remove PRS No. 35-016(b) from the HSWA Module of the Laboratory's RCRA operating permit. The sample data indicate that this site is not likely to pose a significant human health risk now or in the foreseeable future. Also, this PRS is regulated under the NPDES storm-water program. Further ecological risk assessment at this site will be deferred as stated in Section 5.6.8.

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5.7 PRS No. 35-016(j)

PRS No. 35-016(j) is an active outfall that was installed to handle storm-water runoff from the Antares Carbon Dioxide Laser Building (TA-35-125) and electropolishing wastewater from Room B102 in TA-35-125 (LANL 1991, 12451). The outfall discharges southward into Ten Site Canyon.

The only COPC identified as a result of the screening assessment is benzo[a]pyrene. This COPC is evaluated in Section 5.7.7.2. In addition, calcium, chromium, copper, nickel, lead, and zinc were measured above background UTL values.

PRS No. 35-016(j) is recommended for NFA based on NFA criterion number 4 (LANL 1995, 53863).

Radiological sample results are neither presented nor discussed for this PRS and will be provided later as an addendum to this RFI report. A summary of samples for radiological analysis is shown in Section 5.7.4.3

5.7.1 History

PRS No. 35-016(j) is discussed in detail in Section 3.3.2 of the work plan and Section 7.26 of the June 1994 addendum to the work plan (LANL 1992, 7666; Pratt 1994, 43475).

This PRS is an outfall that protrudes from a concrete slope of stabilizing material that covers the backfill material south of TA-35-125. The outfall handles storm-water runoff from storm drains and electropolishing wastewater associated with TA-35-125. The outfall has been in operation since 1975 (LANL 1992, 7666).

The contaminants that were potentially present (and therefore investigated during this RFI) include radionuclides, VOCs, SVOCs, metals, and PCBs.

5.7.2 Description

The outfall consists of a 4-in.-diameter vitrified clay pipe (VCP) that extends approximately 6 to 10 in. from the concrete slope near the fence south of TA-35-125. Flow through the VCP is discharged onto the concrete slope, not directly onto the soil. Drainage from the outfall and from the surface area around the outfall flows southward into Ten Site Canyon. The southern edge of Ten Site Mesa is approximately 10 to 20 ft south of the base of the concrete slope. No erosion is present below the outfall. It seems that only small volumes of water have been discharged at this PRS. Natural mesa-top soil and vegetation appears to be located below the slope. The ground surface is covered with grasses, shrubs, a few pine trees, pine needle debris, and leaves. Vegetation below the outfall appears to be normal and healthy.

5.7.3 Previous Investigations

No previous investigations have been performed at this site.

5.7.4 Field Investigation

The objective of the Phase I RFI was to characterize the nature of potential contamination associated with the outfall and discharge area.

The conceptual model for the RFI did not predict that hazardous chemicals were released to the environment. However, if hazardous chemicals were present, the conceptual model shows that the most likely mechanism of movement beyond the PRS boundary is associated with hydrologic movement in the soil and surface water transport of contaminants over the surface soil and bedrock tuff.

A judgmental sampling approach was used, and the sampling activities were biased toward areas where residual contamination would likely be found. To sample potential contamination, samples were collected at the drainage channel below the outfall.

Field activities included an H&S radiation survey, engineering surveys, and environmental surveys including a radiation grid survey and an organic vapor survey.

Field screening during site surveys and sample collection activities was performed using a Foxboro 128 GC OVA, a Ludlum Model 139 alpha meter, and an Eberline ESP-1 beta/gamma meter. Using this instrumentation, background radiation measurements at TA-35 range from 200 to 500 cpm beta/gamma radiation depending on the location and substrate rock type. Field screening measurements greater than 500 cpm beta/gamma radiation were generally considered to be above background levels. No beta/gamma radiation measurements above background levels were obtained during field screening at this site, and no alpha radiation or organic vapors were detected.

5.7.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed on September 14, 1994. Beta/gamma radiation measurements ranged from 175 to 290 cpm, which are within background levels.

Engineering surveys were performed on September 14, 1994, September 22, 1994, and March 27, 1995. The surveys consisted of reviews of archival information and aerial photographs as well as a field site inspection.

Based on the results of the engineering surveys and on the SAP, the sample points were located in the drainage channel below the outfall. The surface sample was located 2 ft south of the base of the concrete stabilized slope below the outfall, and the hand-auger hole was located about 8 ft south of the surface sample in a natural drainage pathway.

The radiation grid survey was performed on September 22, 1994. The radiation grid locations included Location ID Nos. 35-7935 through 35-7952, which were spaced at approximately 5-ft intervals. Beta/gamma radiation measurements ranged from 159 to 290 cpm, and the average was 220 cpm, which is within background levels.

5.7.4.2 Deviations from the Sampling and Analysis Plan

Sampling activities followed the original SAP, which is described in the June 1994 addendum to the work plan (Pratt 1994, 43475).

5.7.4.3 Sampling Activities

Phase I sampling was performed on April 18, 1995. Four soil samples were collected (not including duplicate QA/QC samples). One surface sample was collected (Location ID No. 35-2191), and one hand-auger hole was drilled to a depth of 3 ft (Location ID No. 35-2192). Three samples were collected from the hand-auger hole. The sample collection intervals are shown in Table 5.7.4-1. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 230 to 290 cpm, which are within background levels.

Table 5.7.4-1 summarizes all sampling for PRS No. 35-016(j); Figure 5.7.4-1 shows the sample locations.

TABLE 5.7.4-1

SUMMARY OF SAMPLES TAKEN AT PRS No. 35-016(j)

Part 1

Location ID	Sample ID	Depth (ft)	Matrix	VOC Mobile Lab	VOC Fixed Lab	PAH Mobile Lab	SVOC Fixed Lab
35-2191	0435-95-0056	0–0.5	Mixed soil	43	43	43	43
35-2192	0435-95-0060	0–1	Mixed soil	43	NR	62	NR
35-2192	0435-95-0062	1–2	Qbt3	43	NR	43	NR
35-2192	0435-95-0063	2–3	Qbt3	59	NR	59	NR

Part 2

Location ID	Sample ID	Depth (ft)	Matrix	INORG Mobile Lab	INORG Fixed Lab	RAD Mobile Lab	RAD Fixed Lab
35-2191	0435-95-0056	0–0.5	Mixed soil	43	NR	62	61
35-2192	0435-95-0060	0–1	Mixed soil	59	NR	62	NR
35-2192	0435-95-0062	1–2	Qbt3	59	NR	62	NR
35-2192	0435-95-0063	2–3	Qbt3	59	59	62	NR

5.7.5 Background Comparisons

Background comparisons were performed for inorganic chemicals for which UTL values are available, as discussed in Section 3.2 in Chapter 3.0 of this RFI report. One soil sample from one location was analyzed in a fixed-site laboratory, and four soil samples from two locations were analyzed by XRF in the mobile laboratory facility. For inorganic chemicals analyzed by XRF in the mobile laboratory facility, the UTL values have been corrected to account for method differences that generally result in higher measured background concentrations by XRF. Derivation of corrected UTL values for XRF data is discussed in Section 3.1.3 in Chapter 3.0 of this RFI report. If data are available by both methods, the data reported by the fixed-site laboratory will be given precedence because more confidence is placed in the fixed-site laboratory data than in the XRF analyses.

Three soil samples from one hand-auger hole and one surface sample were analyzed by XRF in the mobile laboratory facility for an analyte suite that included antimony, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, manganese, mercury, nickel, potassium, selenium, thorium, titanium, uranium, and zinc. As discussed in Section 4.1.3 of Chapter 4.0 of this RFI report, the TA-35 XRF data set is qualified such that antimony, cadmium, mercury, selenium, and uranium data should be regarded as estimated, and nickel data may have a low bias. Individual XRF samples were not qualified. The sample that was collected in the 2- to 3-ft interval (in the Qbt3 unit of the Tshirege Member of the Bandelier Tuff) was also analyzed in a fixed-site laboratory for an inorganic chemical analyte suite that included aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc using the EPA methods described in Section 3.1.1 in Chapter 3.0 of this RFI report. The soil samples were collected in accordance with the work plan (LANL 1992, 7666) and the addendum to the work plan (Pratt 1994, 43475) as described in Section 5.7.4. The surface sample was collected in a 0.5-ft vertical interval, and the samples from the hand-auger hole were collected in 1-ft vertical intervals.

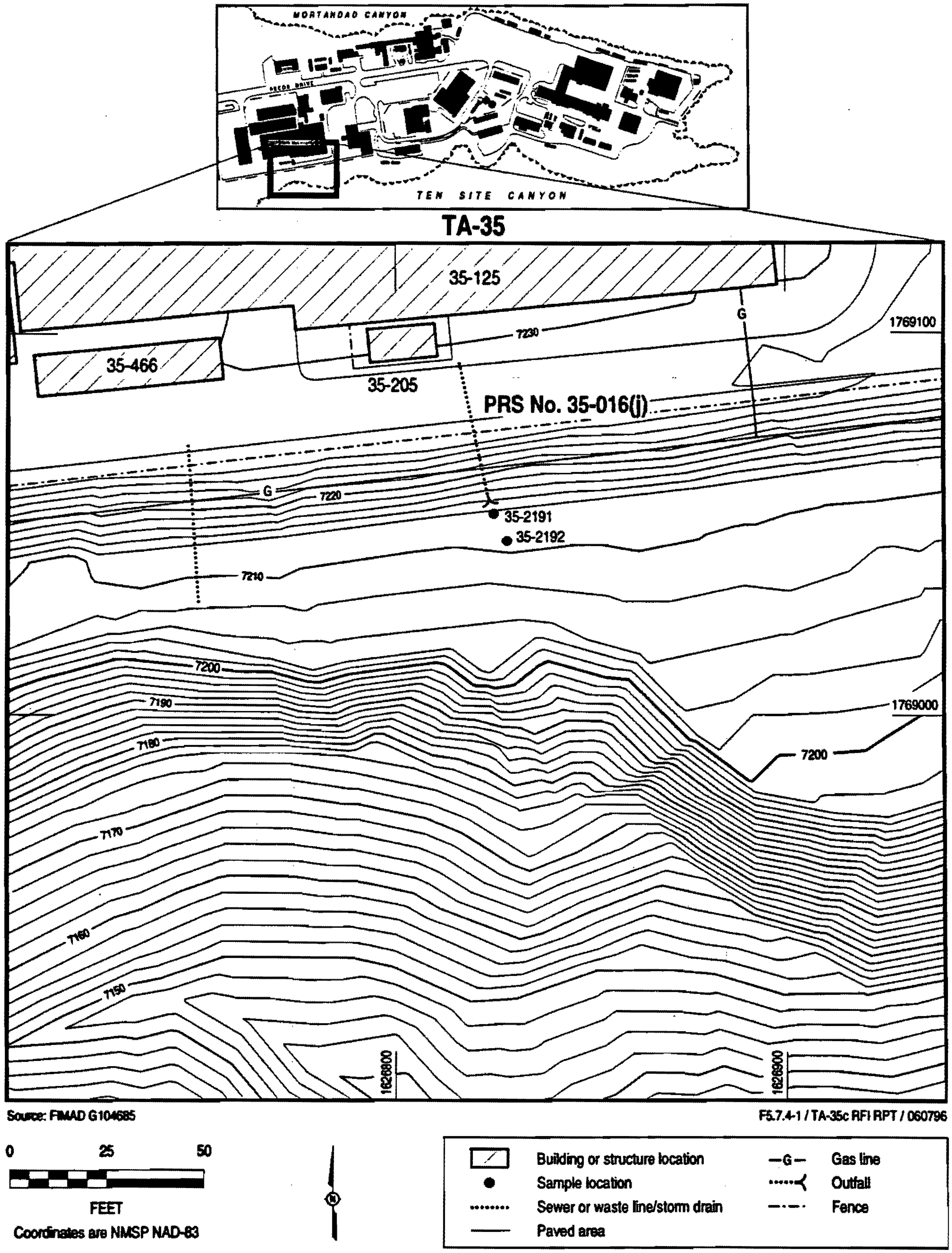

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Figure 5.7.4-1. Locations of samples at PRS No. 35-016(j).

The highest detected value for each analyte was used for the background comparison. The Qbt3 UTL values were used for background comparison for analytes in the fixed-site laboratory suite. XRF UTL values were used for background comparison for analytes in the mobile laboratory facility suite. In Table 5.7.5-1, the values in the boxes indicate inorganic chemical measurements at concentrations greater than or equal to their respective UTL values. Table 5.7.5-1 also shows inorganic chemicals for which there are no UTL values for comparison. Inorganic chemicals that exceed background UTL values are shown on Figure 5.7.5-1. Detected inorganic chemicals with one or more measured concentrations exceeding UTL values, or for which UTL values are unavailable, are summarized below.

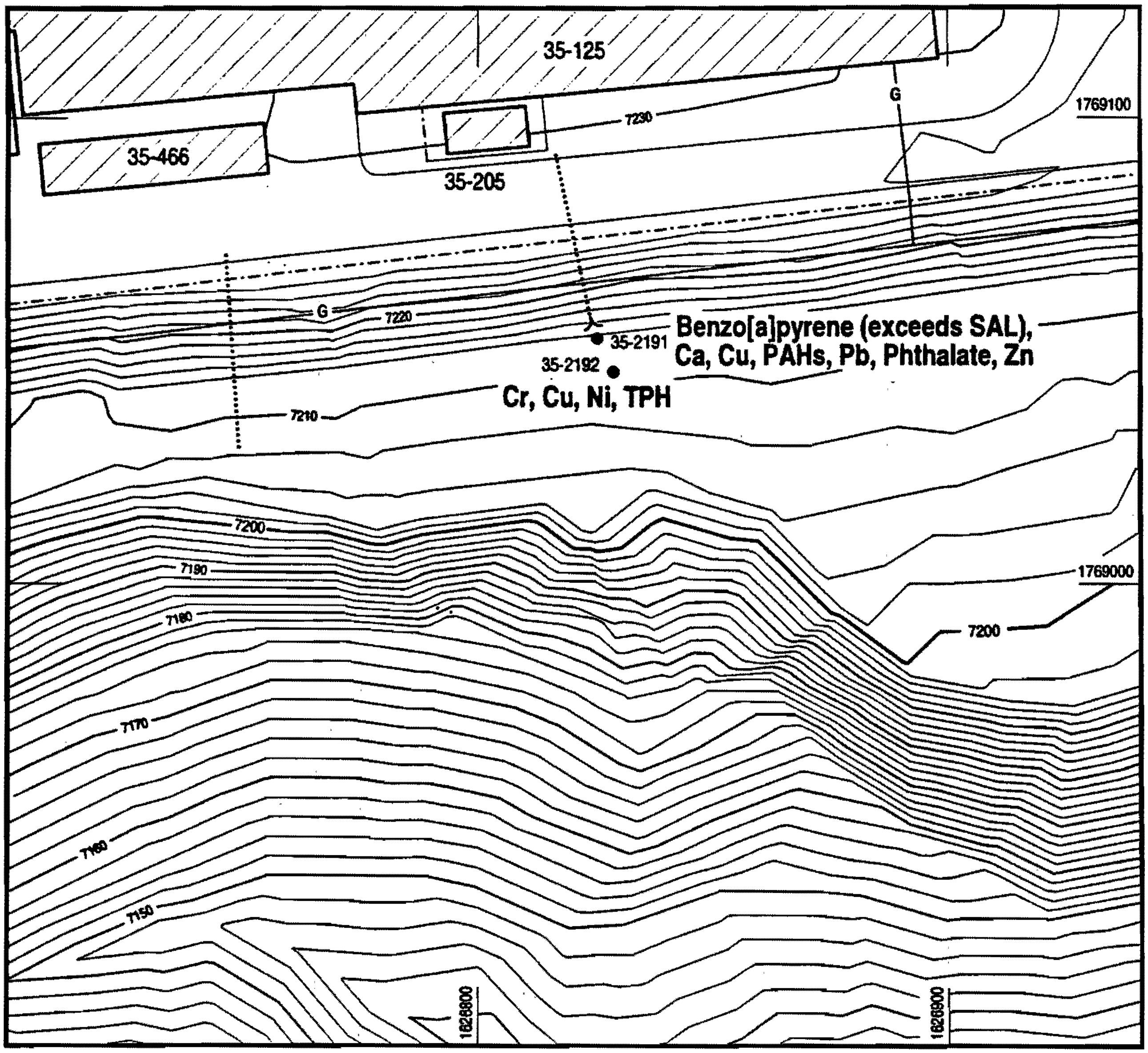
- Calcium was detected in one sample at a concentration of 40,600 mg/kg, which is above the XRF UTL of 10,900 mg/kg.
- Chromium was detected in one sample at a concentration of 10.4 mg/kg, which is above the Qbt3 UTL of 2.1 mg/kg. It was also detected in one sample at a concentration of 52.8 mg/kg, which is above the XRF UTL of 45.1 mg/kg.
- Copper was detected in one sample at a concentration of 2.5 mg/kg, which is above the Qbt3 UTL of 2.0 mg/kg. It was also detected in one sample at a concentration of 62.1 mg/kg, which is above the XRF UTL of 16.7 mg/kg.
- Nickel was detected in one sample at a concentration of 6.5 mg/kg, which is above the Qbt3 UTL of 2.6 mg/kg. It was also detected in one sample at a concentration of 33.9 mg/kg, which is above the XRF UTL of 22.5 mg/kg.
- Lead was detected in one sample at a concentration of 52.1 mg/kg, which is above the XRF UTL of 28.4 mg/kg.
- Selenium was detected in one sample at a concentration of 1.2 mg/kg. Selenium has no Qbt3 UTL for comparison.
- Titanium was detected in all four samples at a maximum concentration of 1,412 mg/kg. Titanium has no XRF UTL for comparison.
- Zinc was detected in one sample at a concentration of 292 mg/kg, which is above the XRF UTL of 76.6 mg/kg.

TABLE 5.7.5-1

INORGANIC CHEMICALS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTLs FOR PRS No. 35-016(j)

Location ID	Sample ID	Depth (ft)	Ca	Cr	Cu	Ni	Pb	Se	Ti	Zn
SAL	N/A	N/A	N.A.	210	2800	1500	400	380	N.A.	23000
Qbt3 UTL	N/A	N/A	1520	2.1	2	2.6	16.2	N.A.	N/A	55.5
XRF UTL	N/A	N/A	10900	45.1	16.7	22.5	28.4	N.A.	N.A.	76.6
35-2191	0435-95-0056	0–0.5	40600	30.9	62.1	<13	52.1	<4	1412	292
35-2192	0435-95-0060	0–1	2260	<12	<8	15.4	14.5	<4	643	35.4
35-2192	0435-95-0062	1–2	1600	52.8	<8	33.9	11.1	<4	572	41.6
35-2192	0435-95-0063	2–3	442 J	10.4	2.5 J	6.5 J	4.1	1.2	591	35

*mg/kg



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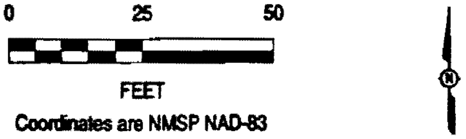


▨	Building or structure location	—G—	Gas line
●	Sample location	······≺	Outfall
········	Sewer or waste line/storm drain	—·—·	Fence
——	Paved area		

Figure 5.7.5-1. Locations of detected organic chemicals and analytes that exceed UTLs and SALs at PRS No. 35-016(j).

5.7.6 Evaluation of Organic Chemicals

The organic chemicals analyzed for at this PRS include VOCs, SVOCs, PAH compounds, and total petroleum hydrocarbons (TPH). Four soil samples from two locations were analyzed for VOCs, SVOCs, PAHs, and TPH in the mobile laboratory facility. One sample was also analyzed for VOCs and SVOCs in a fixed-site laboratory.

TPH was the only organic chemical detected by the mobile laboratory facility. No VOCs were detected by the fixed-site laboratory; SVOCs detected by the fixed-site laboratory are shown in Table 5.7.6-1 and Figure 5.7.5-1 and are summarized below.

- Benzo[a]pyrene was detected in one sample at an estimated concentration of 0.15 mg/kg.
- Benzo[b]fluoranthene was detected in one sample at an estimated concentration of 0.11 mg/kg.
- Benzo[k]fluoranthene was detected in one sample at an estimated concentration of 0.15 mg/kg.
- Bis[2-ethylhexyl]phthalate was detected in one sample at a concentration of 0.38 mg/kg.
- Chrysene was detected in one sample at an estimated concentration of 0.18 mg/kg.
- Fluoranthene was detected in one sample at a estimated concentration of 0.24 mg/kg.
- Pyrene was detected in one sample at an estimated concentration of 0.26 mg/kg.
- TPH were quantitated as C_{10} to C_{20} compounds in two samples from the same location at 190 and 400 mg/kg.

TABLE 5.7.6-1

SOIL CONCENTRATIONS* FOR DETECTED ORGANIC CHEMICALS AT PRS No. 35-016(j)

Part 1

Location ID	Sample ID	Depth (ft)	Benzo[a]pyrene	Benzo[b]-fluoranthene	Benzo[k]-fluoranthene	Bis[2-ethylhexyl]-phthalate
SAL	N/A	N/A	0.061	0.61	6.1	32
CRQL	N/A	N/A	0.33	0.33	0.33	0.33
35-2191	0435-95-0056	0-0.5	0.15 J	0.11 J	0.15 J	0.38
35-2192	0435-95-0062	1-2	ND	ND	ND	ND
35-2192	0435-95-0063	2-3	ND	ND	ND	ND

Part 2

Location ID	Sample ID	Depth (ft)	Chrysene	Fluoranthene	Pyrene	TPH
SAL	N/A	N/A	24	2600	2000	N.A.
CRQL	N/A	N/A	0.33	0.33	0.33	5
35-2191	0435-95-0056	0-0.5	0.18 J	0.24 J	0.26 J	ND
35-2192	0435-95-0062	1-2	ND	ND	ND	190 S
35-2192	0435-95-0063	2-3	ND	ND	ND	400 S

*mg/kg

5.7.7 Human Health Assessment

5.7.7.1 Screening Assessment

Eight inorganic chemicals and eight organic chemicals were carried forward from the background and EQL comparisons. As described in Section 3.4.1 in Chapter 3.0 of this RFI report, analytes are divided into two classes (noncarcinogens and chemical carcinogens) for the screening assessment, depending on which toxicological effect forms the basis of their SAL, to evaluate possible additive effects within each class of chemical.

Benzo[a]pyrene exceeded its SAL value in a surface sample at Location ID No. 35-2191 (see Figure 5.7.5-1). The screening assessment for chemical carcinogens is presented in Table 5.7.7-1. The sample result that exceeded the SAL value is highlighted with black in Table 5.7.7-1.

TABLE 5.7.7-1

CARCINOGENIC CHEMICAL WITH CONCENTRATION*
IN SOIL THAT EXCEEDS SAL FOR PRS No. 35-016(j)

Location ID	Sample ID	Depth (ft)	Benzo[a]pyrene
SAL	N/A	N/A	0.061
35-2191	0435-95-0056	0-0.5	0.15 J
*mg/kg			

The MCE results for noncarcinogens and chemical carcinogens were 0.19 and 0.47, respectively. The MCE values for noncarcinogens and chemical carcinogens are less than unity; therefore, a potential human health risk based on additive effects is not identified for these classes of chemicals.

All the detected inorganic chemicals identified in the background comparison in Section 5.7.5 except calcium and titanium have soil SALs for comparison. Neither calcium nor titanium has a SAL value. Calcium is an essential nutrient that is generally recognized as nontoxic and can be eliminated on the basis of professional judgment (EPA 1989, 8021).Titanium is widely used as a food and cosmetics additive to whiten a product. It is generally considered to be physiologically inert in its common form as titanium dioxide (Amdur et al. 1991, 53961). Therefore, further evaluation of titanium is not proposed.

Chrysene, a carcinogen, was not included in the MCE because its SAL is not based on health effects. The SAL for chrysene is equivalent to its saturation concentration in soil, calculated according to the equation provided in the EPA Region IX PRG table (EPA 1995, 53970). The PRG values for residential exposure published in this table have been adopted by the ER Project as SALs, as described in *Risk-Based Corrective Action Process* (Environmental Restoration Decision Support Council 1996, 53751). Although a risk-based SAL for chrysene would certainly be higher (that is, less restrictive) than the SAL based on a saturation concentration, a risk-based SAL cannot be calculated using the model in the PRG table for estimating intake of volatile contaminants via inhalation because that model is not applicable beyond the soil saturation concentration. However, if chrysene were included in the MCE calculation using its current SAL, the MCE value for chemical carcinogens would increase only from a value of 0.47 to 0.48.

TPH may contain a variety of saturated and unsaturated hydrocarbons. Human health screening is performed on characteristic chemicals including substituted benzenes and PAHs that are analyzed as part of the VOC and SVOC suites. No TPH-associated VOCs were detected at this PRS. PAHs were detected at low concentrations and are screened separately.

TPH was quantitated as C_{10} to C_{20} hydrocarbons in two samples (Sample No. 0435-95-0062 [190 mg/kg] and Sample No. 0435-95-0063 [400 mg/kg]). Although EPA has not developed toxicity values for TPH, the Massachusetts Department of Environmental Protection (MA DEP) has proposed alternate toxicity values for three fractions of TPH based on carbon chain length (Massachusetts Department of Environmental Protection 1994, 54428). Using the proposed MA DEP reference dose for the C_9 through C_{18} hydrocarbons (0.6 mg/kg-day), a residential PRG of 39,000 mg/kg was calculated using equations and parameter values identical to those used to calculate ER Project SALs for nonvolatile organic chemicals (Environmental Restoration Decision Support Council 1996, 53751). This level is two orders of magnitude above the concentrations of TPH (190 and 400 mg/kg) observed at this PRS. Therefore, an adverse human health risk is not predicted.

The MA DEP also publishes "ceiling level" soil criteria for organic chemicals based on the potential for detecting adverse odors associated with soil contamination. The most restrictive ceiling level exposure-based soil concentration for direct contact with TPH-contaminated soil is 500 ppm (Massachusetts Department of Environmental Protection 1993, 54257). The observed soil concentrations of TPH at this PRS are below this value as well as below the toxicity-based soil criteria described above. Therefore, further evaluation of TPH is not proposed at this PRS.

5.7.7.2 Risk Assessment

One COPC was identified in the screening assessment in Section 5.7.7.1. A quantitative human health risk assessment was not performed for this PRS. However, a qualitative evaluation of the COPC is presented below.

One PAH, benzo[a]pyrene, was detected above its SAL value in one surface sample. This sample (Sample No. 0435-95-0056) is a surface sample located at the bottom of the concrete apron that receives discharge from PRS No. 35-016(j). Because this PRS receives storm-water runoff from asphalt-paved areas, the presence of PAHs is not unusual. PAHs are found in asphalt used in paving and are also products of incomplete combustion from motor vehicles. The low concentrations of PAHs at this PRS are likely to be associated with runoff from the paved area rather than PRS-related contamination. In any case, benzo[a]pyrene exceeded its SAL by a factor of only three, which does not indicate potential adverse human exposure in a hillside drainage channel adjacent to an industrial facility. Therefore, benzo[a]pyrene is eliminated as a COPC.

5.7.7.2.1 Review of Chemicals of Potential Concern and Extent of Contamination

Although eight inorganic chemicals were identified above UTL values at this PRS and seven organic chemicals were measured above EQL values, as shown in Figure 5.7.5-1, no risk-based COPCs were identified in Section 5.7.7.2. As described in Section 5.7.4, the sampling sites were selected based on the assumption that contaminants released with outfall water (or storm-water discharge) would remain in the discharge area soils. No obvious erosion channel exists at the discharge point; therefore, only small amounts of water are likely to have been discharged at this PRS. However, it is also possible that contamination may have been carried farther down the drainage in a dissolved state and primarily precipitated onto sediments on the floor of Ten Site Canyon. It is also possible that over time historical contamination that precipitated onto soils in the discharge area may have been remobilized and deposited on the floor of Ten Site Canyon.

Although the extent of contamination cannot be defined with certainty based on data from the two existing sample locations, additional sampling for this PRS is not proposed. Contaminant concentrations in the discharge area were not sufficiently high to result in identification of risk-based COPCs in soils or tuff. Even if patterns of sediment deposition and chemical precipitation were to result in somewhat higher contaminant concentrations at a specific location farther from the outfalls, it is unlikely that a sufficient quantity of contaminants has been released via this discharge to result in unacceptable human health risks at a remote location. If this were the case, residual contamination in the discharge area might be expected to fail the screening-level evaluation described in Section 5.7.7.1.

The pattern of contamination observed at this PRS (several metals near or a factor of two or three times higher than background UTL values, low levels of PAHs, and long-chain TPH) is similar to that seen at several other PRSs at TA-35 where no specific release has been identified. This pattern is probably a function of the numerous, undifferentiated sources typical of an industrial facility such as TA-35. At this PRS the pattern may be associated primarily with storm-water runoff from the paved area around TA-35-125. Concentrations of some metals (for example, chromium, nickel, and zinc) at a factor four or five times higher than background UTL values may be a result of wastewater discharge from electropolishing processes in TA-35-125 but are present at concentrations well below health-based SALs.

5.7.8 Ecological Assessment

In accordance with conversations among Laboratory ER Project personnel, DOE/LAAO, and the regulators, further ecological risk assessment at this site will be deferred until the site can be assessed as part of the new Ecological Exposure Unit (Ecozone) methodology that is being developed by the Laboratory in conjunction with EPA Region 6 and NMED.

5.7.9 Conclusions and Recommendations

This site is not likely to pose a significant human health risk.

The objective of the Phase I RFI at PRS No. 35-016(j) was to determine the presence or absence of contamination associated with the electropolishing wastewater from Room B102 in TA-135-125 and storm-water runoff from the area surrounding the building. The COPC identified in the human health screening assessment was eliminated in a qualitative risk assessment.

Samples for specific analytes were collected from a 3-ft hand-auger hole and a surface sample. The extent of contamination cannot be conclusively determined based on these sample data, but the weight of evidence suggests that widespread contamination at concentrations of human health concern has not occurred.

Based on NFA criterion number 4 (LANL 1995, 53963), a Class III permit modification is requested to remove PRS No. 35-016(j) from the HSWA Module of the Laboratory's RCRA operating permit. The sample data indicate that this site is not likely to pose a significant human health risk now or in the foreseeable future. Further ecological risk assessment at this site will be deferred as stated in Section 5.7.8.

5.8 PRS No. 35-016(q)

PRS No. 35-016(q) is one of several active storm-water trenches that are located between the Sodium Testing Building (TA-35-34) and the southern edge of Ten Site Mesa.

Benzo[a]pyrene and dibenzo[a,h]anthracene were identified as COPCs during the screening assessment. These COPCs are evaluated in Section 5.8.7.2. In addition, antimony, chromium, copper, lead, uranium, and zinc were measured in one or more samples above background UTL values.

PRS No. 35-016(q) is recommended for NFA based on NFA criterion number 4 (LANL 1995, 53863).

Radiological sample results are neither presented nor discussed for this PRS and will be provided later as an addendum to this RFI report. A summary of samples submitted for radiological analyses is shown in Section 5.8.4.3.

5.8.1 History

PRS No. 35-016(q) is discussed in detail in Section 3.3.2 of the work plan and Section 7.24 of the June 1994 addendum to the work plan (LANL 1992, 7666; Pratt 1994, 43475).

This PRS is an elongated trench oriented northeast-southwest that has eroded into a deep cut at the southern edge of Ten Site Mesa. The trench appears to have been cut into backfill material and bedrock tuff by a bulldozer. A smaller trench (PRS No. 35-016[a]) is located in a parallel orientation approximately 60 ft west of PRS No. 35-016(q). PRS Nos. 35-016(a and q) first appear in aerial photographs from 1958. Aerial photographs from 1965 record a diagonal trench extending from the northern end of PRS No. 35-016(a) in a southeasterly direction that appears to connect with the northern end of PRS No. 35-016(q). Aerial photographs from 1974 show that the diagonal trench and approximately two-thirds of the upper northern portion of PRS No. 35-016(q) are no longer present and may have been backfilled. The 1974 aerial photographs show this site much as it appears today. PRS No. 35-016(q) now serves as a storm-water collection channel for a small area on the south side of Ten Site Mesa. PRS No. 35-016(a) will be further addressed in the next RFI report.

The contaminants that were potentially present (and therefore investigated during this RFI) include radionuclides, VOCs, SVOCs, metals, and PCBs.

5.8.2 Description

The trench extends to the edge of Ten Site Mesa. Water channeling through the trench may have caused the trench to erode from the mesa edge to the base of the mesa slope, so that the discharge point is now near the floor of Ten Site Canyon. The south rim of Ten Site Mesa in the area of PRS No. 35-016(q) has been extended by the emplacement of backfill materials composed of crushed tuff, pieces of concrete, and probably other waste construction materials. The backfill material is approximately 30 ft thick near the trench. Concrete slabs with protruding rebar are visible in the trench at the head of PRS 35-016(q). The waste materials appear to have been capped with asphalt in some places to prevent erosion. The trench is approximately 10 ft wide at the mesa edge and 25 ft wide at the point of discharge. Vegetation is composed of shrubs, pine trees, pine needle debris, and leaves; it appears to be normal and healthy.

5.8.3 Previous Investigation

PRS No. 35-016(q) was investigated as part of "Environmental Problem 24" in the DOE Environmental Survey (DOE 1987, 21510). Three sediment samples were collected in Ten Site Canyon below the trench. The samples contained detectable quantities of SVOCs, PCBs, metals, and alpha- and gamma-emitting radioactive materials. No VOCs or beta-emitting materials were present in detectable concentrations.

5.8.4 Field Investigation

The objective of the Phase I RFI was to characterize the nature of potential contamination associated with the storm-water collection basin and discharge area.

The conceptual model for the RFI did not predict that hazardous chemicals were released to the environment. However, if hazardous chemicals were present, the conceptual model shows that the most likely mechanism of movement beyond the PRS boundary is associated with hydrologic movement in the soil and surface water transport of contaminants over and through the backfill material and into the bedrock tuff.

A judgmental sampling approach was used, and the sampling activities were biased toward areas where residual contamination would likely be found. To sample potential contamination, samples were collected from sediment catchment areas within the collection basin and at the point of discharge.

Field activities included an H&S radiation survey, engineering surveys, and environmental surveys including a radiation grid survey and an organic vapor survey.

Field screening during site surveys and sample collection activities was performed using a Foxboro 128 GC OVA, a Ludlum Model 139 alpha meter, and an Eberline ESP-1 beta/gamma meter. Using this instrumentation, background radiation measurements at TA-35 range from 200 to 500 cpm beta/gamma radiation depending on the location and substrate rock type. Field screening measurements greater than 500 cpm beta/gamma radiation were generally considered to be above background levels. No beta/gamma radiation measurements above background levels were obtained during field screening at this site, and no alpha radiation or organic vapors were detected.

5.8.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed on June 2, 1994. Beta/gamma radiation measurements ranged from 215 to 261 cpm, which are within background levels.

Engineering surveys were performed on June 2, 1994, June 3, 1994, and January 18, 1995. The surveys consisted of reviews of archival information and aerial photographs as well as a field site inspection and a description of the PRS. The PRS site was located, and the condition of the site was described.

Based on the results of the engineering surveys, the sample points were modified from the SAP. A hand-auger hole was located near the head of the trench in backfill material, and three surface soil samples were located in sediments along the length of the channel.

The radiation grid survey was performed on September 6, 1994. The radiation grid locations included Location ID Nos. 35-7531 through 35-7613, which were spaced at approximately 20-ft intervals.

Beta/gamma radiation measurements ranged from 145 to 347 cpm, and the average was 232 cpm, which is within background levels.

5.8.4.2 Deviations from the Sampling and Analysis Plan

Engineering surveys and an inspection of aerial photographs of PRS No. 35-016(q) show that the visible feature may have originated as a man-made trench cut into the south side of Ten Site Mesa. Aerial photographs and engineering surveys show that the north end of the trench may be buried and may extend northwest from the visible part of the existing trench. Buried construction materials are evident in the north end of the trench. Therefore, one sample (Location ID No. 35-2114) was relocated to the north end, and three surface samples will be collected from sediments in the trench. The sample collected at Location ID No. 35-2114 was changed from a surface sample to a 3-ft-deep hand-auger hole because no subsurface samples were planned in the area, which are necessary to sample the backfill material. Two surface samples (Location ID Nos. 35-2118 and 35-2119) were not collected from the sides of the trench because engineering surveys showed that this material is recent backfill material and is not associated with the PRS.

These changes to the SAP did not adversely impact the success of the field activities.

5.8.4.3 Sampling Activities

Phase I sampling was performed on March 1, 1995. Six soil samples were collected from four locations (not including duplicate QA/QC samples). One hand-auger hole was drilled to a depth of 3 ft (Location ID No. 35-2114), and three surface samples were collected (Location ID Nos. 35-2115 through 35-2117). The sample collection intervals are shown in Table 5.8.4-1. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 220 to 290 cpm, which are within background levels.

Table 5.8.4-1 summarizes all sampling for PRS No. 35-016(q); Figure 5.8.4-1 shows the sample locations.

TABLE 5.8.4-1

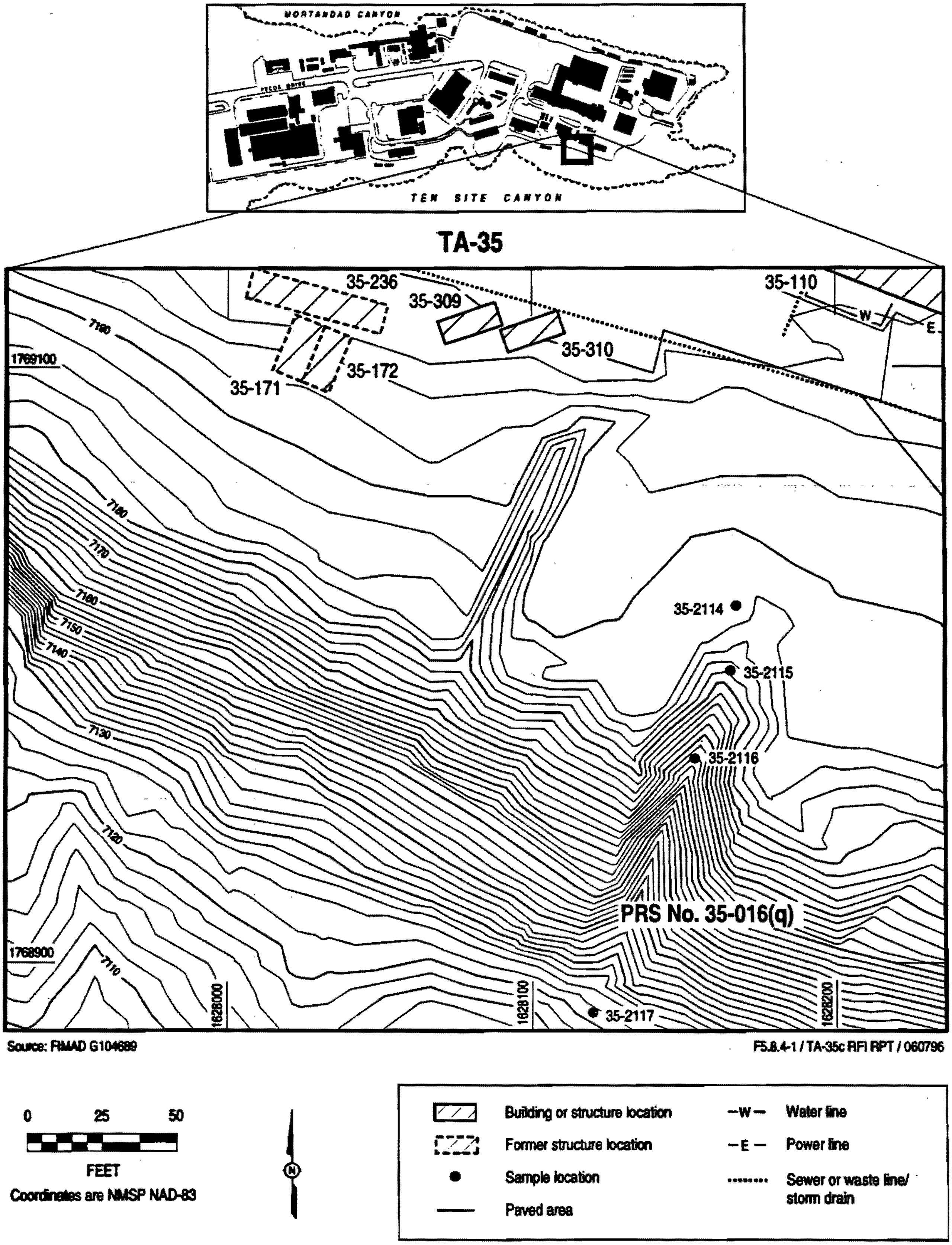
SUMMARY OF SAMPLES TAKEN AT PRS No. 35-016(q)

Part 1

Location ID	Sample ID	Depth (ft)	Matrix	VOC Mobile Lab	VOC Fixed Lab	PAH Mobile Lab	SVOC Fixed Lab
35-2114	AAC1137	0–1	Mixed soil	21473	21455	21473	NR
35-2114	AAC1138	1–2	Mixed soil	21473	NR	21473	NR
35-2114	AAC1139	2–3	Mixed soil	21473	NR	21473	NR
35-2115	AAC1146	0–0.5	Mixed soil	21473	NR	21473	NR
35-2116	AAC1147	0–0.5	Mixed soil	21473	NR	21473	NR
35-2117	AAC1148	0–0.5	Mixed soil	21473	NR	21473	NR

Part 2

Location ID	Sample ID	Depth (ft)	Matrix	PCB Mobile Lab	INORG Mobile Lab	RAD Mobile Lab	RAD Fixed Lab
35-2114	AAC1137	0–1	Mixed soil	21473	21474	21472	21457
35-2114	AAC1138	1–2	Mixed soil	21473	21474	21472	21457
35-2114	AAC1139	2–3	Mixed soil	21473	21474	21472	21457
35-2115	AAC1146	0–0.5	Mixed soil	21473	21474	21472	21457
35-2116	AAC1147	0–0.5	Mixed soil	21473	21474	21742	21457
35-2117	AAC1148	0–0.5	Mixed soil	21473	21474	21472	21457



Source: RMAD G104689

F5.8.4-1 / TA-35c RFI RPT / 060796

Figure 5.8.4-1. Locations of samples at PRS No. 35-016(q).

5.8.5 Background Comparisons

Background comparisons were performed for inorganic chemicals for which UTL values are available, as discussed in Section 3.2 in Chapter 3.0 of this RFI report. For inorganic chemicals analyzed by XRF in the mobile laboratory facility, the UTL values have been corrected for some analytes to account for method differences that generally result in higher measured background concentrations by XRF. Derivation of corrected UTL values for XRF data is discussed in Section 3.1.3 in Chapter 3.0 of this RFI report.

Six samples from four locations were analyzed by XRF in the mobile laboratory facility for an analyte suite that included antimony, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, manganese, mercury, nickel, potassium, selenium, thorium, titanium, uranium, and zinc. As discussed in Section 4.1.3 in Chapter 4.0 of this RFI report, the TA-35 XRF data set is qualified such that the data for antimony, cadmium, mercury, selenium, and uranium should be regarded as estimated, and nickel data may have a low bias. Individual XRF samples were not qualified. No fixed-site laboratory analyses were performed for inorganic chemicals. Surface samples were collected in 0.5-ft vertical intervals, and the sample from the hand-auger hole was collected in a 1-ft vertical interval.

The mixed-soil UTL values were used for background comparison; no samples were collected in tuff at this PRS. In Table 5.8.5-1, the values in the boxes indicate inorganic chemical measurements at concentrations greater than or equal to their respective XRF UTL values. Table 5.8.5-1 also shows inorganic chemicals for which there are no UTL values for comparison. The concentrations above background levels at each location are shown in Figure 5.8.5-1. Detected inorganic chemicals with one or more measured concentrations equal to or exceeding UTL values, or for which UTL values are unavailable, are summarized below.

- Antimony was detected in one sample at a concentration of 4.97 mg/kg, which is above the XRF UTL of 1.45 mg/kg.
- Cadmium was detected in one sample at a concentration of 3.14 mg/kg. No XRF UTL exists for cadmium.
- Copper was detected in three samples at two different locations at a maximum concentration of 22.2 mg/kg, which is above the XRF UTL of 16.7 mg/kg.
- Chromium was detected in one sample at a concentration of 48 mg/kg, which is above the XRF UTL of 45.1 mg/kg.
- Lead was detected in one sample at a concentration of 44.3 mg/kg, which is above the XRF UTL of 28.4 mg/kg.
- Mercury was detected in one sample at a concentration of 6.16 mg/kg. No XRF UTL exists for mercury.
- Titanium was detected in six samples at a maximum concentration of 2,477 mg/kg. No XRF UTL exists for titanium.

- Uranium was detected in one sample at a concentration of 8.88 mg/kg, which is above the XRF UTL of 5.33 mg/kg.

- Zinc was detected in one sample at a concentration of 99.6 mg/kg, which is above the XRF UTL of 76.6 mg/kg.

TABLE 5.8.5-1

INORGANIC CHEMICALS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTLs FOR PRS No. 35-016(q)

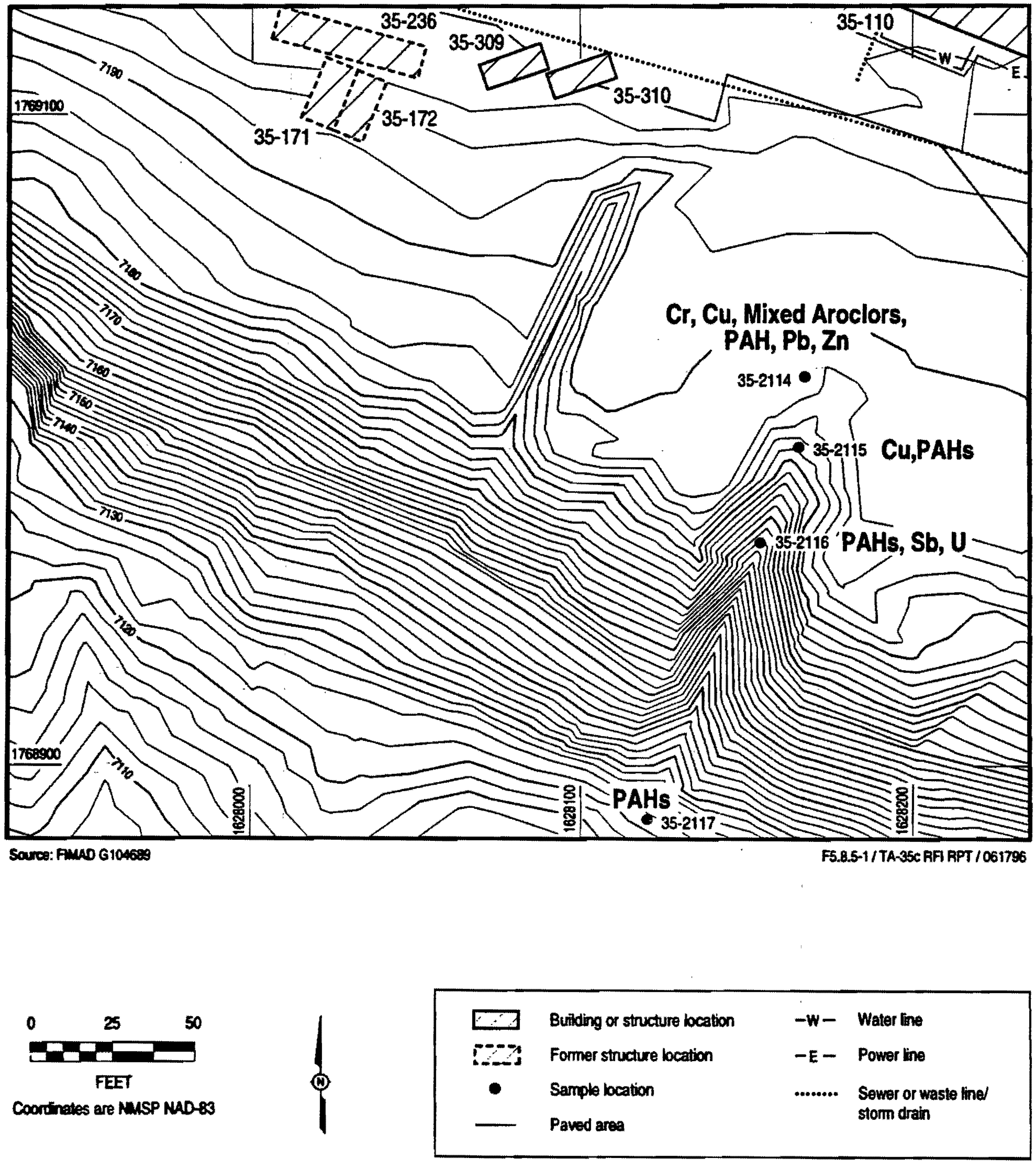
Part 1

Location ID	Sample ID	Depth (ft)	Cd	Cr	Cu	Hg	Pb
SAL	N/A	N/A	38	210	2800	23	400
XRF UTL	N/A	N/A	N.A.	45.1	16.7	N.A.	28.4
35-2114	AAC1137	0–1	<3	<12	20.2	<5	44.3
35-2114	AAC1138	1–2	<3	48	20.4	<5	20.1
35-2114	AAC1139	2–3	<3	<12	<8	<5	17.7
35-2115	AAC1146	0–0.5	<3	<12	22.2	<5	24.6
35-2116	AAC1147	0–0.5	3.14	<12	<8	6.16	19.58
35-2117	AAC1148	0–0.5	<3	<12	<8	<5	21.8

Part 2

Location ID	Sample ID	Depth (ft)	Sb	Ti	U	Zn
SAL	N/A	N/A	31	N.A.	230	23000
XRF UTL	N/A	N/A	1.45	N.A.	5.33	76.6
35-2114	AAC1137	0–1	<4	2477	<8	99.6
35-2114	AAC1138	1–2	<4	1672	<8	59.8
35-2114	AAC1139	2–3	<4	1325	<8	49.2
35-2115	AAC1146	0–0.5	<4	1820	<8	51.5
35-2116	AAC1147	0–0.5	4.97	1280	8.88	46.4
35-2117	AAC1148	0–0.5	<4	1357	<8	48.2

*mg/kg



Source: FIMAD G104689

F5.8.5-1 / TA-35c RFI RPT / 061796

Figure 5.8.5-1. Locations of detected organic chemicals and analytes that exceed UTLs at PRS No. 35-016(q).

5.8.6 Evaluation of Organic Chemicals

The organic chemicals analyzed for at this PRS include VOCs, PCBs, and PAH compounds. Six soil samples from four locations were analyzed for VOCs, PCBs, and PAHs in the mobile laboratory facility. One sample was also analyzed for VOCs in a fixed-site laboratory.

As discussed in Section 4.2.4 in Chapter 4.0 of this RFI report, the presence of SVOCs was screened in the mobile laboratory facility by analyzing PAH compounds. Any extractable organic compounds present in the sample, but not identified as target analytes (that is, PAHs) were quantitated to an EQL of 5 mg/kg using the response factor for naphthalene and reported as "Total Extractable Organic Compounds." The sample results are qualified with an "S" flag and may be biased low because of less effective extraction methods.

In the 0 to 1-ft interval at Location ID No. 35-2114, the mobile laboratory facility reported the presence of a large peak in the chromatogram, which indicates motor oil contamination. No additional information regarding this peak is available. The fact that no specific PAH compounds were identified in this sample may be due to elevated EQL values. Unfortunately, sample-specific EQL values are unavailable for mobile laboratory organic chemical data to corroborate this assumption. The fact that similar peaks were not reported at deeper sample intervals at this location or in the surface samples collected farther down the channel indicates that this contamination is not likely to be widespread.

Organic chemicals detected in soil are shown in Table 5.8.6-1 and are summarized below. The locations of these organic chemicals are shown in Figure 5.8.5-1.

- Aroclor 1260 (evaluated as mixed aroclor) was detected in two samples from the same location at concentrations of 0.071(S) and 0.077(S) mg/kg.
- Benz[a]anthracene was detected in three samples at three different locations at a maximum concentration of 0.146(S) mg/kg.
- Benzo[a]pyrene was detected in one sample at a concentration of 0.225(S) mg/kg.
- Benzo[g,h,i]perylene was detected in two samples at two different locations at a maximum concentration of 0.166(S) mg/kg.
- Benzo[k]fluoranthene was detected in one sample at a concentration of 0.25(S) mg/kg.
- Chrysene was detected in one sample at a concentration of 0.099(S) mg/kg.
- Dibenzo[a,h]anthracene was detected in one sample at a concentration of 0.112(S) mg/kg.

TABLE 5.8.6-1

SOIL CONCENTRATIONS* FOR DETECTED ORGANIC CHEMICALS AT PRS No. 35-016(q)

Part 1

Location ID	Sample ID	Depth (ft)	Benz[a]-anthracene	Benzo[a]-pyrene	Benzo[g,h,i]-perylene
SAL	N/A	N/A	0.61	0.061	N.A.
CRQL	N/A	N/A	0.100	0.100	0.100
35-2114	AAC1137	0-1	ND	ND	ND
35-2114	AAC1138	1-2	ND	ND	ND
35-2114	AAC1139	2-3	0.146 S	ND	ND
35-2115	AAC1146	0-0.5	ND	ND	0.095 S
35-2116	AAC1147	0-0.5	0.135 S	ND	0.166 S
35-2117	AAC1148	0-0.5	0.114 S	0.225 S	ND

Part 2

Location ID	Sample ID	Depth (ft)	Benzo[k]-fluoranthene	Chrysene	Dibenzo[a,h]-anthracene	Mixed Aroclors
SAL	N/A	N/A	6.1	24	0.061	1
CRQL	N/A	N/A	0.100	0.100	0.100	0.05
35-2114	AAC1137	0-1	ND	ND	ND	0.071 S
35-2114	AAC1138	1-2	ND	ND	ND	0.077 S
35-2114	AAC1139	2-3	ND	ND	ND	ND
35-2115	AAC1146	0-0.5	ND	0.099 S	ND	ND
35-2116	AAC1147	0-0.5	0.25 S	ND	0.112 S	ND
35-2117	AAC1148	0-0.5	ND	ND	ND	ND

*mg/kg

5.8.7 Human Health Assessment

5.8.7.1 Screening Assessment

Ten inorganic chemicals and seven organic chemicals were carried forward from the background and EQL comparisons. As described in Section 3.4.1 in Chapter 3.0 of this RFI report, analytes are divided into two classes (noncarcinogens and chemical carcinogens) for the screening assessment, depending on which toxicological effect forms the basis of their SAL, to evaluate possible additive effects within each class of chemical.

Benzo[a]pyrene and dibenzo[a,h]anthracene exceeded SAL values in surface samples at Location ID Nos. 35-2117 and 35-2116, respectively. The screening assessment for chemical carcinogens is presented in Table 5.8.7-1; sample results that exceeded SAL values are highlighted with black. Figure 5.8.7-1 shows the locations of these samples. The MCE results for noncarcinogens and chemical carcinogens were 0.67 and 0.59, respectively. The MCE values for noncarcinogens and chemical carcinogens are less than unity; therefore, a potential human health risk based on additive effects is not identified for these classes of chemicals.

TABLE 5.8.7-1

CARCINOGENIC CHEMICALS WITH CONCENTRATIONS* IN SOIL THAT EXCEED SALs FOR PRS No. 35-016(q)

Location ID	Sample ID	Depth (ft)	Benzo[a]pyrene	Dibenzo[a,h]anthracene
SAL	N/A	N/A	0.061	0.061
35-2116	AAC1147	0-0.5	ND	0.112 S
35-2117	AAC1148	0-0.5	0.225 S	ND
*mg/kg				

All the detected inorganic chemicals identified in the background comparison in Section 5.8.5 and the detected organic chemicals identified in the evaluation of organic chemicals in Section 5.8.6 have soil SALs for comparison. The only detected analytes for which neither a UTL nor a SAL value is available are titanium and benzo[g,h,i]perylene. Titanium is widely used as a food and cosmetics additive to whiten a product. It is generally considered to be physiologically inert in its common form as titanium dioxide (Amdur et al. 1991, 53961). Therefore, further evaluation of titanium is not proposed. Benzo[g,h,i]perylene is not a known or suspected human carcinogen (EPA carcinogen class D). In general, the noncarcinogenic PAHs have significantly higher SAL values than the carcinogenic PAHs. It is unlikely that the presence of benzo[g,h,i]-perylene at concentrations below 1 mg/kg is of human health concern at this PRS. Therefore, further evaluation of benzo[g,h,i]perylene is not proposed.

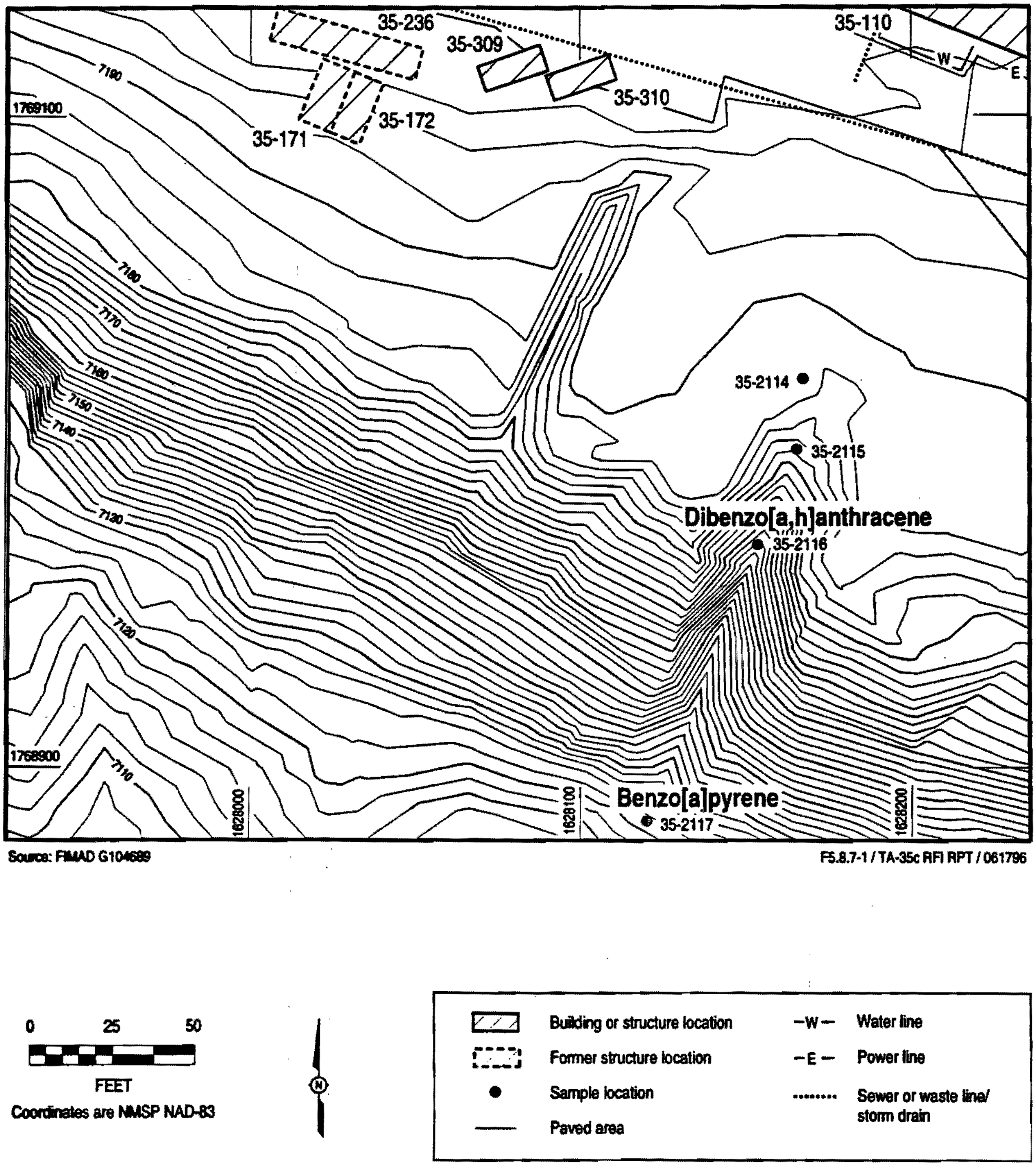
Chrysene, a carcinogen, was not included in the MCE because its SAL is not based on health effects. The SAL for chrysene is equivalent to its saturation concentration in soil, calculated according to the equation provided in the EPA Region IX PRG table (EPA 1995, 53970). The PRG values for residential exposure published in this table have been adopted by the ER Project as SALs, as described in *Risk-Based Corrective Action Process* (Environmental Restoration Decision Support Council 1996, 53751). Although a risk-based SAL for chrysene would certainly be higher (that is, less restrictive) than the SAL based on a saturation concentration, a risk-based SAL cannot be calculated using the model in the PRG table for estimating intake of volatile contaminants via inhalation because that model is not applicable beyond the soil saturation concentration. However, if chrysene were included in the MCE calculation using its current SAL, the MCE value for chemical carcinogens would still be below unity.

5.8.7.2 Risk Assessment

A quantitative human health risk assessment was not performed for this PRS. Although two COPCs were identified in the screening assessment, the soil concentrations and locations of these COPCs do not indicate a potential human health risk. A qualitative evaluation of potential human health risk is presented below.

5.8.7.2.1 Review of Chemicals of Potential Concern and Extent of Contamination

Benzo[a]pyrene and dibenzo[a,h]anthracene exceeded SAL values in two separate surface samples. The concentrations of benzo[a]pyrene and dibenzo[a,h]anthracene exceeded SAL values by approximately a factor of four and two, respectively. The fact that these and other PAHs were measured above



Source: FIMAD G104689

F5.8.7-1 / TA-35c RFI RPT / 061796

Figure 5.8.7-1. Locations of detected organic chemicals that exceed SALs at PRS No. 35-016(q).

EQL values in only one or two samples each, and at concentrations consistently below 1 mg/kg, indicates that a large and widespread release has not impacted surface sediments and backfill material at this location. Because this PRS is associated with surface water runoff only and not a specific release site, the most likely explanation for the observation of PAHs and metals in surface samples is that they represent nonspecific contamination associated with general industrial activities, asphalt roadways and parking areas, and motor vehicle use. The observed concentrations are only slightly above residential screening values and do not indicate the potential for unacceptable human health risk under industrial or recreational land use scenarios appropriate at this location. Therefore, further investigation of these COPCs is not proposed.

As described in Section 5.8.4, the sampling sites were selected based on the assumption that contaminants released with runoff water would remain in discharge channel sediments. Site samples were placed to provide information on possible contamination in the construction debris at the north end of the existing trench (Location ID No. 35-2114) and in surface sediments in the lower portions of the trench (Location ID Nos. 35-2115, 35-2116, and 35-2117). Because no specific historical release has been identified at this PRS, samples to evaluate potential releases into the trench during the period from the late 1950s to the mid 1970s (when aerial photographs show the trench as it exists today) were not obtained.

Additional sampling for this PRS is not proposed. Contaminant concentrations measured in backfill material and surface sediments do not indicate an adverse human health risk. The available evidence summarized in Sections 5.8.1 through 5.8.4 suggests that this trench was used primarily for disposal of construction debris and currently accepts surface water runoff. Although site samples were not placed to provide information on historical contamination, additional sampling is unwarranted because no evidence exists that this PRS is associated with historical releases.

5.8.8 Ecological Assessment

In accordance with conversations among Laboratory ER Project personnel, DOE/LAAO, and the regulators, further ecological risk assessment at this site will be deferred until the site can be assessed as part of the new Ecological Exposure Unit (Ecozone) methodology that is being developed by the Laboratory in conjunction with EPA Region 6 and NMED.

5.8.9 Conclusions and Recommendations

This site is not likely to pose a significant human health risk.

The objective of the Phase I RFI at PRS No. 35-016(q) was to determine the presence or absence of contamination associated with a storm-water trench at the southern edge of Ten Site Mesa. Benzo[a]pyrene and dibenzo[a,h]anthracene were identified as COPCs in the human health screening assessment.

Samples for specific analytes were collected from a 3-ft hand-auger hole and three surface samples. The extent of contamination cannot be conclusively determined based on these sample data, but widespread contamination of surface sediments at concentrations of human health concern has not occurred, and historical contamination in subsurface soils is unlikely.

Based on NFA criterion number 4 (LANL 1995, 53863), a Class III permit modification is requested to remove PRS No. 35-016(q) from the HSWA Module of the Laboratory's RCRA operating permit. The sample data indicate that this site is not likely to pose a significant human health risk now or in the foreseeable future. Further ecological risk assessment at this site will be deferred as stated in Section 5.8.8.

REFERENCES

Amdur, M. O., J. Doull, and C. D. Klaassen, 1991. "Casarett and Doull's Toxicology: The Basic Science of Poisons," Fourth Edition, McGraw-Hill, Inc., New York. **(Amdur et al. 1991, ER ID Number 53961)**

Bowen, B. M., May 1990. "Los Alamos Climatology," Los Alamos National Laboratory Report LA-11735-MS, Los Alamos, New Mexico. **(Bowen 1990, ER ID Number 6899)**

Cox, J., January 28, 1985. "Contaminated Soil and Concrete Left of the Excavation of MH-TLS-12 and Line 90A, Work Package II.5, TA-35," Los Alamos National Laboratory Memorandum HSE-1-SS-5 to Allen Valentine (Radiation Protection Group) from Jim Cox (HSE-1), Los Alamos, New Mexico. **(Cox 1985, ER ID Number 781)**

Devaurs, M., and W. D. Purtymun, 1985. "Hydrologic Characteristics of the Alluvial Aquifers in Mortandad, Cañada del Buey, and Pajarito Canyons," Los Alamos National Laboratory Report LA-UR-85-4002, Los Alamos, New Mexico. **(Devaurs and Purtymun 1985, ER ID Number 7415)**

DOE (US Department of Energy), April 27, 1987. DOE Environmental Problem 19, Los Alamos, New Mexico. **(DOE 1987, ER ID Number 5622)**

DOE (US Department of Energy), April 29, 1987. DOE Environmental Problem 24, Los Alamos, New Mexico. **(DOE 1987, ER ID Number 21510)**

DOE (US Department of Energy), October 1987. "Phase I: Installation Assessment, Los Alamos National Laboratory," Vol. I (draft), Comprehensive Environmental Assessment and Response Program, Albuquerque Operations Office, Albuquerque, New Mexico. **(DOE 1987, ER ID Number 8663)**

Dransfield, B. J., and J. N. Gardner, May 1985. "Subsurface Geology of the Pajarito Plateau, Española Basin, New Mexico," Los Alamos National Laboratory Report LA-10455-MS, Los Alamos, New Mexico. **(Dransfield and Gardner 1985, ER ID Number 6612)**

Elder, J. C., E. J. Cox, D. P. Hohner, and A. M. Valentine, September 1986. "Radioactive Liquid Waste Lines Removal Project at Los Alamos (1981–1986)," Los Alamos National Laboratory Report LA-10821-MS, Los Alamos, New Mexico. **(Elder et al. 1986, ER ID Number 3089)**

Environmental Restoration Decision Support Council, January 2, 1996. "Risk-Based Corrective Action Process," Los Alamos National Laboratory Report LA-UR-96-111, Los Alamos, New Mexico. **(Environmental Restoration Decision Support Council 1996, ER ID Number 53751)**

EPA (US Environmental Protection Agency), November 1986. "Test Methods for Evaluating Solid Waste, Volume IA: Laboratory Manual, Physical/Chemical Methods," SW-846, Third Edition, Washington, DC. **(EPA 1986, ER ID Number 31732)**

EPA (US Environmental Protection Agency), November 1986. "Test Methods for Evaluating Solid Waste, Volume IB: Laboratory Manual, Physical/Chemical Methods," SW-846, Third Edition, Washington, DC. **(EPA 1986, ER ID Number 31733)**

EPA (US Environmental Protection Agency), December 1989. "Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)," Interim Final, EPA 540/1-89/002, Office of Emergency and Remedial Response, Washington, DC. **(EPA 1989, ER ID Number 8021)**

EPA (US Environmental Protection Agency), February 1994. "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," EPA-540/R-94-013, Office of Solid Waste and Emergency Response, Washington, DC. **(EPA 1994, ER ID Number 48639)**

EPA (US Environmental Protection Agency), December 1994. "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review: Multi-Media, Multi-Concentration (ILMO 1.0) and Low Concentration Water (OLCO 1.0)," EPA/540/R/94/090, Office of Solid Waste and Emergency Response, Washington, DC. **(EPA 1994, ER ID Number 48640)**

EPA (US Environmental Protection Agency), September 1, 1995. "Region IX Preliminary Remediation Goals (PRGs) Second Half 1995," EPA Region IX, Technical Support Section, San Francisco, California. **(EPA 1995, ER ID Number 53970)**

Galusha, T., and J. C. Blick, April 1971. "Stratigraphy of the Santa Fe Group, New Mexico," in Bulletin of the American Museum of Natural History, Vol. 144, Article 1, Lund Humphries, Great Britian, pp. 1–128. **(Galusha and Blick 1971, ER ID Number 21526)**

Gardner, J. N., F. Goff, S. Garcia, and R. C. Hagan, February 10, 1986. "Stratigraphic Relations and Lithologic Variations in the Jemez Volcanic Field, New Mexico," in *Journal of Geophysical Research*, Vol. 91, No. B2, pp. 1763–1778. **(Gardner et al. 1986, ER ID Number 21527)**

Gardner, J. N., T. Kolbe, and S. Chang, January 1993. "Geology, Drilling, and Some Hydrologic Aspects of Seismic Hazards Program Core Holes, Los Alamos National Laboratory, New Mexico," Los Alamos National Laboratory Report LA-12460-MS, Los Alamos, New Mexico. **(Gardner et al. 1993, ER ID Number 12582)**

Heiken, G., F. Goff, J. Stix, S. Tamanyu, M. Shafiqullah, S. Garcia, and R. Hagan, February 10, 1986. "Intracaldera Volcanic Activity, Toledo Caldera and Embayment, Jemez Mountains, New Mexico," in *Journal of Geophysical Research*, Vol. 91, No. B2, pp. 1799–1815. **(Heiken et al. 1986, ER ID Number 48638)**

Izett, G. A., and J. D. Obradovich, February 10, 1994. "40Ar/39Ar Age Constraints for the Jaramillo Normal Subchron and the Matuyama-Brunhes Geomagnetic Boundary," in *Journal of Geophysical Research*, Vol. 99, No. B2, pp. 2925–2934. **(Izett and Obradovich 1994, ER ID Number 48817)**

LANL (Los Alamos National Laboratory), November 1990. "Solid Waste Management Units Report," Vol. I–IV, Los Alamos National Laboratory Report LA-UR-90-3400, prepared by International Technology Corporation, Contract No. 9-XS8-0062R-1, Los Alamos, New Mexico. **(LANL 1990, ER ID Number 7511)**

LANL (Los Alamos National Laboratory), 1991. "Waste Stream Characterization Reports," Los Alamos National Laboratory Reports (preliminary), prepared by International Technology Corporation, Project No. 301215.06.03, Los Alamos, New Mexico. **(LANL 1991, ER ID Number 12451)**

LANL (Los Alamos National Laboratory), May 1991. "Environmental Restoration Standard Operating Procedures," Vol. I–III, Los Alamos, New Mexico. **(LANL 1991, ER ID Number 21556)**

LANL (Los Alamos National Laboratory), May 1992. "RFI Work Plan for Operable Unit 1129," Los Alamos National Laboratory Report LA-UR-92-800, Los Alamos, New Mexico. **(LANL 1992, ER ID Number 7666)**

LANL (Los Alamos National Laboratory), July 1993. "Health and Environmental Chemistry: Analytical Techniques, Data Management, and Quality Assurance," Los Alamos National Laboratory Report LA-10300-M, Vol. II, Los Alamos, New Mexico. **(LANL 1993, ER ID Number 31794)**

LANL (Los Alamos National Laboratory), March 28, 1995. "No Further Action Criteria Policy," Los Alamos National Laboratory Memorandum EM/ER:95-PCT-015 to Distribution, Los Alamos, New Mexico. **(LANL 1995, ER ID Number 53863)**

LANL (Los Alamos National Laboratory), July 1995. "Statement of Work – Analytical Support," Revision 2, RFP No. 9-XS1-Q4257, Los Alamos, New Mexico. **(LANL 1995, ER ID Number 49738)**

LANL (Los Alamos National Laboratory), November 1995. "Installation Work Plan for Environmental Restoration Program," Revision 5, Los Alamos National Laboratory Report LA-UR-95-4048, Los Alamos, New Mexico. **(LANL 1995, ER ID Number 52009)**

LANL (Los Alamos National Laboratory), June 1996. "RFI Report for Potential Release Sites 35-003(d, e, f, g, l, o, q, and r) 35-016(g and h)," Los Alamos National Laboratory Report LA-UR-96-1605, Los Alamos, New Mexico. **(LANL 1996, ER ID Number 54422)**

Longmire, P. A., D. E. Broxton, and S. L. Reneau, October 1995. "Natural Background Geochemistry and Statistical Analysis of Selected Soil Profiles, Sediments, and Bandelier Tuff, Los Alamos, New Mexico," Los Alamos National Laboratory Report LA-UR-95-3468, Los Alamos, New Mexico. **(Longmire et al. 1995, ER ID Number 52227)**

Longmire, P., S. Reneau, P. Watt, L. McFadden, J. Gardner, C. Duffy, and R. Ryti, January 1995. "Natural Background Geochemistry, Geomorphology, and Pedogenesis of Selected Soil Profiles and Bandelier Tuff, Los Alamos, NM" (draft), Los Alamos National Laboratory Report LA-12913-MS, Los Alamos, New Mexico. **(Longmire et al. 1995, ER ID Number 48818)**

Massachusetts Department of Environmental Protection, July 1, 1993. "Revised Massachusetts Contingency Plan," 310 CMR 40.0000, prepared by the Bureau of Waste Site Cleanup, Boston, Massachusetts. **(Massachusetts Department of Environmental Protection 1993, ER ID Number 54257)**

Massachusetts Department of Environmental Protection, August 1994. "Interim Final Petroleum Report: Development of Health-Based Alternative to the Total Petroleum Hydrocarbon (TPH) Parameter," prepared by the Office of Research and Standards, Boston, Massachusetts. **(Massachusetts Department of Environmental Protection 1994, ER ID Number 54428)**

Miller, I. C., March 31, 1994. "Health Effects Assessment Summary Tables Annual Update, FY-1994," 9200.6-303(94-1), EPA 540-R-94-020, prepared by Oak Ridge National Laboratory for the Environmental Protection Agency, Oak Ridge, Tennessee. **(Miller 1994, ER ID Number 54429)**

Nyhan, J. W., L. W. Hacker, T. E. Calhoun, and D. L. Young, June 1978. "Soil Survey of Los Alamos County, New Mexico," Los Alamos Scientific Laboratory Report LA-6779-MS, Los Alamos, New Mexico. **(Nyhan et al. 1978, ER ID Number 5702)**

Pratt, A., June 2, 1994. "Addendum to the OU 1129 RFI Work Plan," Los Alamos National Laboratory Memorandum EES-13-ER-05-94-011 to Tracy Glatzmaier (EES-5) from Allyn Pratt (EES-13), Los Alamos, New Mexico. **(Pratt 1994, ER ID Number 43475)**

Purtymun, W. D., January 1995. "Geologic and Hydrolog et Test Holes, Test Wells, Supply Wells, Springs, and Surface Water Stations in the Los Alamos Area," Los Alamos National Laboratory Report LA-12883-MS, Los Alamos, New Mexico. **(Purtymun 1995, ER ID Number 45344)**

Roberson, K., August 5, 1991. Notes recorded during site inspection of TA-35 on International Technology (IT) Corporation Field Activity Daily Log, Los Alamos, New Mexico. **(Roberson 1991, ER ID Number 21576)**

Ryti, R., P. Longmire, and E. McDonald, March 29, 1996. "Application of LANL Background Data to ER Project Decision-Making, Part I: Inorganics" (draft), Los Alamos National Laboratory Report, Los Alamos, New Mexico. **(Ryti et al. 1996, ER ID Number 53953)**

Turbeville, B. N., D. B. Waresback, and S. Self, February 1989. "Lava-Dome Growth and Explosive Volcanism in the Jemez Mountains, New Mexico: Evidence from the Plio-Pleistocene Puye Alluvial Fan," in Journal of Volcanology *and Geothermal Research*, Vol. 36, pp. 267–291. **(Turbeville et al. 1989, ER ID Number 21587)**

Vaniman, D. and K. Wohletz, November 16, 1993. "Reconnaissance Geology of North-Central LANL," Facility for Information Management, Analysis, and Display Map G101599, Los Alamos National Laboratory, Los Alamos, New Mexico. **(Vaniman and Wohletz 1993, ER ID Number 48822)**

Wolff, J. A. and J. N. Gardner, May 1995. "Is the Valles caldera entering a new cycle of activity?" in *Geology*, Vol. 23, No. 5, pp. 411–414. **(Wolff and Gardner 1995, ER ID Number 48821)**

Appendix A

Analytical Data

APPENDIX A. ANALYTICAL DATA

All analytical data are available in the Facility for Information Management, Analysis, and Display (FIMAD). If FIMAD is not accessible, data will be provided upon request.

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Appendix B

Data Quality Evaluation Tables

APPENDIX B. DATA QUALITY EVALUATION TABLES

This appendix contains the sample-specific data quality evaluation. Data quality evaluation tables are presented for potential release site (PRS) decision sets evaluated for this Resource Conservation and Recovery Act facility investigation (RFI) report. Data quality evaluation tables were not prepared for the following PRSs because no qualifications of the analytical data were required: PRS Nos. 35-004(a), 35-009(e), and 35-016(q). Data quality for the entire data set can be found in Chapter 4.0 of this RFI report.

TABLE B-1

DATA QUALITY EVALUATION FOR PRS Nos. 35-004(a) AND 35-009(e)

Request No.	Location ID No.	Sample ID No.	Analytical Suite	QC Parameter	Explanation
21483	35-2103	AAC1158	PCB screen	Accuracy	Aroclor 1260 reported 3.188 mg/kg; result should be regarded as estimated and biased low due to low surrogate recovery.

TABLE B-2

DATA QUALITY EVALUATION FOR PRS No. 35-004(h)

Request No.	Location ID No.	Sample ID No.	Analytical Suite	QC Parameter	Explanation
17052	35-2024	AAA6601	SVOC screen	Accuracy	Di-n-butyl-phthalate present in the water blank, the soil QC sample, and the sample; sample result attributed to laboratory contamination.

TABLE B-3

DATA QUALITY EVALUATION FOR PRS No. 35-004(g)

Request No.	Location ID No.	Sample ID No.	Analytical Suite	QC Parameter	Explanation
21476	35-2102	AAC1179	SVOC screen	Accuracy	Unsaturated hydrocarbons reported as TICs: 2.4 mg/kg. Multiple unknown organic compounds reported as TICs.

TABLE B-4

DATA QUALITY EVALUATION FOR PRS Nos. 35-004(m) AND 35-014(g_2)

Request No.	Location ID No.	Sample ID No.	Analytical Suite	QC Parameter	Explanation
34	35-2167	0435-95-0011	PCB screen	Accuracy	Low surrogate recovery; sample EQLs should be regarded estimated and biased low.
34	35-2167	0435-95-0011	VOC screen	Accuracy	Low internal standard area due to matrix effect; sample EQLs should be regarded as estimated and biased low.
34	35-2168	0435-95-0015	PCB screen	Accuracy	Low surrogate recovery; sample EQLs should be regarded estimated and biased low.
34	35-2168	0435-95-0015	VOC screen	Accuracy	Low internal standard area due to matrix effect; sample EQLs should be regarded as estimated and biased low.
34	35-2168	0435-95-0019	PCB screen	Accuracy	Low surrogate recovery; sample EQLs should be regarded estimated and biased low.

TABLE B-5

DATA QUALITY EVALUATION FOR PRS Nos. 35-014(g_1) AND 35-016(n)

Request No.	Location ID No.	Sample ID No.	Analytical Suite	QC Parameter	Explanation
34	35-2169	0435-95-0021	PCB screen	Accuracy	Low surrogate recovery; sample EQLs should be regarded as estimated and biased low.
34	35-2170	0435-95-0023	PCB screen	Accuracy	Low surrogate recovery; sample EQLs should be regarded as estimated and biased low.
34	35-2170	0435-95-0023	VOC screen	Accuracy	Low internal standard area due to matrix effect; sample EQLs should be regarded as estimated and biased low.
34	35-2171	0435-95-0027	PCB screen	Accuracy	Low surrogate recovery; sample EQLs should be regarded as estimated and biased low. Detected Aroclor 1260 concentration should be considered estimated and biased low.
34	35-2171	0435-95-0027	VOC screen	Accuracy	Low internal standard area due to matrix effect; sample EQLs should be regarded as estimated and biased low.
34	35-2171	0435-95-0028	PCB screen	Accuracy	Low surrogate recovery; sample EQLs should be regarded as estimated and biased low.
34	35-2171	0435-95-0028	VOC screen	Accuracy	Low internal standard area due to matrix effect; sample EQLs should be regarded as estimated and biased low.

TABLE B-6

DATA QUALITY EVALUATION FOR PRS No. 35-016(b)

Request No.	Location ID No.	Sample ID No.	Analytical Suite	QC Parameter	Explanation
43	35-2190	0435-95-0005	PAH screen	Accuracy	Total extractable SVOCs reported: 63 mg/kg (quantitated as naphthalene). Sample result should be regarded as estimated.
43	35-2190	0435-95-0005	VOC screen	Accuracy	Low internal standard area due to matrix effect; sample EQLs should be regarded as estimated and biased low.
59	35-2190	0435-95-0009	VOC screen	Accuracy	Low internal standard area due to matrix effect; sample EQLs should be regarded as estimated and biased low.

TABLE B-7

DATA QUALITY EVALUATION FOR PRS No. 35-016(j)

Request No.	Location ID No.	Sample ID No.	Analytical Suite	QC Parameter	Explanation
43	35-2192	0435-95-0062	PAH screen	Accuracy	C10-C20 hydrocarbons reported: 190 mg/kg (quantitated as tetradecane). Sample result should be regarded as estimated.
59	35-2192	0435-95-0063	PAH screen	Accuracy	C10-C20 hydrocarbons reported: 400 mg/kg (quantitated as tetradecane). Sample result should be regarded as estimated.

TABLE B-8

DATA QUALITY EVALUATION FOR PRS No. 35-016(q)

Request No.	Location ID No.	Sample ID No.	Analytical Suite	QC Parameter	Explanation
21473	35-2114	AAC1137	PAH screen	Accuracy	Oil qualitatively identified; no quantitation performed.
21473	35-2114	AAC1139	PAH screen	Accuracy	Target compound reported: benz[a]anthracene 0.146 mg/kg. No surrogate recovery reported; sample result should be regarded as estimated.
21473	35-2115	AAC1146	PAH screen	Accuracy	Target compounds reported: chrysene 0.99 mg/kg, and benzo[g,h,i]perylene 0.95mg/kg. No surrogate recovery reported; sample results should be regarded as estimated.
21473	35-2115	AAC1146	VOC screen	Accuracy	Low internal standard area due to matrix effect; sample EQLs should be regarded as estimated and biased low.
21473	35-2116	AAC1147	PAH screen	Accuracy	Target compounds reported: benz[a]anthracene 0.135 mg/kg, benzo[k]fluoranthene 0.25 mg/kg, dibenzo[a,h]anthracene 0.112 mg/kg, and benzo[g,h,i]perylene 0.166 mg/kg. No surrogate recovery reported; sample results should be regarded as estimated.
21473	35-2117	AAC1148	PAH screen	Accuracy	Target compound reported: benz[a]anthracene 0.114 mg/kg and benzo[a]pyrene 0.225 mg/kg. No surrogate recovery reported; sample results should be regarded as estimated.

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Appendix C

Risk Assessment Calculations

APPENDIX C. RISK ASSESSMENT CALCULATIONS

No quantitative risk assessment was performed for any of the potential release site decision sets evaluated for this Resource Conservation and Recovery Act facility investigation report.

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Attachment I

Distributions and Statistical Tests for XRF Data

ATTACHMENT I. DISTRIBUTIONS AND STATISTICAL TESTS FOR XRF DATA

I.1 Discussion

This attachment presents a discussion of the statistical tests that were performed on the x-ray fluorescence (XRF) data for the potential release sites (PRSs) in Technical Area (TA) -35. It also contains the distribution plots, which provide an overview of the XRF data for inorganic chemicals in soil, sediment, and tuff samples across all TA-35 PRSs (or groups of PRSs in decision sets). The following two types of plots are provided:

- side-by-side box plots for the distribution of concentrations within a PRS (or group of PRSs) for elements that are measured above detection levels in at least 20% of the samples (barium, calcium, chromium, copper, iron, lead, manganese, potassium, thorium, titanium, and zinc) and
- side-by-side point plots of the concentrations within a PRS (or group of PRSs) for elements that are usually measured below detection levels (antimony, arsenic, cadmium, mercury, nickel, selenium, and uranium).

The distribution of the TA-35 data combined across all PRSs is also shown at the bottom of each plot.

XRF background data are available for eight of the elements in the first class (all except thorium and titanium) and for most elements in the second class (all except selenium and uranium), as described in Section 3.1.3 in Chapter 3.0 of this Resource Conservation and Recovery Act facility investigation (RFI) report. Where available, the distribution of the background data is also shown at the bottom of the plot.

For the eight elements in the first class with XRF background data, four statistical tests were applied to compare XRF background data with data from each PRS and group of PRSs. These tests supplement the comparison to upper tolerance limits (UTLs) described in the background comparison sections in Chapter 5.0 of this RFI report. The tests, which are summarized below, are described in Ryti et al. (1996, 53953).

- The t-test looks for an upward shift in mean at the PRS (or group of PRSs) relative to background. For the purposes of this test, below-detection-limit data are accommodated by using one-half of the reported detection limit as if it were the measured result for a given sample.
- Likewise, the nonparametric Wilcoxon-Gehan test looks for an upward shift in the distribution at the PRS (or group of PRSs) relative to the background distribution. This test, based on ranks rather than actual data values, accommodates below-detection-limit data without the necessity for making arbitrary replacement decisions. Results from this test tend to be well correlated with results from the t-test, unless the t-test is influenced by one or more extreme outliers.
- The quantile test determines whether the number of PRS (or group of PRSs) samples included among the highest 20% of the combined set of data from that PRS (or group of PRSs) plus the background data is larger than would be expected if the PRS data came from the background distribution. Because the test looks only at the highest 20% of the data, nondetects are not a problem when they constitute less than 80% of the population. This test is sensitive to shifts affecting only part of the data from the PRS (or group of PRSs).
- The slippage test determines whether the number of PRS (or group of PRSs) samples exceeding the largest background measurement is larger than would be expected if the PRS data came from the background distribution. Again, nondetects are not a problem for this test unless for some reason there are nondetect values above the maximum positive value in the background data set.

Likewise, this test is sensitive to shifts affecting only part of the data from the PRS (or group of PRSs).

The plots for titanium and antimony have been rescaled to delete one very high outlier in each case. Including the outliers would compress the plot on the horizontal scale and make the distribution of data unintelligible. The titanium outlier is located in PRS No. 35-004(a); the antimony outlier is located in PRS No. 35-016(q).

I.2 Description of the Plots

I.2.1 Box Plots

In the side-by-side box plots, the distribution of concentrations at a PRS (or group of PRSs) is represented by a central "box" with "whiskers" and sometimes additional lines representing outliers that are far removed from most of the data.

- The central box includes the middle 50% of the data (at least). Its width estimates the interquartile range (IQR), which is the difference between the 75th and 25th percentile of the underlying distribution.
- The white bar across this box designates the median concentration (the 50th percentile of the data).
- Whiskers, which are the dashed horizontal lines extending left and right of the box to the staple end bars, cover all the data observed within a distance 1.5*IQR of the ends of the central box. For a normal distribution, this would include approximately 90% of the data, except 5% at each end.
- Each value beyond the whiskers is plotted explicitly with a vertical line. Because the distributions illustrated in these plots are mostly skewed rather than symmetric, these outliers tend to be on the high side much more frequently than on the low side.

Below-detection-limit results are included in these distributions at one-half the reported detection limit. Additional information shown on these plots include

- sample sizes (shown in parentheses to the right of the largest observation at each PRS);
- UTLs, where applicable (shown by vertical dashed lines for the XRF measurements and dotted lines for results of samples prepared by using total digestion methods); and
- statistical test results, indicated next to the PRS (or group of PRSs) label on the y-axis. For example, "t" indicates that the t-test rejected the hypothesis that the PRS data come from the background level at the 5% significance level, and "g," "q," and "s" indicate rejection of the same null hypothesis by the gehan, quantile, and slippage tests, respectively.

As an example, consider the box plot for chromium (see Figure AI-5). Only about 42% of the chromium XRF measurements are above the detection limit, which is 12 mg/kg in most cases. Therefore, for some PRSs the box plot collapses to a single line at one-half the detection level (for example, see PRS No. 35-003[e]). In several other cases, at least half the samples are below the detection level so the median line is at 6 mg/kg (for example, see PRS No. 35-010[a] and the background distribution). A PRS with consistently elevated results stands out relative to the others, such as PRS No. 35-016(g), which is an outfall permitted by the National Pollutant Discharge Elimination System that receives cooling tower blowdown.

The large number of PRSs for which the statistical background comparison tests fail indicates that chromium is an element that has been widely released at TA-35.

- The t-test and the gehan test fail for the combined data. However, note that 17 samples above the background maximum out of a total of 429 is not statistically excessive given that only 44 background samples were analyzed.
- In most cases where the null hypothesis was rejected, both a test for overall shift (the t-test or the gehan test) and a test for a shift in the tail (the quantile test or the slippage test) failed. The t-test and gehan test generally fail together; therefore, they do not provide independent information.
- Frequently these tests fail when no individual observation exceeds the UTL (for example, PRS Nos. 35-010[e] and 35-016[c and d]). The opposite situation is more rare, where one observation exceeds the UTL but no statistical test fails (for chromium, only PRS No. 35-016[q]).

Note that for thorium the background UTL value was derived from "whole rock" measurements (samples were completely digested using hydrofluoric acid) on samples from all soil horizons.

I.2.2 Point Plots

Where most (approximately 80%) of the observations are nondetects, box plots are uninformative and are replaced by point plots in a similar format.

- Below-detection-limit results are represented by a square plotted at one-half the detection level. Multiple below-detection-limit results are usually overplotted.
- Above-detection-limit results are represented by a plus symbol at the appropriate level.
- As before, sample sizes are indicated, and total digestion UTLs and background comparisons are presented where available.

As an example, consider the point plot for arsenic (see Figure AI-1). Fewer than 10% of the observations are reported above the detection level, which for most TA-35 samples was 5 mg/kg. A handful of higher detection levels, up to 33 mg/kg, were reported in both PRS and background samples. Only one positive background result was reported, and it was also at 5 mg/kg. Only a handful of the positive results exceed the mixed soil partial digestion UTL (7.8 mg/kg), and none exceed the total digestion UTL of 18 mg/kg.

Statistical tests were performed for arsenic, but the results are not meaningful and are not shown in Figure AI-1 because they are artifacts of the different detection levels, and only a single background sample was reported above detection level. PRSs for which all results were reported as below the higher limits (PRS Nos. 35-016[m, o, and p]) fail the t-test, and some PRSs with more than one result out of only five or six above 5 mg/kg fail the slippage test. Only one gehan test comparison failed (PRS No. 35-016[d], which has five samples including two reported above 5 mg/kg). The quantile test could not be performed because less than 20% of the data were above the detection level. Overall, the number of tests failed is not out of line with an expected false positive rate of 5% (see below). Together with the fact that no observation exceeds the total digestion UTL for arsenic, this low failure rate is taken as an indication that arsenic has not been released at TA-35.

I.3 Summary of Statistical Test Results

All tests were conducted at the 5% significance level, which means that they can be expected to fail 5% of the time even where there is no true difference between the PRS (or group of PRSs) and background. Because four tests are being applied to nine elements, for a total of 36 tests in each PRS, occasional false positive results are expected. Therefore, it is most useful to look for patterns in the results: elements that are above background at several PRSs or multiple elements above background at the same PRS (or group of PRSs).

At least one statistical background comparison test was failed by the combined TA-35 data for the elements chromium, copper, lead, and zinc. All these elements are expected in a heavily industrialized area such as TA-35. Consistently, statistical comparisons of these elements with background for individual PRSs (or groups of PRSs) rejected the null hypothesis more than the expected 5% of the time: the t-test and gehan test failed for more than 40% of the PRSs; the quantile test and the slippage test failed for at least 10% of the PRSs, except the slippage test for chromium. The test results also provide some less consistent evidence for releases of nickel.

PRSs for which a relatively large number of statistical background comparison failures were reported were PRS Nos. 35-003(d, l, q, and r); 35-004(b) (where the only inorganic chemical actually above its UTL was one copper result); and 35-016(e, g, and h). Chemicals that failed background comparison tests were carried forward to the screening assessment as described in Section 3.2 in Chapter 3.0 of this RFI report.

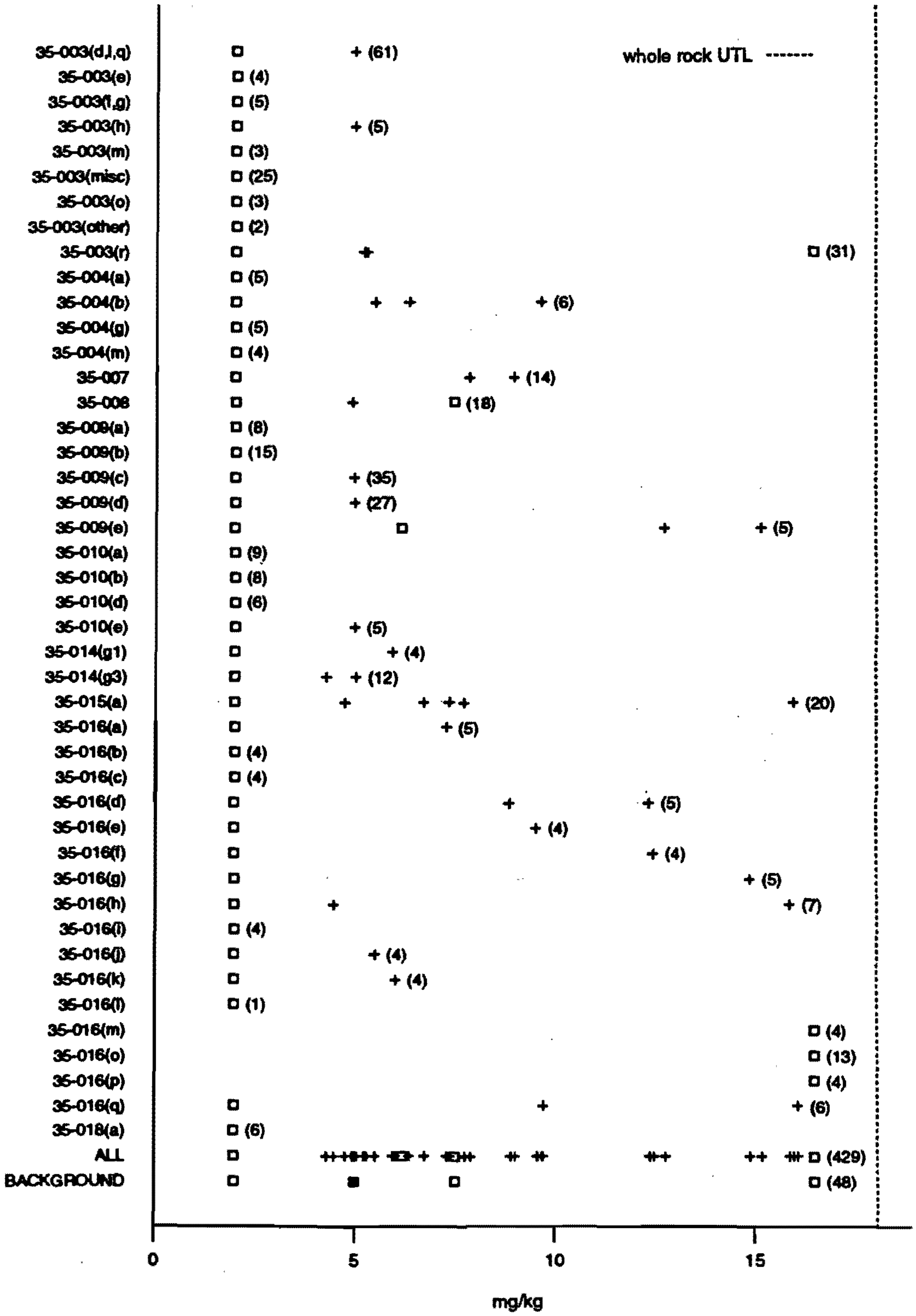

Figure AI-1. Distribution of arsenic in TA-35 PRSs.

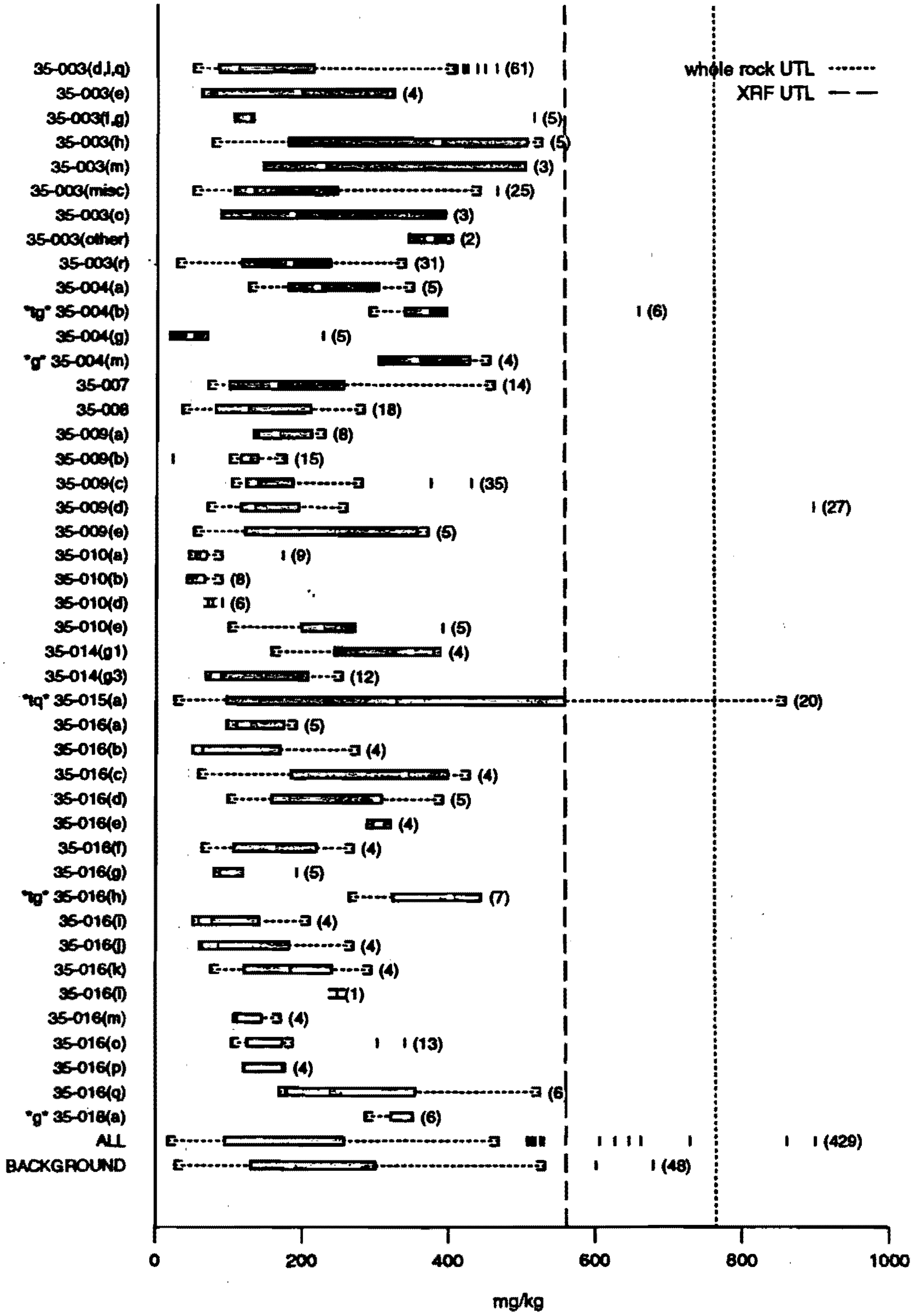

Figure AI-2. Distribution of barium in TA-35 PRSs.

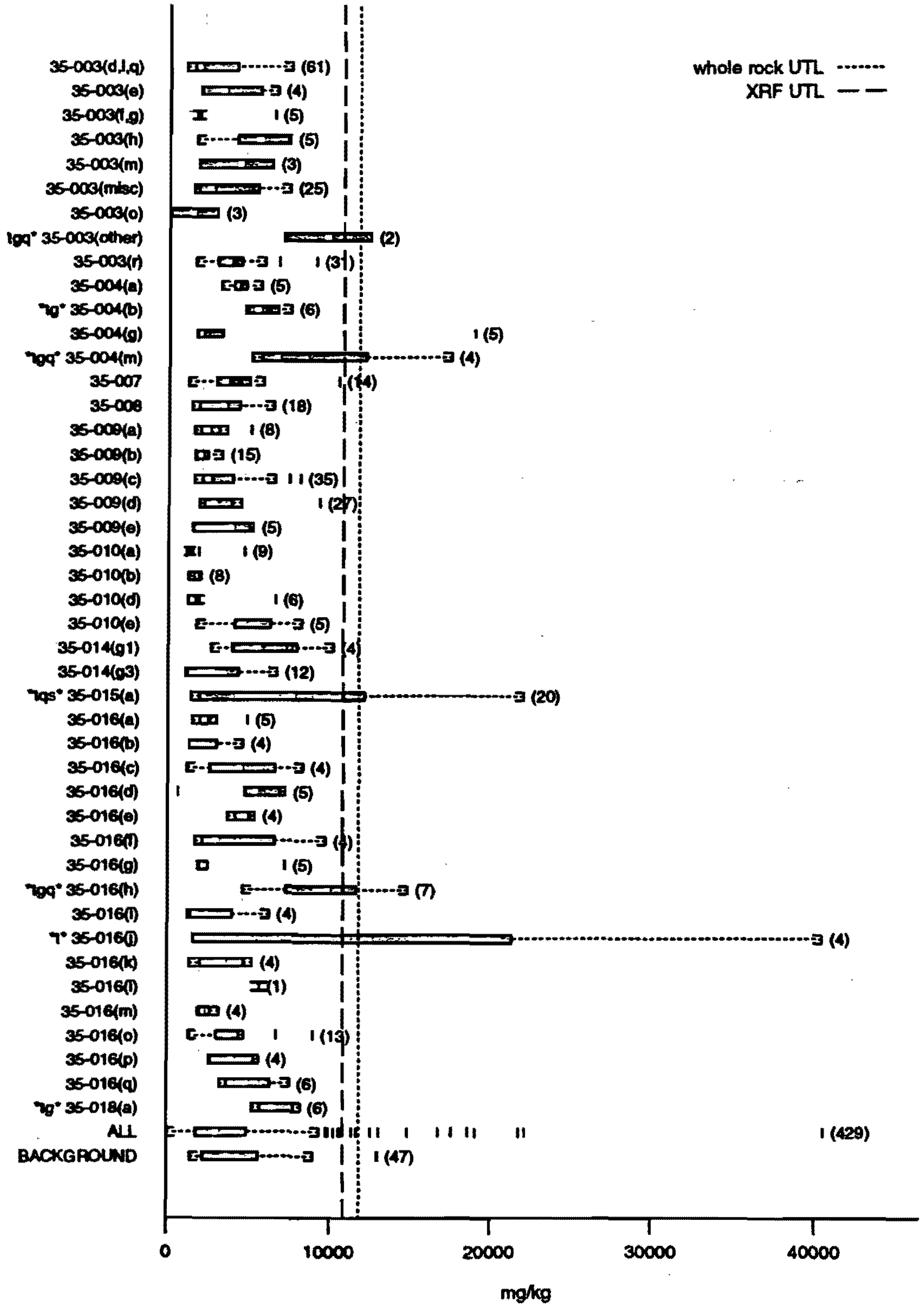

Figure AI-3. Distribution of calcium in TA-35 PRSs.

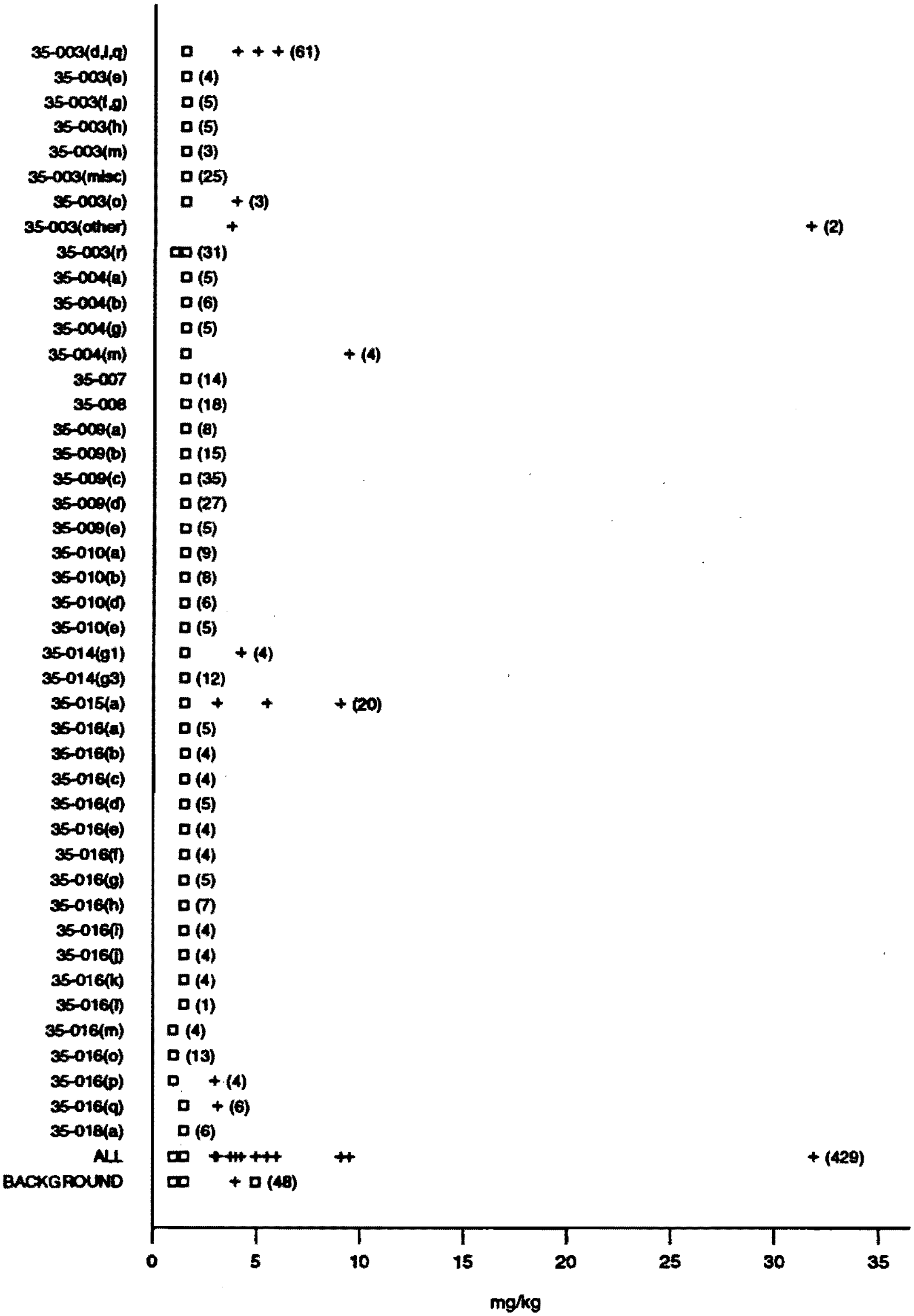

Figure AI-4. Distribution of cadmium in TA-35 PRSs.

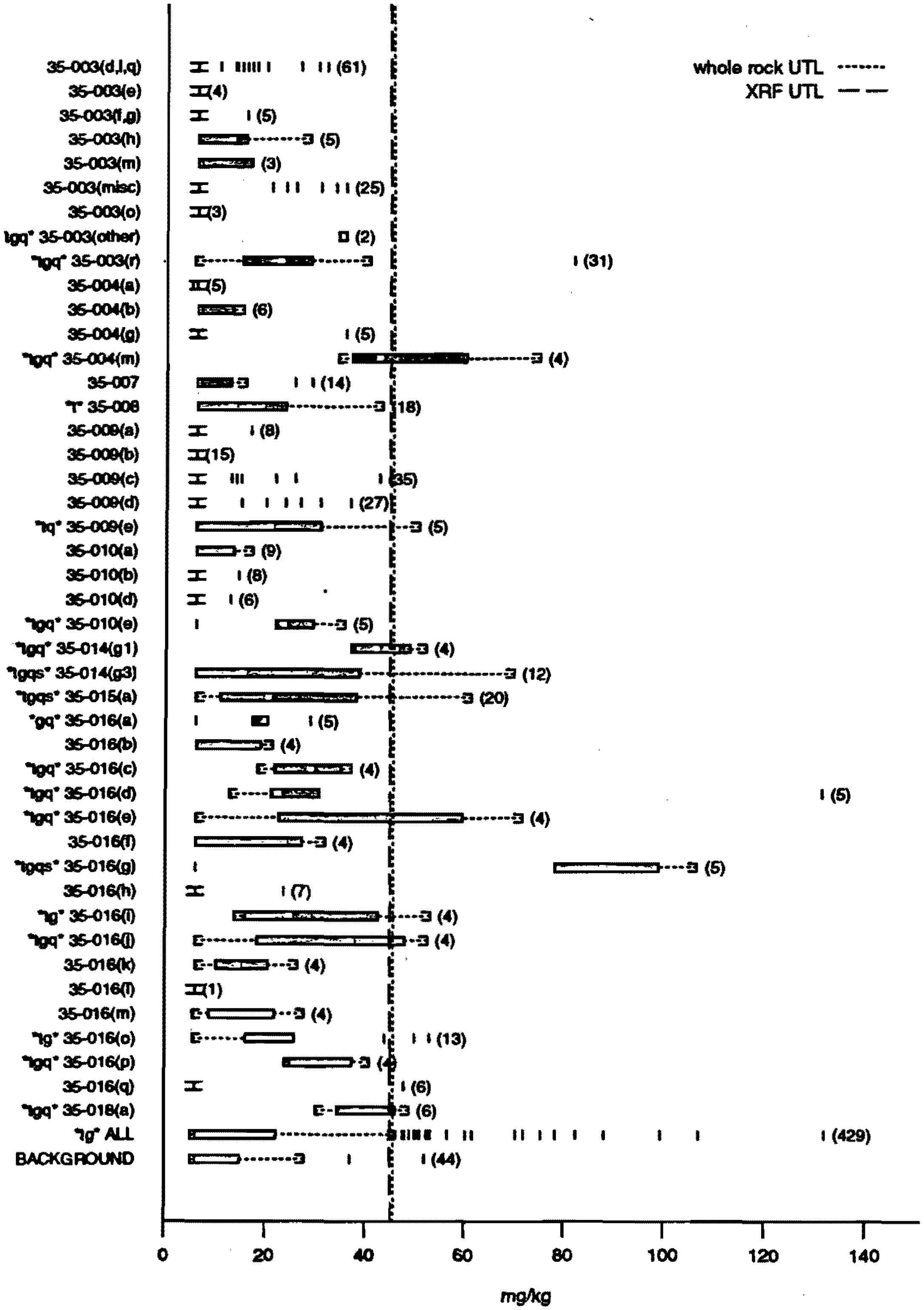

Figure AI-5. Distribution of chromium in TA-35 PRSs.

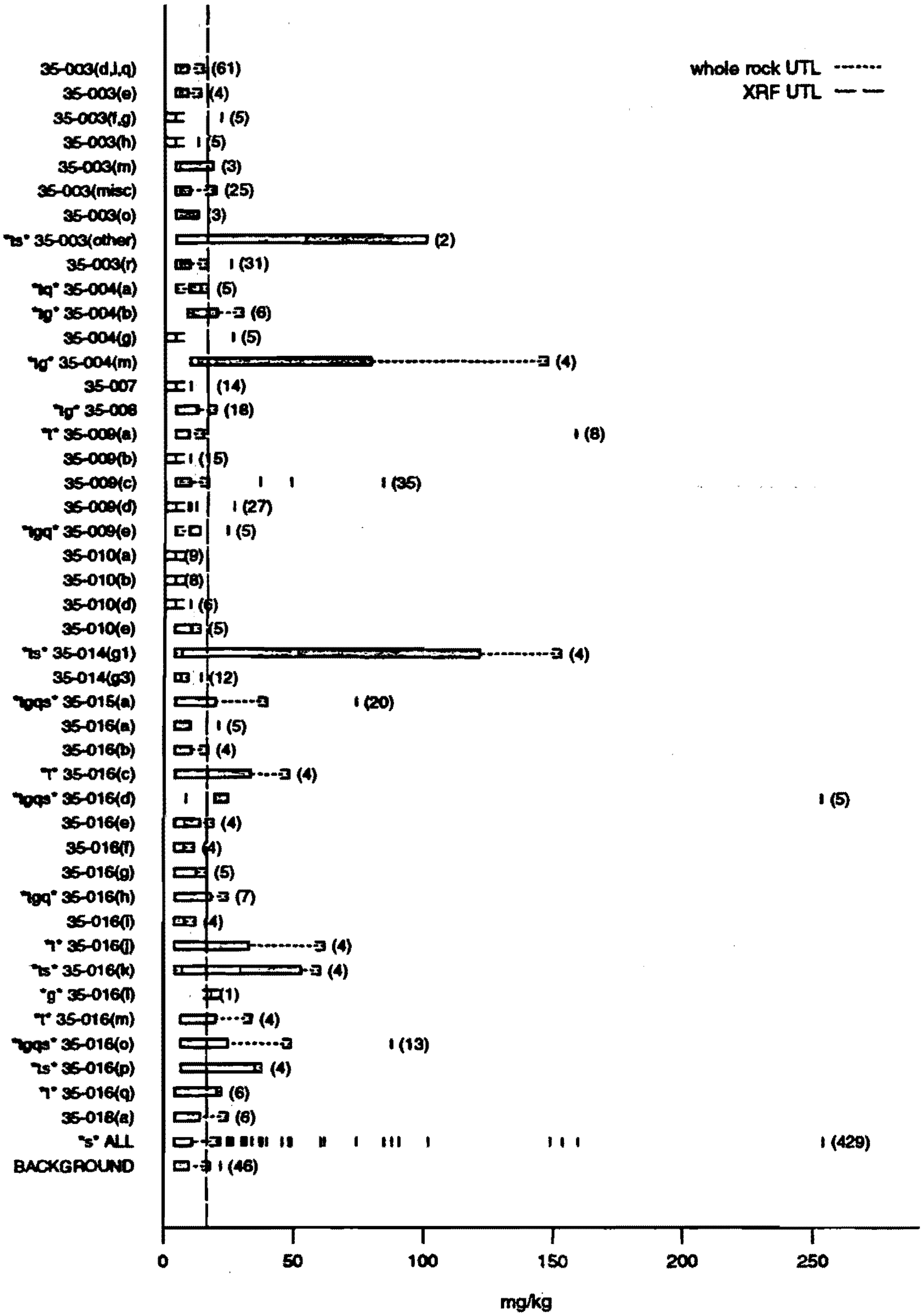

Figure AI-6. Distribution of copper in TA-35 PRSs.

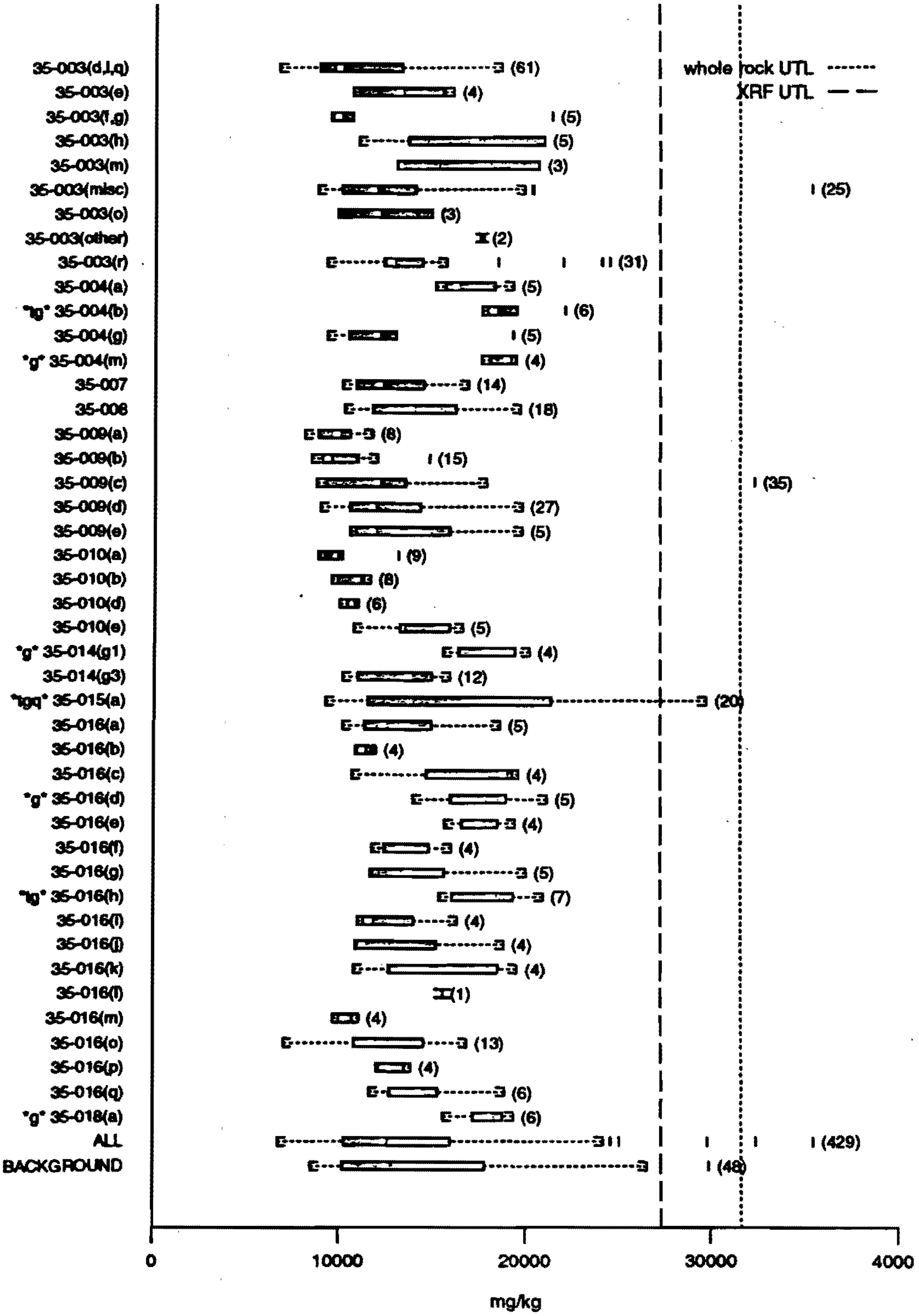

Figure AI-7. Distribution of iron in TA-35 PRSs.

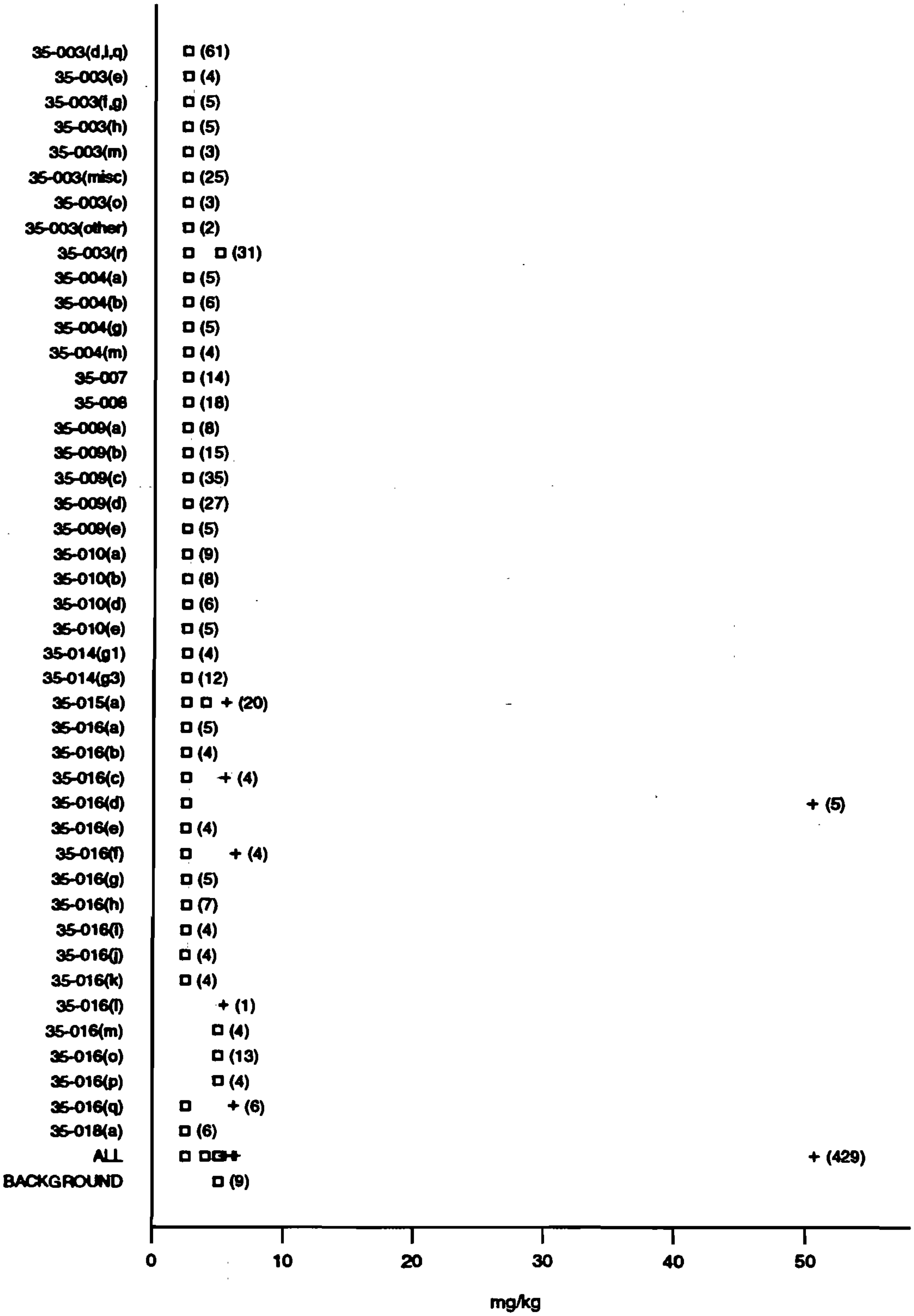

Figure AI-8. Distribution of mercury in TA-35 PRSs.

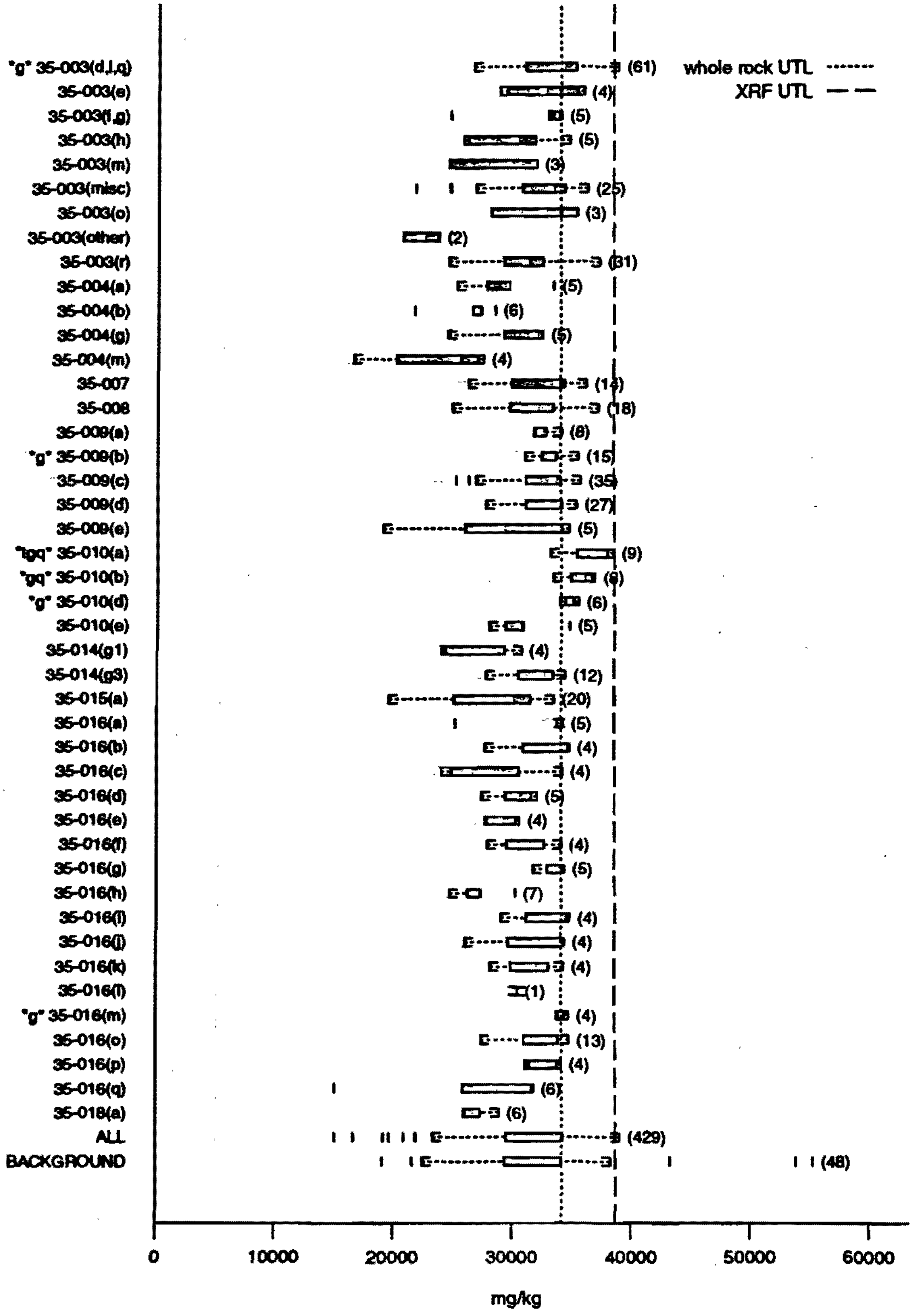

Figure AI-9. Distribution of potassium in TA-35 PRSs.

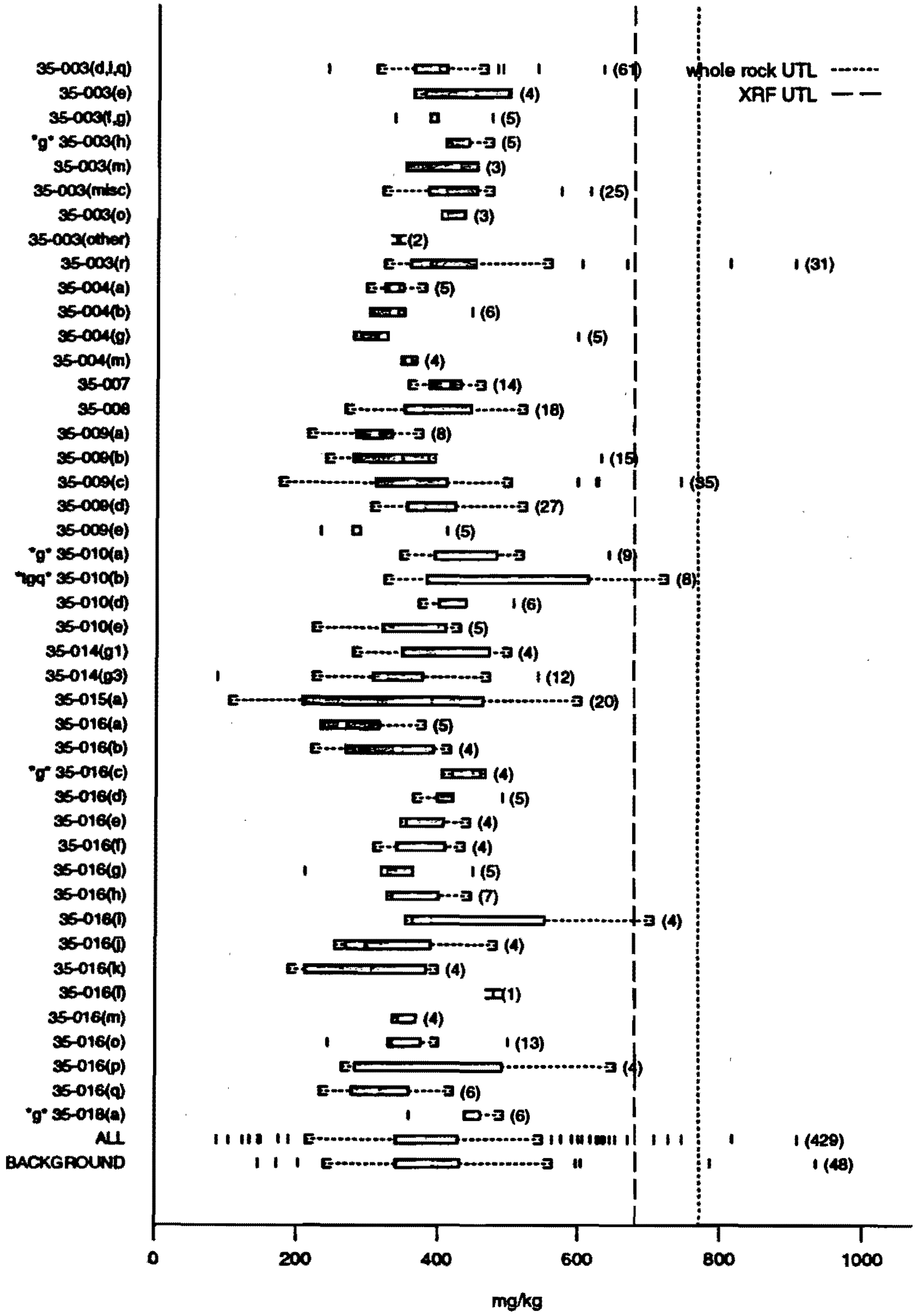

Figure AI-10. Distribution of manganese in TA-35 PRSs.

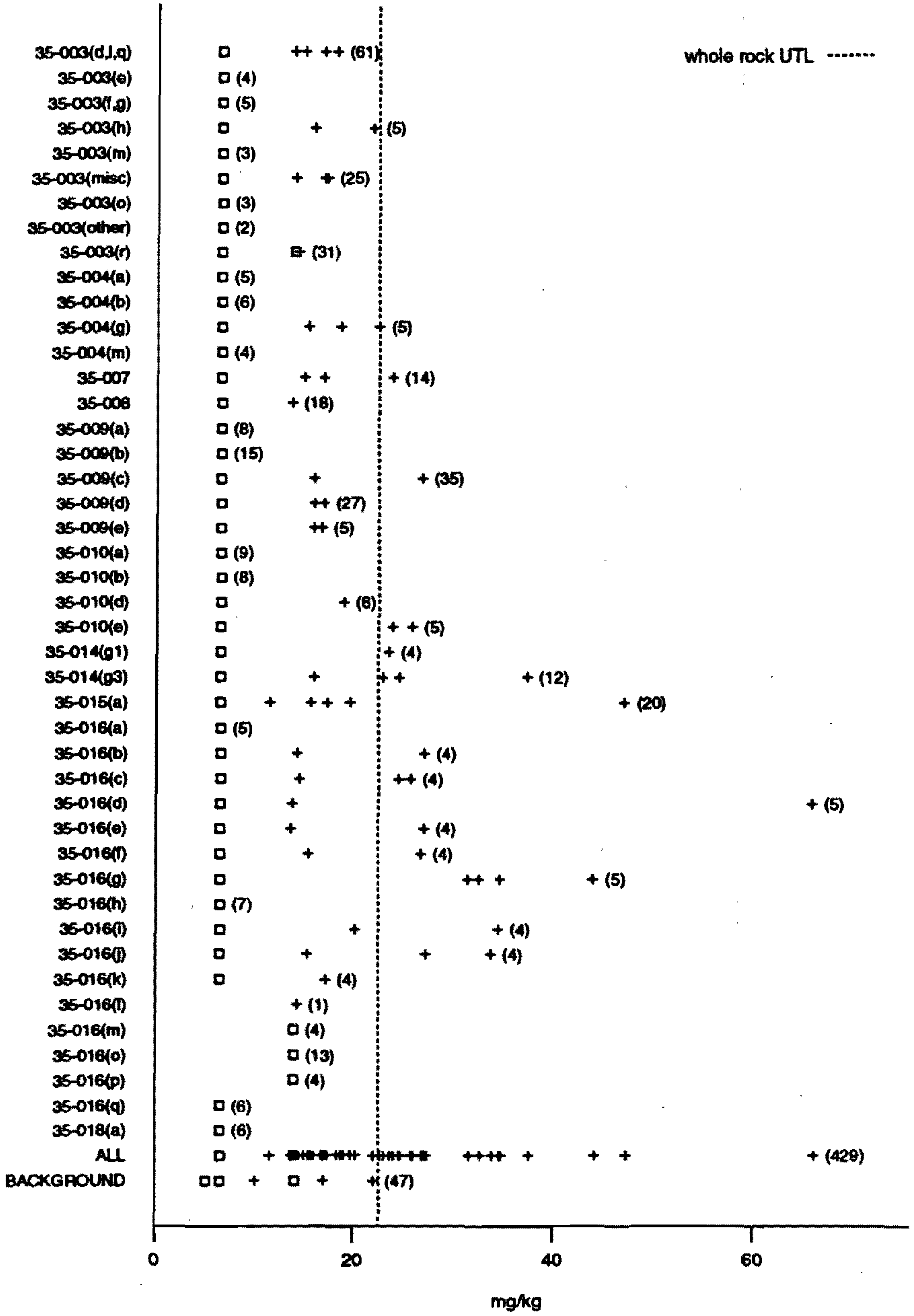

Figure AI-11. Distribution of nickel in TA-35 PRSs.

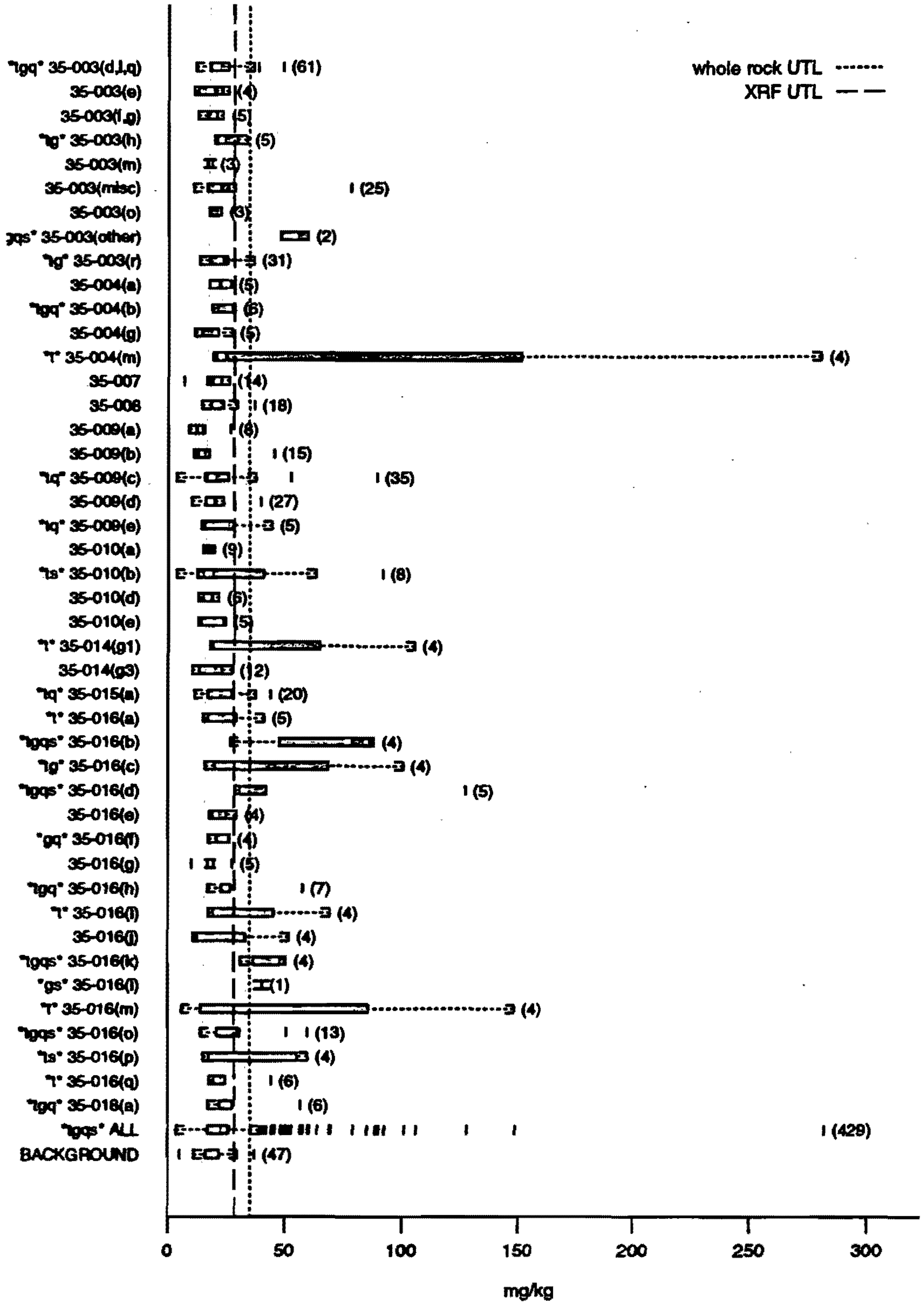

Figure AI-12. Distribution of lead in TA-35 PRSs.

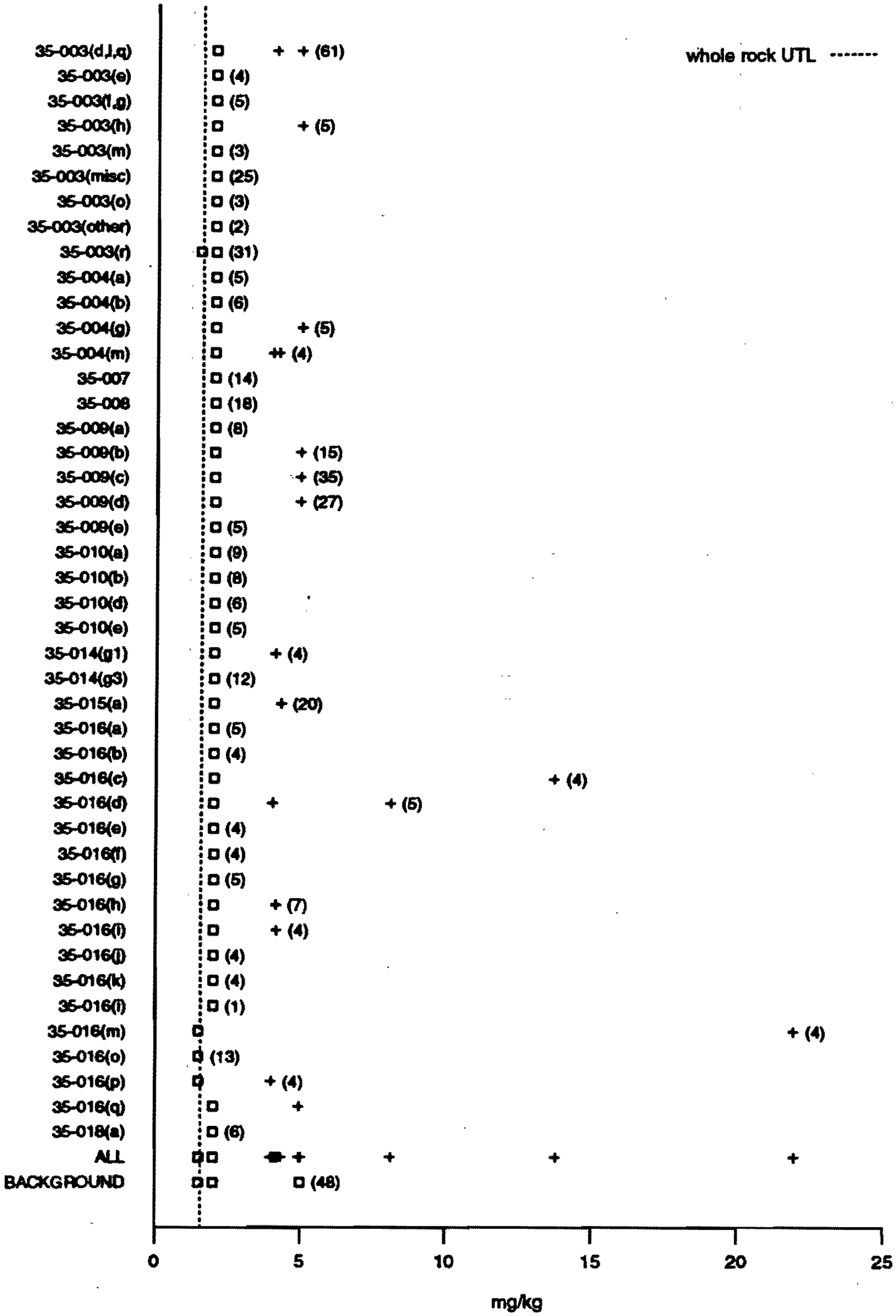

Figure AI-13. Distribution of antimony in TA-35 PRSs.

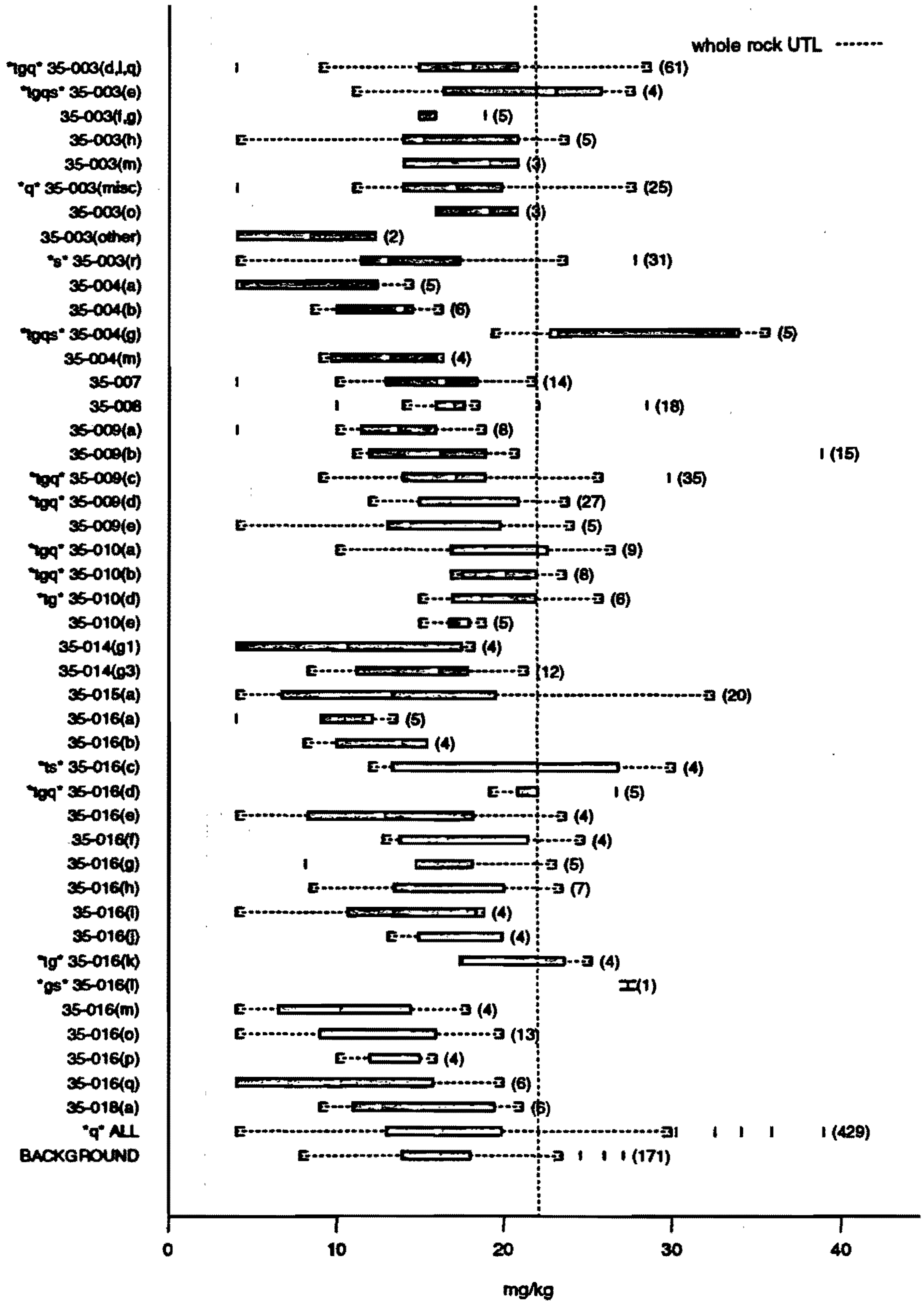

Figure AI-14. Distribution of thorium in TA-35 PRSs.

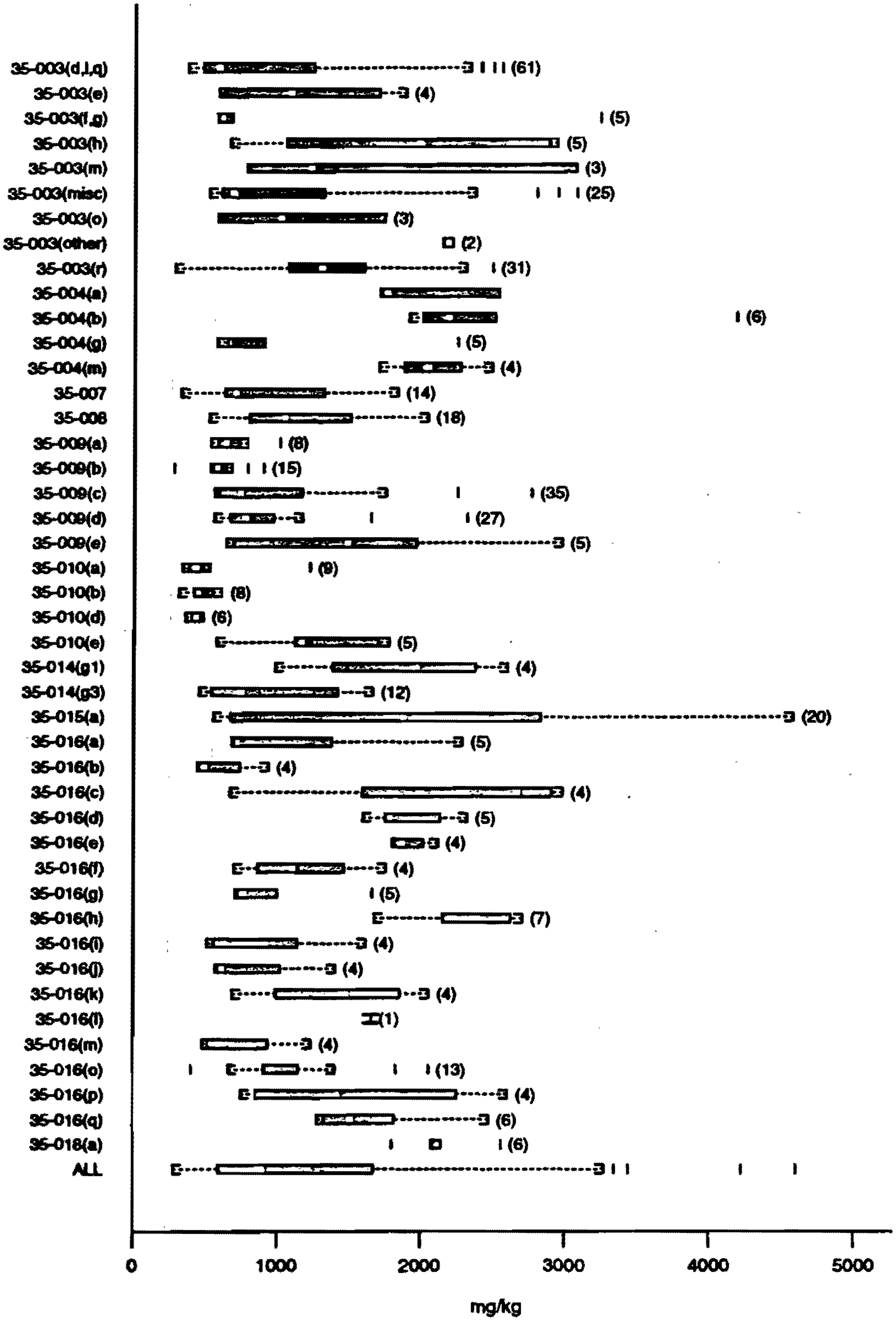

Figure AI-15. Distribution of titanium in TA-35 PRSs.

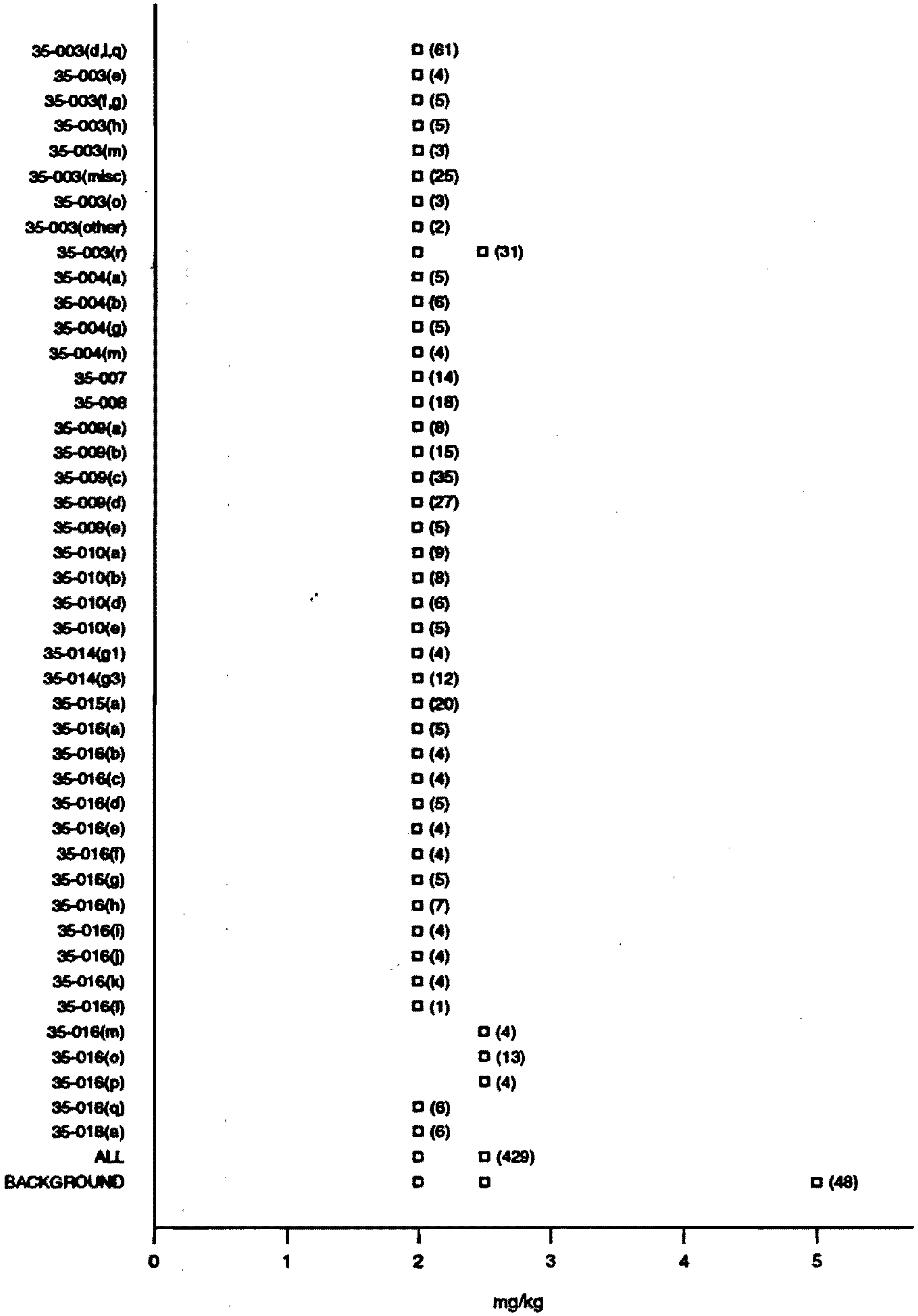

Figure AI-16. Distribution of selenium (uniformly nondetect) in TA-35 PRSs.

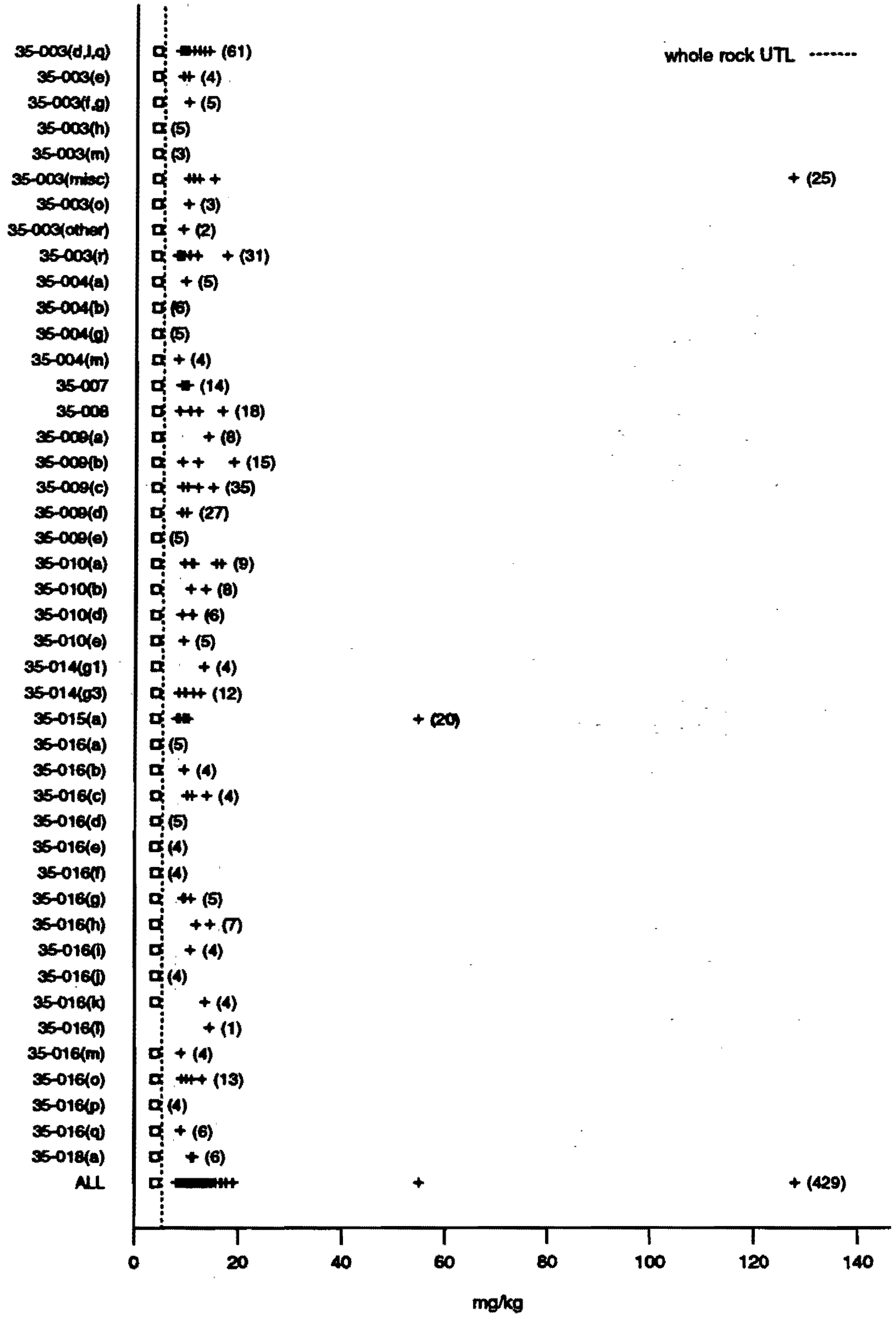

Figure AI-17. Distribution (point plot) of uranium in TA-35 PRSs.

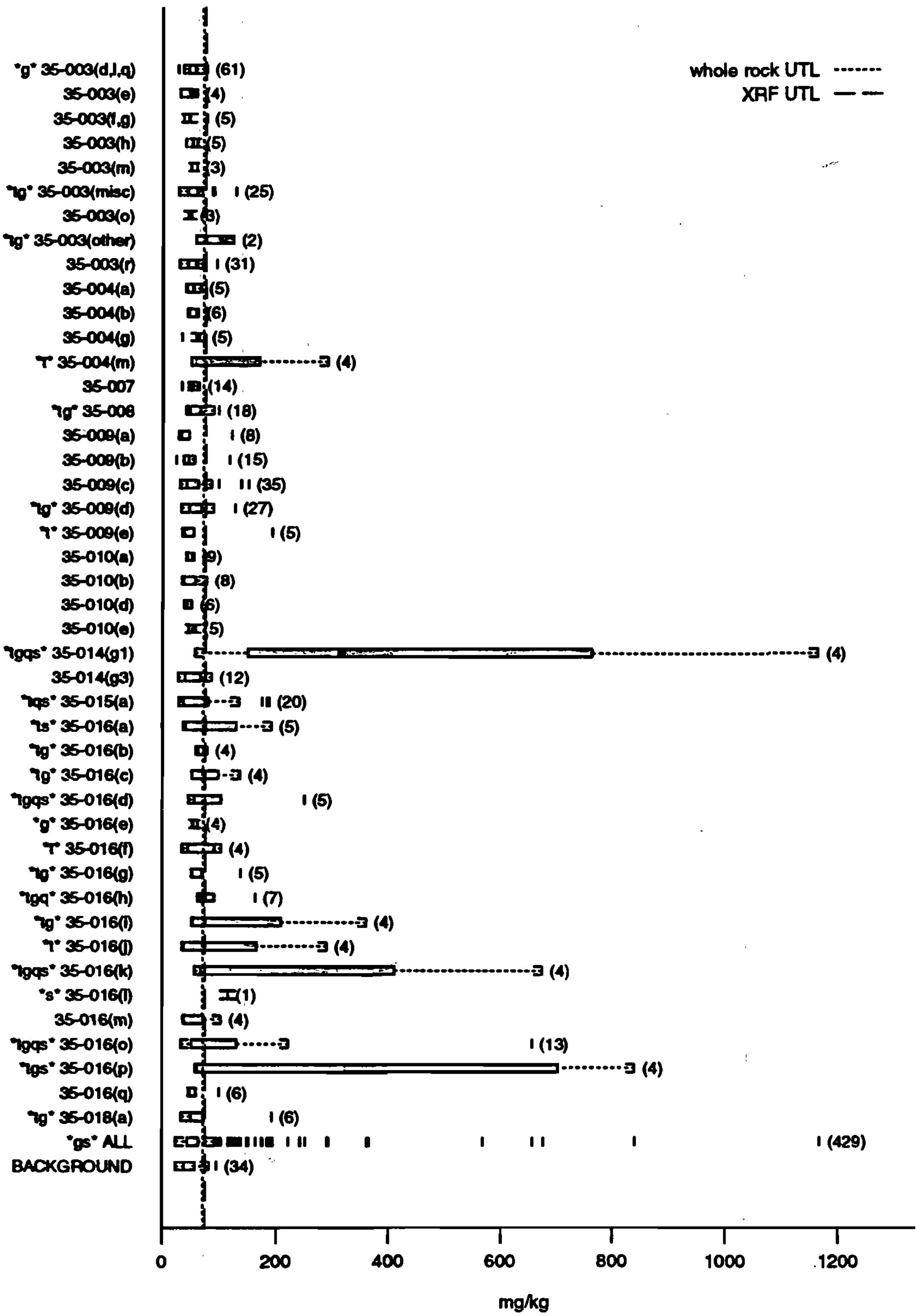

Figure AI-18. Distribution of zinc in TA-35 PRSs.