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Date: May 2, 1996
Refer to: EM/ER:96-237

RECEIVED
MAY 7 1996

Mr. Benito Garcia
NMED - HRMB
P.O. Box 26110
2044 Galisteo St, Bldg. A
Santa Fe, NM 87502

SUBJECT: SUBMITTAL OF THE RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION (RFI) REPORT FOR POTENTIAL RELEASE SITES (PRSs) IN TECHNICAL AREA (TA) 35

Dear Mr. Garcia:

Enclosed are two copies of the Los Alamos National Laboratory's RFI Report concerning PRSs 35-003(h,j, and k), 35-004(b), 35-008, 35-009(a-d), 35-014(a,b,d,e1,e2, and f), 35-015(b), and 35-016(e,f, and i) in TA-35. The report documents the field work performed as detailed in the approved RFI Work Plan for Operable Unit 1129 and the sampling. This RFI Report is due to your office on May 6, 1995.

Please ask your office to contact Allyn Pratt at (505) 667-4308 or Bob Simeone at (505) 667-0587, if you have any questions.

Sincerely,

Jorg Jansen, Program Manager
Environmental Restoration

Sincerely,

Theodore J. Taylor, Program Manager
Los Alamos Area Office

JJ/TT/bp

Enclosure: Two copies of the RFI Report for PRSs at TA-35
Certification

5226

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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 gather and evaluate 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 the Resource Conservation and Recovery Act Facility Investigation Report for Potential Release Sites In Technical Area 35

Name: _____ Date: 5-2-96

Jorg Jansen, Program Manager
Environmental Restoration Project
Los Alamos National Laboratory

or

Tom Baca, Program Director
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Date: June 5, 1996
Refer to: EM/ER:96-329

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JUN 12 1996

Mr. Benito Garcia
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P.O. Box 26110
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SUBJECT: CORRECTION TO EXECUTIVE SUMMARY OF THE RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION (RFI) REPORT FOR POTENTIAL RELEASE SITES (PRSs) IN TECHNICAL AREA (TA) 35

Dear Mr. Garcia:

On May 2, 1996, we submitted a letter, EM/ER:96-237, with an RFI Report for TA-35 in former Operable Unit 1129. Included in this RFI report were the results of investigations for PRSs 35-003(h, j, and k); 35-004(b); 35-008; 35-009(a through d); 35-014(a, b, d, c, e_1, e_2, and f); 35-015(b); and 35-016(e, f, and i). After the document had been mailed, Field Unit 4 discovered an error on the table in the executive summary. That error has been corrected, therefore we are enclosing the corrected executive summary.

Please ask your office to contact Allyn Pratt at (505) 667-4308 or Bob Simeone at (505) 667-0587, if you have any questions.

Sincerely,

Jorg Jansen, Program Manager
LANL/ER Project

Sincerely,

Theodore J. Taylor, Program Manager
DOE/LAAO

JJ/TT/bp

Enclosure: Corrected Executive Summary for RFI Report for TA-35

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RFI Report for Potential Release Sites

35-003(h, j, and k)
35-004(b)
35-008
35-009(a through d)
35-014(a, b, d, e_1, e_2, and f)
35-015(b)
35-016(e, f, and i)

(located in former
Operable Unit 1129)

Field Unit 4

Environmental
Restoration
Project

May 1996

A Department of Energy
Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

LA-UR-96-1293

EXECUTIVE SUMMARY

This is the first 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. 35-003(h, j, and k); 35-004(b); 35-008; 35-009(a through d); 35-014(a, b, d, e_1, e_2, and f); 35-015(b); and 35-016(e, f, and i).

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 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 November 4, 1993, and ended on December 22, 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 was performed to determine if COPCs are present. An ecological assessment was performed by evaluating the potential for ecological receptors to be exposed to COPCs associated with the site.

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 September 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. 35-003(h, j, and k); 35-004(b); 35-009(a through d); 35-014(a, b, d, and e_2); 35-015(b); and 35-016(e, f, and i). The following PRSs are recommended for voluntary corrective action: PRS Nos. 35-008, 35-014(e_1), and 35-014(f). 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.
35-003(h)	X	4		Contamination below SALs, no COPCs identified	5.3
35-003(j) 35-003(k) 35-014(d) 35-015(b)	X X X	4		COPCs were determined to pose a negligible threat to human health	5.4
35-004(b)	X	4		Contamination below SALs, no COPCs identified in human health screening assessment	5.6
35-016(e)		4		Contamination below SALs, no COPCs identified in human health screening assessment	5.7
35-009(a)	X	4		Contamination below SALs, no COPCs identified in human health screening assessment	5.8
35-009(b)	X	4		Contamination below SALs, no COPCs identified in human health screening assessment	5.9
35-009(c)	X	4		COPCs were determined to pose a negligible threat to human health	5.10
35-009(d)	X	4		Contamination below SALs, no COPCs identified in human health screening assessment	5.11
35-014(a)	X	1		Site has not received solid or hazardous wastes as defined in the HSWA module	5.12
35-014(b)	X	4		Contamination below SALs, no COPCs identified	5.13
35-014(e_2) 35-016(i)	X X	3 and 4		Contamination below SALs, no COPCs identified in human health screening assessment	5.14
35-014(f)			VCA	Contamination obvious, small area, remedy obvious	5.15
35-016(f)		4		Contamination below SALs, no COPCs identified in human health screening assessment	5.16
35-008 35-014(e_1)	X X		VCA	Contamination above SALs, surface water issues, remedy obvious	5.19

EXECUTIVE SUMMARY

This is the first 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. 35-003(h, j, and k); 35-004(b); 35-008; 35-009(a through d); 35-014(a, b, d, e_1, e_2, and f); 35-015(b); and 35-016(e, f, and i).

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The following PRSs are recommended for no further action: PRS Nos. 35-003(h, j, and k); 35-004(b); 35-009(a through d); 35-014(a, b, d, and e_2); 35-015(b); and 35-016(e, f, and i). The following PRSs are recommended for voluntary corrective action: PRS Nos. 35-008, 35-014(e_1), and 35-014(f). 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.**
35-003(h)	X	4		Contamination below SALs, no COPCs identified	5.3
35-003(j) 35-003(k) 35-014(d) 35-015(b)	X X X	4		COPCs were determined to pose a negligible threat to human health	5.4
35-004(b)	X	4		Contamination below SALs, no COPCs identified	5.6
35-016(e)		4		Contamination above SALs, surface water issues, remedy obvious	5.7
35-008 35-014(e_1)	X X		VCA	Contamination above SALs, surface water issues, remedy obvious	5.19
35-009(a)	X	4		Contamination below SALs, no COPCs identified in human health screening assessment	5.8
35-009(b)	X	4		Contamination below SALs, no COPCs identified in human health screening assessment	5.9
35-009(c)	X	4		COPCs were determined to pose a negligible threat to human health	5.10
35-009(d)	X	4		COPCs were determined to pose a negligible threat to human health	5.11
35-014(a)	X	1		Site has not received solid or hazardous wastes as defined in the HSWA module	5.12
35-014(b)	X	4		Contamination below SALs, no COPCs identified	5.13
35-014(e_2) 35-016(i)	X X	3 and 4		Contamination below SALs, no COPCs identified in human health screening assessment	5.14
35-014(f)			VCA	Contamination obvious, small area, remedy obvious	5.15
35-016(f)		4		Contamination below SALs, no COPCs identified	5.16

RESOURCE CONSERVATION AND RECOVERY ACT
FACILITY INVESTIGATION REPORT

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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
DL	detection limit
EDL	estimated detection limit
EDXRF	energy dispersive x-ray fluorescence
EPA	Environmental Protection Agency
EQL	estimated quantitation limit
ER	Environmental Restoration
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
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
LAPRE	Los Alamos Power Reactor Experiment
LCS	laboratory control sample
Myr	million years
MCE	multiple chemical evaluation
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
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
Qbt3	cooling unit 3 of the Tshirege Member of the Bandelier Tuff

QA/QC	quality assurance/quality control
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.
Rad Van	radiological analysis van
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
VCA	voluntary corrective action
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. 35-003(h, j, and k); 35-004(b); 35-008; 35-009(a through d); 35-014(a, b, d, e_1, e_2, and f); 35-015(b); and 35-016(e, f, and i).

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), for plutonium research laboratories, and as 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;
- 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;

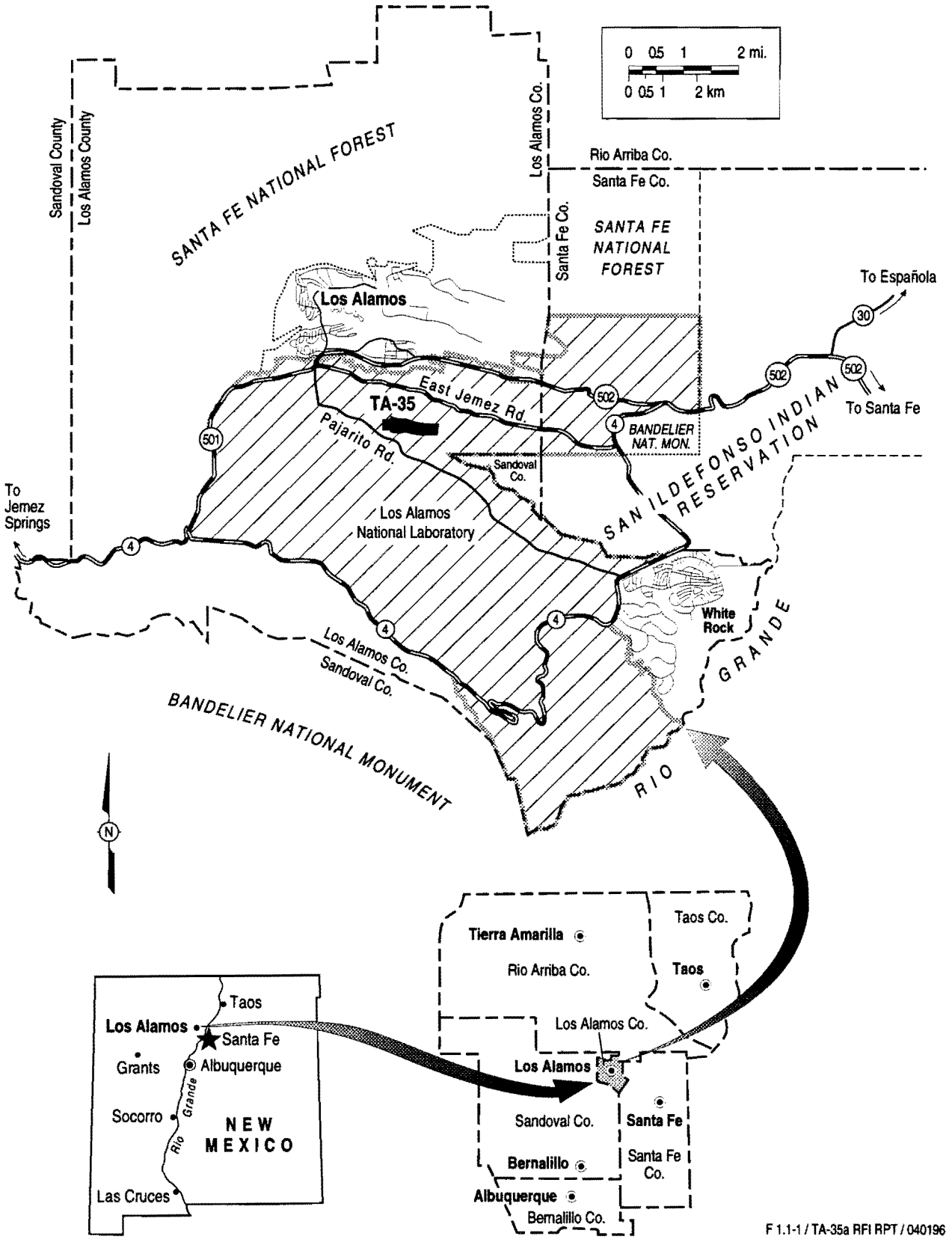


Figure 1.1-1. Location map of TA-35 within Los Alamos National Laboratory.

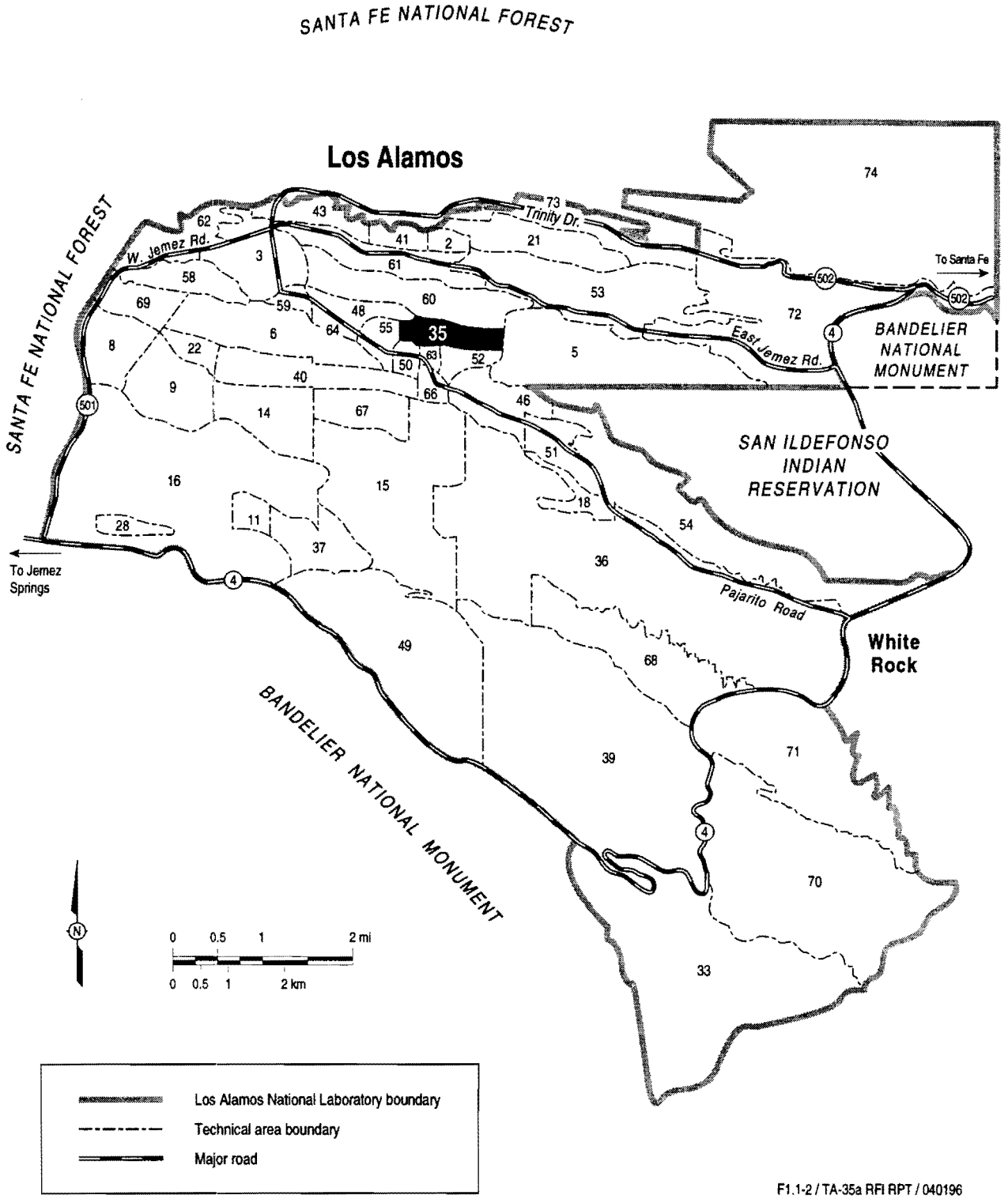


Figure 1.1-2. Location of TA-35 with respect to Laboratory technical areas and surrounding land holdings.

- 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 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 (PCB) compounds, and radionuclides. Radionuclides were investigated as part of this RFI, although radiological contamination is not regulated by RCRA.

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 F contains four septic systems that are widely separated on the mesa top.

Table 1.1-1 shows all PRSs in Aggregates D, E, F, H, I, and U of the work plan (LANL 1992, 7666). This RFI report focuses on the PRSs from the table that are proposed for no further action. The results of the RFI and the Phase II SAPs for PRSs that require additional investigation or further action will be presented in a future RFI report, which will be submitted by June 1996. 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.

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, the two PRSs in Aggregate H (Section 7.12 of the work plan) have been evaluated separately because they are attributable to two different types of releases. PRS No. 35-014(a) is the radionuclide stack emission release from TA-35-2, and PRS No. 35-014(b) is a release from an oil drum that contained PCBs. Also, where PRSs are in such close proximity that contamination from one release would be intermingled with contamination from another release, the PRSs have been combined to create a single decision set. For example, the PRSs in Aggregate U spatially overlap the PRS in Aggregate E, and the contamination from the releases 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 (Phase II),
- 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.

TABLE 1.1-1

POTENTIAL RELEASE SITE DECISION SETS

RFI Report Section	Work Plan Section	PRSs Included in Decision Set	Description
5.1*	7.8	35-003(d, e, l, and q)	Former holding tanks, storage tank, pump pit, and associated piping
5.2*	7.8	35-003(f, g, m, and o)	Former flocculator tank, regenerant tank, sludge tank, and manhole
5.3	7.8	35-003(h)	Former retention tank
5.4	7.13	35-003(j and k), 35-014(d), and 35-015(b)	Dielectric oil spills behind TA-35-2, overlapping PRSs
5.5*	7.8	35-003(r)	Site of effluent discharge and spills from holding tanks
5.6	7.25	35-004(b)	Container storage area northeast of TA-35-85
5.7	7.25	35-016(e)	Outfall on south rim of Mortandad Canyon north of TA-35-85
5.8	7.10	35-009(a)	Former septic system south of TA-35-34
5.9	7.10	35-009(b)	Former septic system south of TA-35-67
5.10	7.10	35-009(c)	Former septic system north of TA-35-2
5.11	7.10	35-009(d)	Former septic system northeast of TA-35-27
5.12	7.12	35-014(a)	Stack emissions from TA-35-2
5.13	7.12	35-014(b)	Localized oil spill behind TA-35-2
5.14	7.25	35-014(e_2) and 35-016(i)	Dielectric oil spill and outfall north of TA-35-85
5.15	7.25	35-014(f)	Dielectric oil spill south of TA-35-85
5.16	7.25	35-016(f)	Outfall
5.17*	7.25	35-016(g)	Active NPDES -permitted outfall
5.18*	7.25	35-016(h)	Outfalls
5.19*	7.9 and 7.25	35-008 and 35-014(e_1)	Disposal area and dielectric oil spill

*The results of the RFI and the Phase II SAPs for these PRSs will be presented in a future RFI report.

A complete description of the conceptual model is discussed in Chapter 4 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 of this RFI report. Field activities began on November 16, 1993, and ended on December 22, 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).

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 39 alpha meter. Radiation grid surveys were conducted using an Eberline ESP-1 beta/gamma meter with probe model HP-260 and the Ludlum Model 39 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.

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

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* (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 *RFI Work Plan for Operable Unit 1129* (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.

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

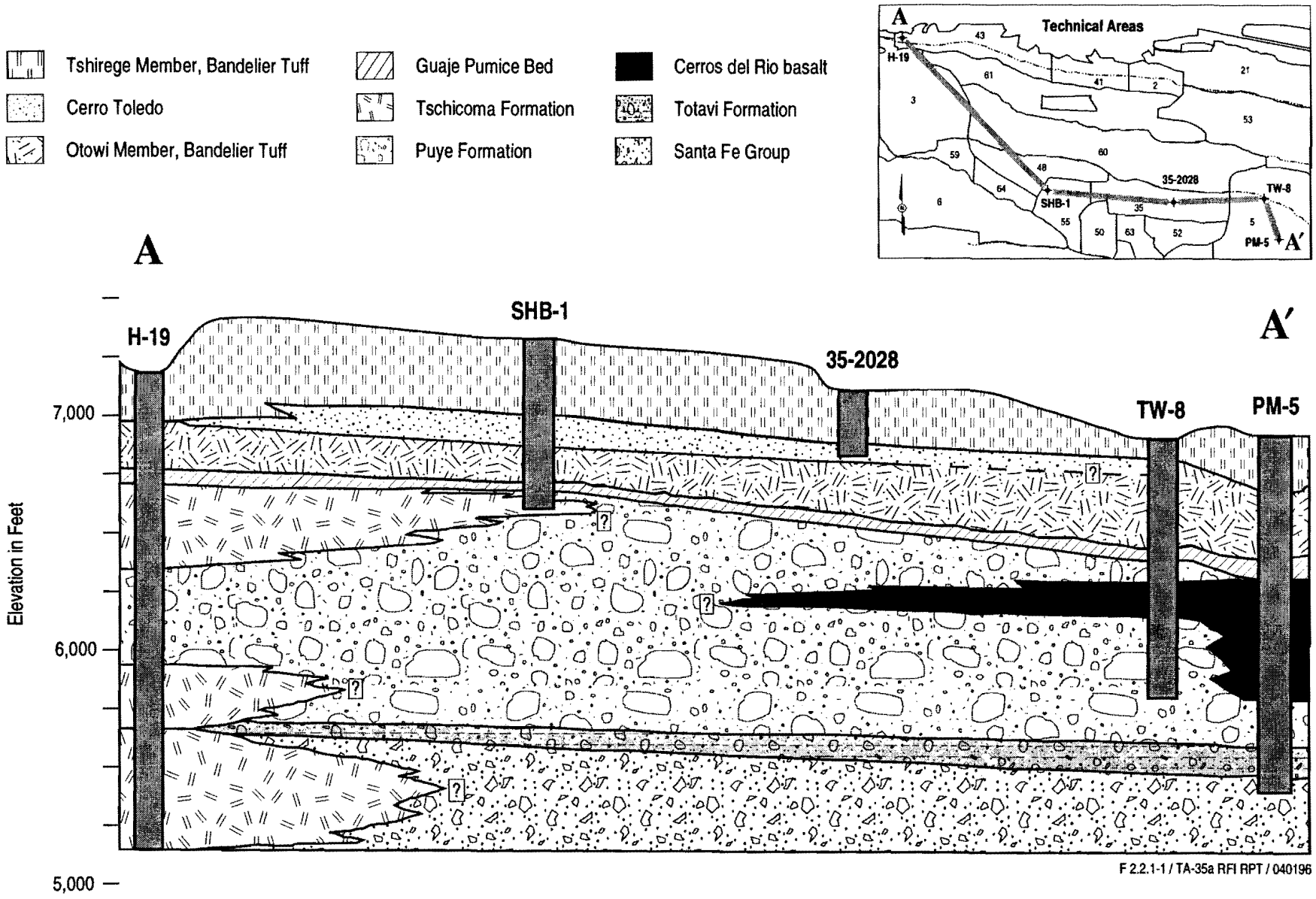


Figure 2.2.1-1 Generalized stratigraphy of TA-35.

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 comprises the following three wells: 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; and test hole H-19, located in Los Alamos Canyon near the Diamond Drive bridge. 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).

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 (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 this 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 wasprobably 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 Chaquehi Formation, the Chamita Formation, and the Tesuque Formation. The Chaquehi 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 35-002 (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 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.

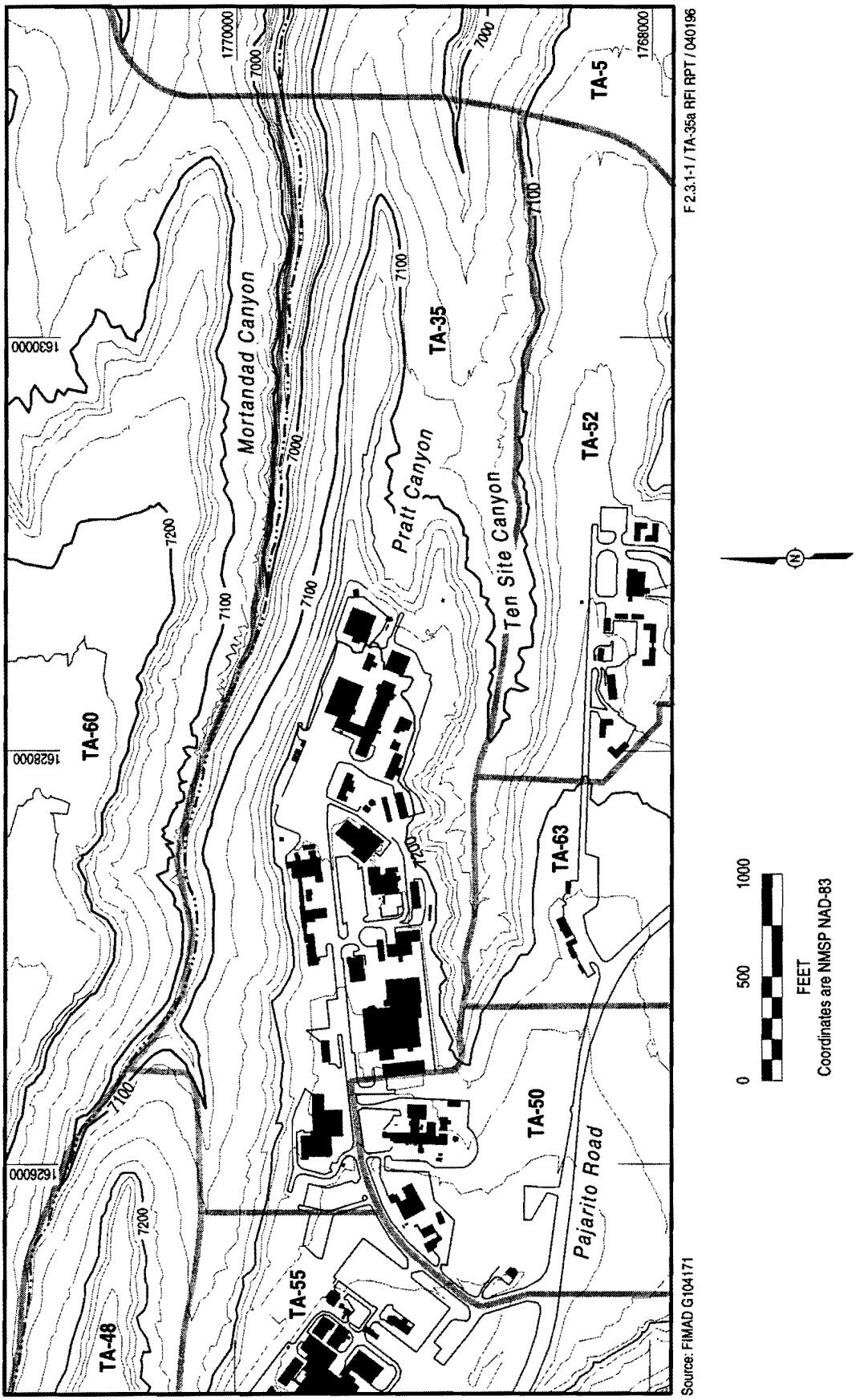


Figure 2.3.1-1. Topography of TA-35.

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

Surveys to identify floodplains/wetlands and the presence of sensitive species or habitats in the vicinity of the sites discussed in this report were conducted during August and October 1991 (Dunham 1992, 31276). Critical habitat for the spotted bat (*Euderma maculatum*) was found in the area, but no specimens have been reported by the Laboratory. The area also includes wetlands and floodplains that could be impacted if contaminants are transported beyond PRS boundaries.

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

TABLE 2.4-1

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

RFI Report Section	PRS No.	Landscape Condition[a]	Receptor Access[b]	Description
5.3	35-003(h)	1	2	Has undergone decommissioning; waste-treatment plant retention tank
5.4	35-015(b)	1	1	Has undergone decommissioning; oil-handling facility
5.4	35-014(d)	1	1	Inactive area; stained soil; oil spills
5.4	35-003(j)	1	1	Has undergone decommissioning; oil storage tanks
5.4	35-003(k)	1	1	Has undergone decommissioning; oil storage tanks
5.6	35-004(b)	2	2	Active and inactive storage areas
5.7	35-016(e)	2	3	Inactive outfall
5.8	35-009(a)	2	3	Inactive abandoned septic system
5.9	35-009(b)	2	1	Inactive septic system
5.10	35-009(c)	2	2	Inactive septic system
5.11	35-009(d)	2	3	Inactive septic leach field
5.12	35-014(a)	2	3	Inactive area with radionuclide-contaminated soil
5.13	35-014(b)	1	1	Inactive area; leaking drums
5.14	35-016(i)	2	3	Active discharge channel
5.14	35-014(e_2)	2	3	Active area with oil spill/impoundment area
5.16	35-016(f)	2	3	Active storm drain

a. 1 = heavily disturbed/developed, 2 = moderately disturbed, 3 = lightly disturbed or not disturbed
b. 0 = no potential for receptor access to COPCs or for COPC transport, 1 = low potential for access or transport, 2 = moderate potential for access or transport, 3 = high potential for access or transport

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 constituents 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, 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 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. Samples collected as part of this RFI were submitted to the Sample Management Office for shipment to a fixed-site laboratory facility 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).

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 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

TABLE 3.1.1-1

ANALYTICAL METHODS

Analyte Suite	Analytical Method	
	Fixed-Site Laboratory	Mobile Laboratory
Inorganic Constituents		
Trace metals	ICPES, GFAA, ICPMS	EDXRF
Organic Constituents		
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
Radionuclide Constituents		
^{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

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).

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
Ba	315	766	561
Ca	6,120	11,900	10,900
Cd	2.7	N.A.	not calculated
Cr	19.3	45.8	45.1
Cu	15.5	16.7	16.7
Fe	21,300	31,600	27,400
Hg	0.1*	N.A.	not calculated
K	3,410	34,200	38,700
Mn	714	771	681
Ni	15.2	22.5	not calculated
Pb	23.3	35.2	28.4
Sb	1*	1.45	not calculated
Se	1.7	N.A.	not calculated
Th	14.6	22.1	N.A.
U	1.87	5.33	N.A.
Zn	50.8	72.4	76.6

* 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.

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-48 and TA-35 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 1 of this RFI report, which shows data in box plots).

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.

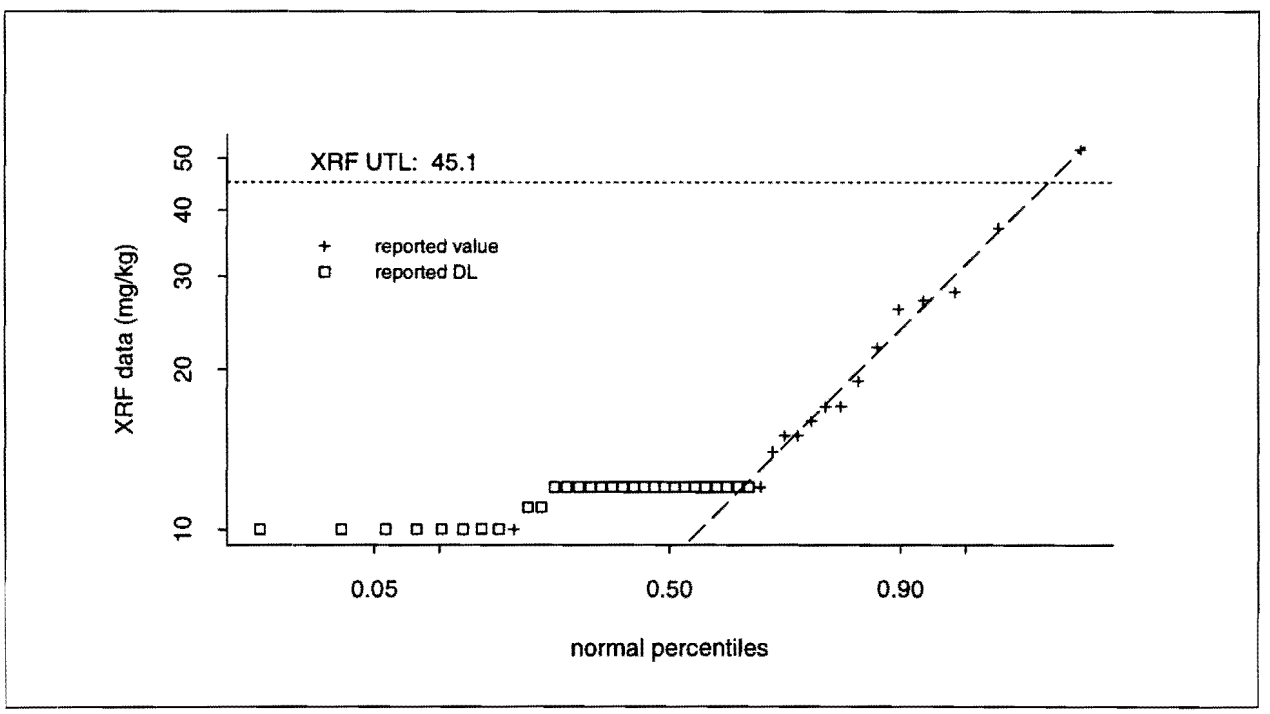


Figure 3.1.3-1. Lognormal probability plot of XRF chromium data for 44 background samples at TA-35 and TA-48.

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-48 and TA-35 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 for Los Alamos surface soils). 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 specific tuff unit from which the sample was collected is specified.

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

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, and a chemical that is not detected in any sample may be carried through the decision process if the chemical can be expected to be present at the site based on historical operations.

3.4 Human Health Assessment

3.4.1 Screening Assessment

The screening assessment 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 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 complete description 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 that exceed background concentration thresholds (certain inorganic chemicals and radionuclides) or are detected (organic chemicals) in at least one sample, and whose highest 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 should be 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 or radionuclide having no UTL is measured above detection limits, the highest value will also be used in the MCE calculation.

Chemicals are divided into three classes for the MCE calculation: noncarcinogens, chemical carcinogens, and radionuclides. Additive effects are assumed within each class, but each class is evaluated separately. For further information on the calculation of MCEs, see *Risk-Based Corrective Action Process* (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. For some sites where COPCs were identified, collection of additional data and/or accelerated action have been proposed before risk assessment activities are conducted.

3.5 Ecological Assessment

An ecological risk assessment will be conducted when an approach has been approved by the regulators. Threatened and endangered species and sensitive habitats have been identified based on field surveys (see Section 2.4 in Chapter 2.0 of this RFI report). A qualitative habitat screening model was applied to each PRS to evaluate the potential for exposure to ecological receptors. The model evaluates potential ecological risk by ranking general landscape condition (development and disturbance) and the potential for receptors to access COPCs, as described in a draft policy paper (Environmental Restoration Decision Support Council 1996, 53751). The criteria for retaining COPCs as sources for the ecological risk assessment were that the media was soil (not tuff) collected from depths less than 5 ft and that COPCs were not eliminated by the background comparison.

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 unit. 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. 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. 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 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; EPA 1986, 31733) (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 (CVAA). 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.

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

Of the 354 soil samples 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 constituents, the SW-846 results are reported when results by both XRF and SW-846 methods are available.

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 UTLs and 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.

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. No historical evidence exists to indicate that any of these six metals were released to the environment at the PRSs assessed in this RFI report.

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. Titanium was not considered to be a COPC at TA-35 because no archival evidence of its use exists, and 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 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. The sensitivity of either method is sufficient to detect trace metals in soil samples at levels

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	38,700	3,700	NA	N/A	77,000
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	5,300
Beryllium	1	1.95	1.53	NA	N/A	N/A
Cadmium	1	2.7	N.A.	3	N.A.	38
Calcium	1,000	6,120	1,520	100	10,900	N.A.
Chromium	2	19.3	2.1	12	45.1	210
Cobalt	10	19.2	27.4	NA	N/A	4,600
Copper	5	15.5	2	8	16.7	2,800
Iron	20	21,300	9,040	10	27,400	N.A.
Lead	0.2	23.3	16.2	7	28.4	400
Magnesium	1,000	4,610	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*	1,500
Potassium	1,000	3,410	735	100	38,700	N.A.
Selenium	1.0	1.7	N.A.	4	N.A.	380
Silver	2	N.A.	1.9	NA	N/A	383
Sodium	1,000	915	1,940	NA	N/A	N.A.
Strontium	2	317	N.A.	NA	N/A	46,000
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*	29
Vanadium	10	41.9	4.01	NA	N/A	540
Zinc	4	50.8	55.5	5	76.6	23,000

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

below the background UTLs for those constituents for which UTL values are available. 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.

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 nonhomogeneous 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 4.1.2-1

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).

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 recovery 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 and are qualified with an "S" flag in the tables in Chapter 5.0 of this RFI report.

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. The EQLs for this method are generally the same as for the fixed-site laboratory method.

Of the 173 VOC analyses requested for this 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

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.

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.

The common laboratory contaminants acetone and 2-butanone were detected in five method blank samples at levels less than five times the EQL. Contamination was also present in 32 soil samples analyzed concurrently with the contaminated blank samples, including 26 samples analyzed in the mobile laboratory facility. Affected sample results have been qualified according to EPA guidelines. Trichloropropane was present in nine soil samples collected from PRS No. 35-009(c) and analyzed at the mobile laboratory facility; it was also detected in the method blank sample. Consequently, the trichloropropane detected in the soil samples has been attributed to laboratory contamination (see Appendix B of this RFI report).

All technical holding times for analysis were met for the samples evaluated in this RFI report. No contamination above the EQL was detected in any of the trip blank samples.

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. 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 five compounds: benz[a]anthracene (0.610 mg/kg), benzo[b]fluoranthene (0.610 mg/kg), benzo[a]pyrene (0.061 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 this 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 two laboratories. 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.

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.

A common phthalate contaminant was detected in one method blank sample at less than five times the EQL. Contamination was also present in one soil sample analyzed concurrently with the contaminated blank sample. The affected sample result has been qualified according to EPA guidelines (see Appendix B of this RFI report). All technical holding times for extraction and analysis were met for the samples evaluated in this RFI report.

4.2.3 Polychlorinated Biphenyl 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

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

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.

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.

Of the 327 PCB analyses requested for this 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,

TABLE 4.2.3-1

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

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

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.

Analysis hold times were missed by 12 days for one sample delivery group (Request No. 16672); therefore, the sample results should be regarded as estimates.

4.2.4 Polycyclic Aromatic Hydrocarbon Analysis

To screen for the presence of SVOCs, 57 soil samples collected from PRS Nos. 35-004(b), 35-014(e1 and e2), 35-014(f), and 35-016(e, f, g, h, and i) were analyzed for PAH compounds at the mobile laboratory facility. The gas chromatography/flame ionization detector (GC/FID) 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.

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. Dibenz[a,h]anthracene is not included as a target analyte. 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."

System performance was monitored by the addition of a surrogate compound, tetradecane. The average surrogate recovery was 89 ± 13%, which indicates acceptable method bias. In several of the samples, the surrogate recovery could not be determined because of the presence of petroleum hydrocarbon interferences.

No target analytes were detected in any of the 57 soil samples analyzed in the mobile laboratory facility. Six confirmatory samples (10%) were analyzed for full-suite SVOCs at a fixed-site laboratory; no target analytes were detected in any of the confirmatory samples. TPH in the C10 to C20 range were reported in three samples collected from PRS No. 35-014(e_1) and one sample collected from PRS No. 35-016(g). The TPH were quantitated as tetradecane.

Analysis holding times were exceeded by 5 to 18 days for four soil samples. The impact on data quality is minimal because no target analytes were detected in any of the effected samples.

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	2,600
Anthracene	0.1	19
Pyrene	0.1	2,000
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.

4.2.5 Total Petroleum Hydrocarbons Analysis

Soil samples from PRS Nos. 35-003(j and k) and 35-014(d) were analyzed for TPH at a fixed-site laboratory. Twenty-six samples were analyzed for diesel range (C_{10} to C_{20}) TPH by a modified SW-846 Method 8100 procedure using GC/FID instrumentation. All required holding times for extraction and analysis were met. All obtainable surrogate recoveries for p-terphenyl were within the acceptance criteria of 46 to 143%. Several samples required 100- to 500-fold dilution because of the presence of high levels of target compounds (see Appendix B of this RFI report), which caused the surrogate to be diluted out. All blank spike recoveries were within the acceptance criteria of 46 to 143%. All matrix spike recoveries were within the acceptance criteria of 43 to 136%.

For ten samples collected from PRS Nos. 35-003(j and k) and submitted for SVOC analysis using the SW-8270 GC/MS method, the analytical laboratory also reported TPH as tentatively identified compounds. These TPH values are reported in Chapter 5.0 of this RFI report and should be regarded as estimates because the GC/MS method was not optimized for TPH analysis.

4.3 Radiochemistry Analyses

The data quality evaluation for radiochemistry analyses will be provided later as an addendum to this RFI report.

5.0 SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 PRS Nos. 35-003(d, e, l, and q)

Results of the Phase I Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) and the sampling and analysis plan (SAP) for further investigation at Potential Release Site (PRS) Nos. 35-003(d, e, l, and q) will be presented in a subsequent RFI report, which will be submitted on June 5, 1996.

5.2 PRS Nos. 35-003(f, g, m, and o)

Results of the Phase I RFI and the SAP for further investigation at PRS Nos. 35-003(f, g, m, and o) will be presented in a subsequent RFI report, which will be submitted on June 5, 1996.

5.3 PRS No. 35-003(h)

PRS No. 35-003(h) is the site of a former concrete retention tank (TA-35-31), which was located adjacent to the former caustic treatment building (TA-35-41).

No chemicals of potential concern (COPCs) were identified during the screening assessment. Antimony, lead, and thorium were measured above background levels. Di-n-butyl phthalate was the only organic chemical detected above estimated quantitation limit (EQL) values.

PRS No. 35-003(h) is recommended for no further action (NFA) based on NFA criterion number 4 (LANL 1995, 53863).

Radiological sample results are not presented or 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 5.3.4.3

5.3.1 History

PRS No. 35-003(h) is listed in Table 3-13 in Section 3.3.2 and Section 7.8 of the *RFI Work Plan for Operable Unit 1129* (the work plan) (LANL 1992, 7666).

TA-35-31 was constructed in 1961 as an added component to the wastewater treatment facility that was operated at the east end of Technical Area (TA) -35 from 1951 to 1963. TA-35-31 stored solutions that were treated at TA-35-41 and then discharged to the liquid waste holding tanks (TA-35-10). The liquid wastes originated from operations in the test pit building (TA-35-29) and later from operations in the reactor core test building (TA-35-27). A portion of acid waste Line 68 that discharged from the north side of TA-35-29 to TA-35-41 was reportedly never used for wastes and was integrated into the sewer system. It is not known how much TA-35-31 and TA-35-41 were used, but indications are that they were not used extensively.

The TA-35 wastewater treatment facility was decommissioned in 1963. TA-35-31 was decommissioned in 1985 when the tank and the associated pipelines were completely removed (Elder et al. 1986, 3089). During decommissioning, no leaks or discharges from the tank were documented.

The contaminants that were potentially present include gross-alpha, -beta, and -gamma radiation; volatile organic compounds (VOCs); semivolatile organic compounds (SVOCs); metals; polychlorinated biphenyls (PCBs); and tritium.

5.3.2 Description

The site is located in a highly industrialized area at TA-35 near the east end of Ten Site Mesa approximately 85 ft east of TA-35-29, 60 ft south of TA-35-27, and 70 ft northeast of building TA-35-7. TA-35-31 was a rectangular-shaped, reinforced concrete, underground tank that had a total capacity of 6,000 gal. The dimensions of the tank were approximately 8 ft by 12 ft by 10 ft deep. It was connected to TA-35-41 and TA-35-10 by 4-in.-diameter stainless steel underground pipelines.

At the time of the investigation, the site was a grass- and weed-covered south-facing slope that drained into a daylight storm sewer channel located about 25 ft south of the site. Surface runoff from the site drained southward and eastward toward Ten Site Canyon. The site is covered with backfill material, trash, and debris. No evidence of the former tank was noted at the site during the investigation.

5.3.3 Previous Investigations

No previous investigations have been performed at this site. However, at the time of removal, the tank and the excavated soil were screened for radioactive components, and no reports of radioactive contamination were documented.

5.3.4 Field Investigation

The objective of the Phase I RFI was to characterize the nature of potential contamination associated with the wastewater treatment facility.

The conceptual model for the RFI took into account that no spills, leaks, or routine releases had been reported from TA-35-31. Therefore, sampling activities were biased toward areas where residual contamination is most likely to be present.

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 Hazco 1256 organic vapor analyzer (OVA), a Ludlum Model 39 alpha meter, and an Eberline ESP-1 beta/gamma meter. Using this instrumentation, background radiation measurements at 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.

5.3.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed on January 6, 1994. The beta/gamma radiation measurement was 350 cpm, which is within background levels.

Engineering surveys were performed from January 6, 1994, through March 15, 1994. The surveys consisted of a review of archival information, oblique photographs, aerial photographs, and engineering drawings of TA-35 as well as a field site inspection. Because TA-35-31 had been removed, the location of the former tank was scaled from engineering drawings of the site and then located in the field. Registered professional surveyors located the former tank site and monumented the corners with stakes.

The radiation grid survey was performed on January 13, 1994. The radiation grid locations included Location ID Nos. 35-6284 through 35-6288 and 35-6309 through 35-6312, which were spaced at approximately 20-ft intervals. The radiation grid survey was conducted as part of the overall grid survey performed for PRS Nos.

35-003(d, e, f, g, h, l, m, o, q, and misc.). Beta/gamma radiation measurements ranged from 180 to 300 cpm, and the average was 250 cpm, which is within background levels.

5.3.4.2 Deviation from the Sampling and Analysis Plan

The original SAP is described in Section 7.8 of the work plan (LANL 1992, 7666). However, the SAP was modified after engineering and environmental surveys were performed. Sampling specifically for PRS No. 35-003(h) was not included in the original SAP; therefore, one borehole (Location ID No. 35-2027) was assigned to appropriately sample the PRS. The changes to the SAP are documented in the March 28, 1994, memorandum to the Operable Unit 1129 file (Koch 1994, 46647).

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

5.3.4.3 Sampling Activities

Phase I sampling was performed on March 22, 1994. The borehole (Location ID No. 35-2027) was drilled to a depth of 30 ft. The borehole encountered backfill material from the surface to 20 ft and bedrock tuff below 20 ft. Four soil samples were collected (not including duplicate quality assurance/quality control [QA/QC] samples). The sample collection intervals are shown in Table 5.3.4-1. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 180 to 300 cpm, which are within background levels.

Table 5.3.4-1 summarizes all sampling for PRS No. 35-003(h); Figure 5.3.4-1 shows the sample locations.

5.3.5 Background Comparisons

Background comparisons were performed for inorganic chemicals for which upper tolerence limit (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 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 soil samples from one borehole, including one field duplicate, were analyzed by XRF in the mobile laboratory facility for an analyte suite that included antimony, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, mercury, manganese, nickel, potassium, selenium, thorium, titanium, uranium, and zinc. The sample collected in the 2- to 3-ft interval was also analyzed in a fixed-site laboratory for an inorganic chemical analyte

TABLE 5.3.4-1

SUMMARY OF SAMPLES TAKEN AT PRS No. 35-003(h)

Location ID	Sample ID	Depth (ft)	Matrix	SVOC Mobile Lab	SVOC Fixed Lab	PCB Fixed Lab	INORG Mobile Lab	INORG Fixed Lab	Rad Van	Rad Fixed Lab
35-2027	AAA6605	2-3	mixed soil	17050	NR	NR	17230	17219	18034	17299
35-2027	AAA6607	9-10	mixed soil	17050	NR	NR	17230	NR	18034	17299
35-2027	AAA6606	9-10	mixed soil	17050	17049	17049	17230	NR	18034	17299
35-2027	AAA6608	20-21	mixed soil	17050	NR	NR	17230	NR	18034	17299
35-2027	AAA6609	28.5-29.5	Qbt3	17050	NR	NR	17230	NR	18034	17299

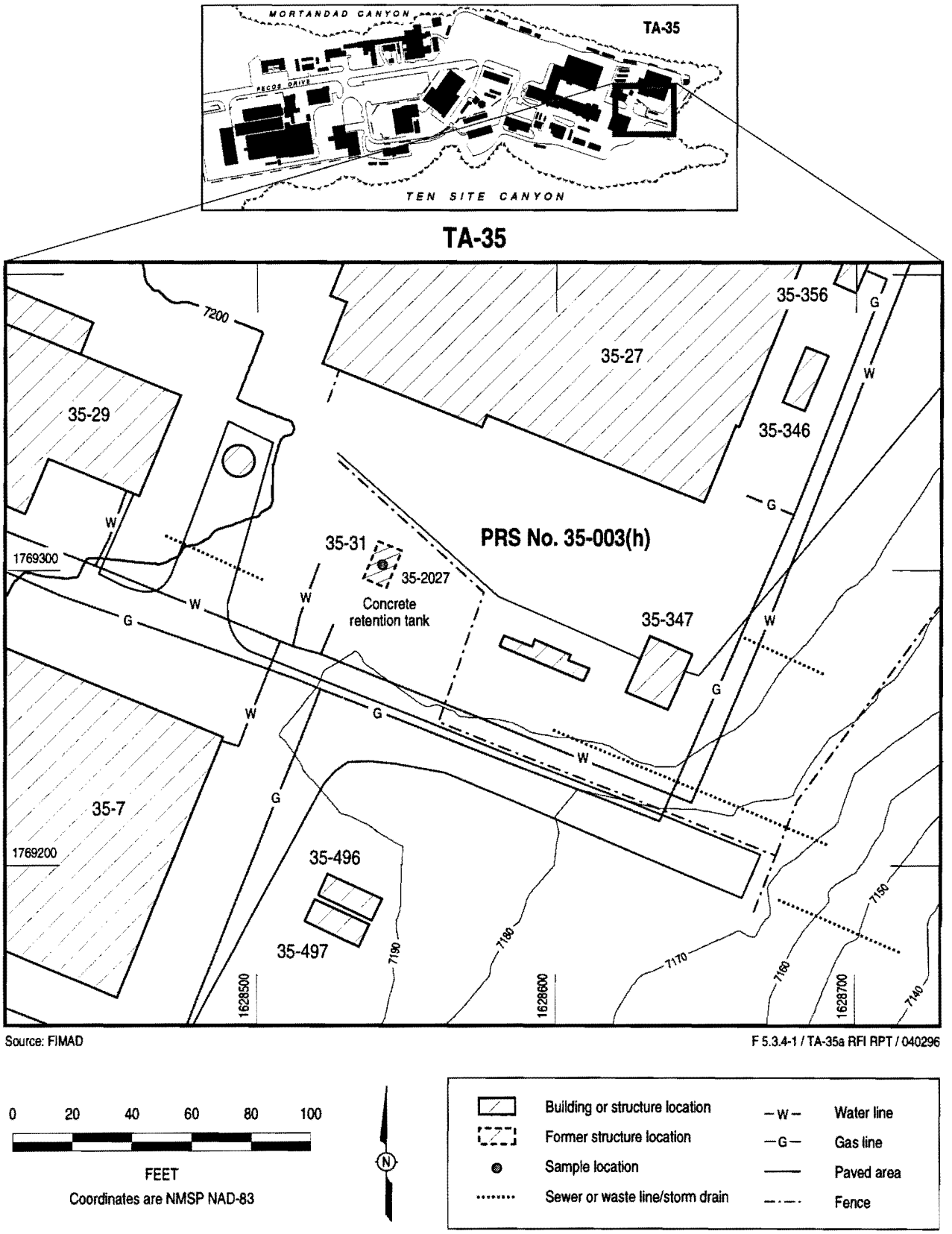


Figure 5.3.4-1. Location of sample at PRS No. 35-003(h).

suite that included aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, lithium, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, sodium, strontium, 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 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 5.3.4. Samples were collected in 1-ft vertical intervals.

The highest detected value for each analyte was used for the background comparison. The sample matrices consisted of a mixture of sand and clay except the deepest sample, which was collected in tuff. In Table 5.3.5-1, the values in the boxes indicate inorganic chemicals that were detected in soil at concentrations greater than or equal to their respective UTLs. The highest observed concentrations above background levels at each location are shown in Figure 5.3.5-1 and are summarized below.

- Antimony was detected in one sample at a concentration of 5 mg/kg, which is above the XRF UTL of 1.45 mg/kg.
- Lead was detected in one sample at a concentration of 34 mg/kg, which is above the XRF UTL of 28.4 mg/kg.
- Thorium was detected in one sample at a concentration of 24 mg/kg, which is slightly above the XRF UTL of 22.1 mg/kg.

5.3.6 Evaluation of Organic Constituents

The organic chemicals analyzed for at this PRS include SVOCs and PCBs. Five soil samples from one borehole, including one field duplicate, were analyzed for SVOCs in the mobile laboratory facility. The sample collected in the 9- to 10-ft interval was also analyzed for SVOCs and PCBs in a fixed-site laboratory.

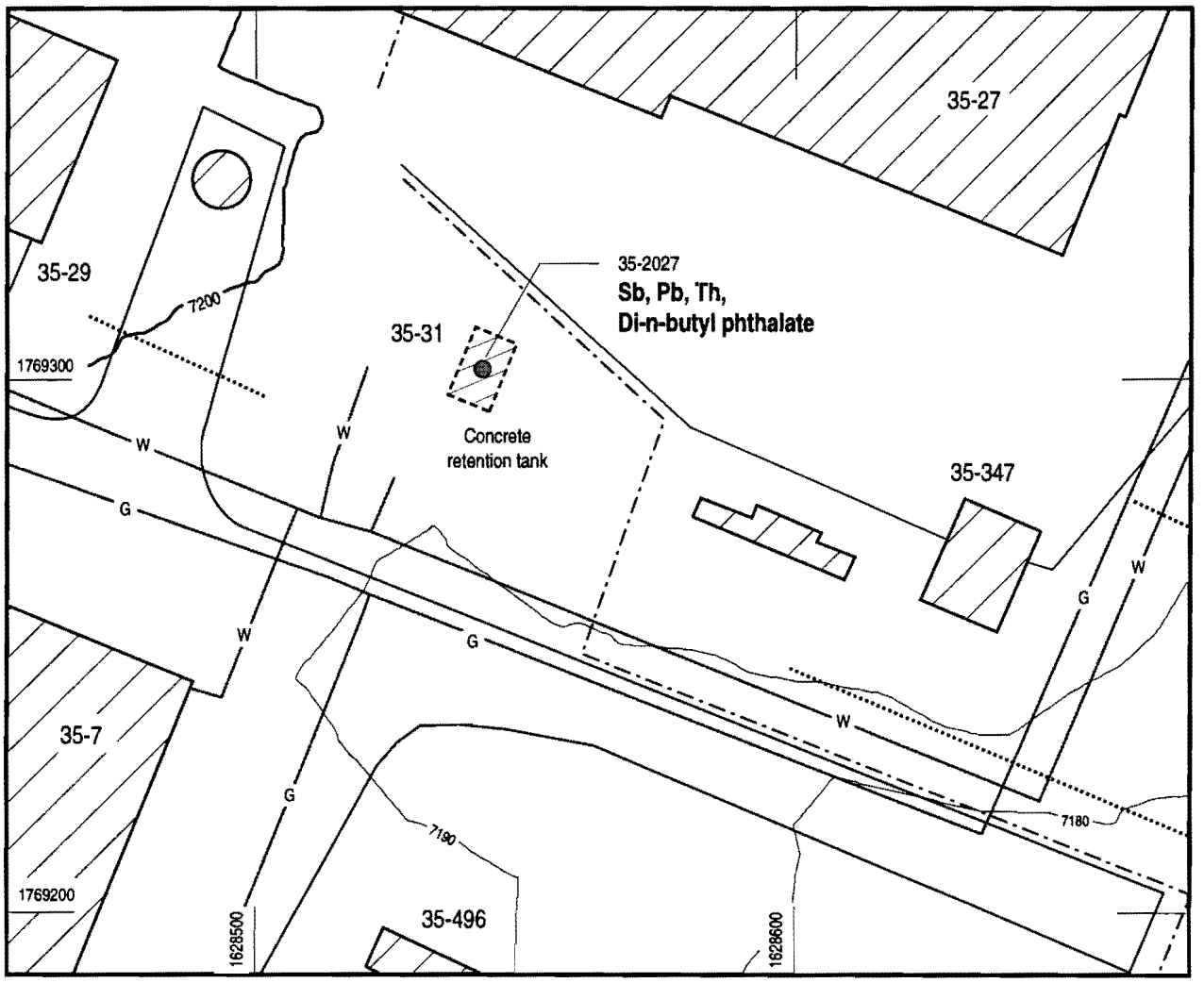
Di-n-butyl phthalate was the only organic chemical detected in any sample. This chemical was detected at a concentration of 1.8 mg/kg in the sample collected in the 9- to 10-ft interval (see Table 5.3.6-1 and Figure 5.3.5-1).

TABLE 5.3.5-1

INORGANIC CONSTITUENTS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTL FOR PRS No. 35-003(h)

Location ID	Sample ID	Depth (ft)	Cd	Hg	Li	Pb	Sb	Se	Sr	Th	Ti	U
SAL	N/A	N/A	38	23	1500	400	31	380	46000	N.A.	N.A.	29
Mixed soil UTL	N/A	N/A	2.7	0.1	N.A.	23.3	1	1.7	N.A.	22.6	N.A.	5.45
Qbt3 UTL	N/A	N/A	N.A.	N.A.	N.A.	16.2	0.4	N.A.	N.A.	16.3	N.A.	4.37
XRF UTL	N/A	N/A	N.A.	N.A.	N/A	28.4.	1.45	N.A.	N/A	22.1	N.A.	5.33
35-2027	AAA6605	2-3	<3	<5	14	21	<4	<4	18	<8	2010	<8
35-2027	AAA6607	9-10	<3	<5	NA	34	5	<4	NA	15	2980	<8
35-2027	AAA6608	20-21	<3	<5	NA	23	<4	<4	NA	21	1060	<8
35-2027	AAA6609	28.5-29.5	<3	<5	NA	20	<4	<4	NA	24	668	<8

*mg/kg



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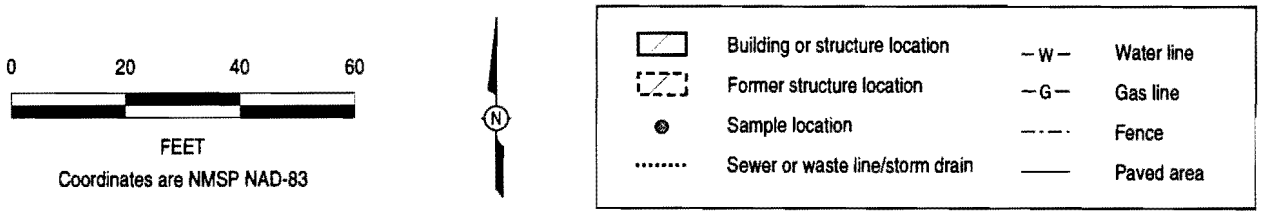


Figure 5.3.5-1. Location of detected organic chemicals and analytes that exceed UTLs at PRS No. 35-003(h).

TABLE 5.3.6-1

PRS No. 35-003(h) SOIL CONCENTRATIONS* FOR DETECTED ORGANIC CONSTITUENTS

Location ID	Sample ID	Depth (ft)	Di-n-butyl phthalate
SAL	N/A	N/A	6500
CRQL	N/A	N/A	0.33
35-2027	AAA6606	9-10	1.8

*mg/kg

5.3.7 Human Health Assessment

5.3.7.1 Screening Assessment

Three inorganic chemicals and one organic chemical 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 screening action level (SAL), to evaluate possible additive effects within each class of chemical.

No sample results for any chemical exceeded SAL values at this PRS. The multiple chemical evaluation (MCE) result for noncarcinogens was 0.26. Because no chemical carcinogens were identified as COPCs in Sections 5.3.5 and 5.3.6, an MCE calculation for chemical carcinogens was not performed.

No COPCs were identified in the human health screening assessment. All the COPCs identified in the background comparison in Section 5.3.5 except thorium have soil SALs for comparison. Thorium was measured above its XRF UTL value in only one of four samples and at a concentration just 10% higher than the UTL. Therefore, additional evaluation of thorium is not proposed. 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. 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.

5.3.8 Ecological Assessment

The general landscape condition around this PRS is highly developed and disturbed, and a low potential exists for receptors to come in contact with ecological COPCs associated with the site (see Table 2.4-1 in Chapter 2.0 of this RFI report). Therefore, no further ecological evaluation of this site is required.

5.3.9 Extent of Contamination

One borehole (Location ID No. 35-2027) was drilled to a depth of 30 ft below TA-35-31. Because the borehole location is only proximal to the actual location of TA-35-31, the data collected in the borehole are insufficient to conclusively determine the extent of contamination at this PRS. However, the data do support the conclusion that a widespread release of contaminants is unlikely to have occurred at this PRS because no significant

contaminant concentrations were observed in the borehole. The expense of drilling additional boreholes is judged to be unwarranted because the information already obtained indicates that a low probability exists of detecting significant contamination at this location.

5.3.10 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. 35-003(h) was to determine the presence or absence of contamination associated with TA-35-31. No COPCs were identified in the human health screening assessment.

The extent of contamination has been determined to the degree that is feasible from limited judgemental sampling. Samples for specific analytes were collected from a 30-ft borehole located at the location of TA-35-31, where contaminants would be most likely to occur in site soils today.

Based on NFA criterion number 4, a Class III permit modification is requested to remove PRS No. 35-003(h) from the Hazardous and Solid Waste Amendments (HSWA) Module of the Laboratory's RCRA operating permit. The sample data indicate that this site does not pose a significant human health risk now or in the foreseeable future.

5.4 PRS Nos. 35-003(j and k), 35-014(d), and 35-015(b)

PRS Nos. 35-003(j and k) are the sites of two former aboveground oil storage tanks (TA-35-96 and TA-35-97); PRS No. 35-014(d) is the stained area associated with the tanks; and PRS No. 35-015(b) is the site of a former waste-oil treatment facility. These PRSs are included in the same decision set because they are located in the same area and have the same potential contaminants. Therefore, they cannot be evaluated independently.

COPCs identified as a result of the screening assessment include Aroclor 1260, benzo(a)pyrene, and benzo(b)fluoranthene. The COPCs are evaluated in the risk assessment in Section 5.4.7.2.

PRS Nos. 35-003(j and k), 35-014(d), and 35-015(b) are recommended for NFA based on NFA criterion number 4 (LANL 1995, 53863).

Radiological sample results are not presented or 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 5.4.4.3.

5.4.1 History

PRS Nos. 35-003(j and k), 35-014(d), and 35-015(b) are discussed in detail in Sections 3.3.2 and 7.13 of the work plan (LANL 1992, 7666).

The waste-oil treatment facility was installed in 1974 to treat dielectric oil used for the Gemini gas laser and was removed in 1989 and 1990. The tanks were large, rectangular, external frame structures approximately 35 ft long by 10 ft wide by 10 ft tall used to store dielectric oil associated with the waste-oil treatment facility. They were installed in 1974 and were used intermittently until they were removed in 1989 or 1990. The soil at the site may be stained with dielectric oil that leaked from hose connections at the tanks. Stained soil was reported at the entry point to a storm-water culvert that drains the site.

In 1988 equipment at the waste-oil treatment facility was reported to be leaking dielectric oil. Subsequently, the equipment was removed, and the site was backfilled with clean soil material and covered with asphalt for a parking area. The volume of the oil leak is unknown, and it is not known if the leak prompted a cleanup of the site.

The contaminants that were potentially present include gross-alpha, -beta, and -gamma radiation; VOCs; SVOCs; and PCBs.

5.4.2 Description

These PRSs are located in a highly industrialized area near the east end of TA-35, east of the north wing of building TA-35-2 and west of building TA-35-29. The site is a relatively flat area near the center of Ten Site Mesa. Surface storm-water drainage from the site flows down the asphalt, along the road south of TA-35-29, and into the small canyon at the east end of Ten Site Mesa, which is a tributary of Ten Site Canyon.

5.4.3 Previous Investigations

No previous investigations have been performed at these sites.

5.4.4 Field Investigation

The objective of the Phase I RFI was to characterize the nature of potential contamination associated with the oil storage tanks, the stained area, and the former waste-oil treatment facility. No visual signs of the PRSs were observed at the site, and the RFI focused on collecting soil samples beneath the asphalt, concrete, and fill material.

The conceptual model for the RFI was based on evidence that the only known releases to the environment were dielectric oil. There is a lack of evidence that any decommissioning activity had taken place at these sites other than removing the tanks and equipment and capping stained soils with clean soil and/or asphalt. Because the site has been capped with asphalt, evaporation and surface movement are not considered primary release routes. Therefore, the transportation of contaminants may have been retarded. The conceptual model predicted that the most likely transport mechanism for releasing contaminants to the environment is associated with hydrologic processes and free-phase movement of oils in the vadose zone.

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 Hazco 1256 OVA, a Ludlum Model 39 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 these sites, and no alpha radiation was detected. Organic vapors were detected, as noted below.

5.4.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed in November 1993 in association with TA-35 site-wide radiation surveillance. Personnel from Laboratory group ESH-1 conduct environmental monitoring of the area continually.

Engineering surveys were performed on November 5, 1993, and November 15, 1993. The surveys consisted of field site inspections and reviews of archival aerial photographs and archival site photographs to determine the locations of the PRSs. Sample locations were selected after reviewing the photographs.

The radiation grid survey was performed on November 12, 1993. A total of 14 radiation measurements were obtained from grid locations east of the north wing of TA-35-2 and west of TA-35-29. The radiation grid locations included Location ID Nos. 35-6020 through 35-6034, which were spaced at approximately 30-ft intervals. Beta/gamma radiation measurements ranged from 125 to 300 cpm, and the average was 239 cpm, which is within background levels.

5.4.4.2 Deviations from the Sampling and Analysis Plan

The original SAP is described in Section 7.13 of the work plan (LANL 1992, 7666). However, the SAP was modified based on information gathered during the engineering surveys. The changes to the SAP, which are summarized below, are documented in the December 17, 1993, memorandum to the Operable Unit 1129 file (Walterscheid 1993, 42495).

The original SAP specified the removal of two 30-ft by 10-ft sections of asphalt and the collection of random samples. Instead, 1-ft by 1-ft sections of asphalt were removed, and soil samples were collected at those locations. Also, the "surface" soil samples called for in the original SAP were collected at the ground level that existed at the time of the releases and not at the present-day surface.

The original SAP did not require SVOC analysis to be performed on the surface soil samples. However, all samples were analyzed for SVOCs because SVOC analysis would detect petroleum compounds if oil contamination was present. The original SAP required VOC analysis for all samples. However, only subsurface soil samples were analyzed for VOCs because VOCs volatilize from the surface within a few weeks. Any VOCs present at the time of a release would have already volatilized. Discrete subsurface soil samples were analyzed for VOCs in two of the boreholes and in the auger holes where VOCs were detected using the OVA.

Supplemental sampling was performed at the site in December 1995 because total petroleum hydrocarbons (TPH) were not specifically analyzed for during the Phase I sampling (Pratt 1995, 52179). Supplemental analytical data for organic components were necessary because the analytical laboratory identified the presence of TPH and large unresolved hydrocarbon peaks in the Phase I samples. The supplemental sample locations included 2 3-ft-deep hand-auger holes (Location ID Nos. 35-2290 and 35-2294) and 5 10-ft-deep boreholes (Location ID Nos. 35-2288, 35-2289, 35-2291, 35-2292, and 35-2293). All supplemental sampling was performed at PRS Nos. 35-003(j and k) except for Location ID No. 35-2294, which was collected at PRS No. 35-014(d). All supplemental samples were analyzed for gross-alpha, -beta, and -gamma radiation; SVOCs; and TPH; some were also analyzed for VOCs, metals, gamma spectroscopy, and PCBs.

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

5.4.4.3 Sampling Activities

Phase I sampling was performed from November 30, 1993, through December 19, 1993, and on December 18, 1995. A total of 17 locations were sampled, and 45 soil samples were collected: 8 surface samples and 37 subsurface samples (not including duplicate QA/QC samples).

Since the time of the potential release of contaminants, these sites have been partially backfilled, leveled, and paved with asphalt. Therefore, a hand auger was used to drill through the pavement and backfill material and reach the original surface material that was to be sampled. A total of eight "surface" soil samples were collected. The "surface" soil samples were obtained from the top 6 in. of the original surface material. The sample locations are shown in Figure 5.4.4-1; sample collection intervals are shown in Table 5.4.4-1. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 80 to 290 cpm, which are within background levels.

5.4.4.3.1 PRS No. 35-003(j)

On December 1, 1993, three surface soil samples were collected at Location ID Nos. 35-2081, 35-2082, and 35-2085. Organic vapor, recorded at 0.4 units, was detected in the sample collected at Location ID No. 35-2081. However, no organic vapor was detected at Location ID Nos. 35-2082 or 35-2085. One hand-auger hole was drilled to a depth of 6 ft, and samples were collected at 1-ft intervals.

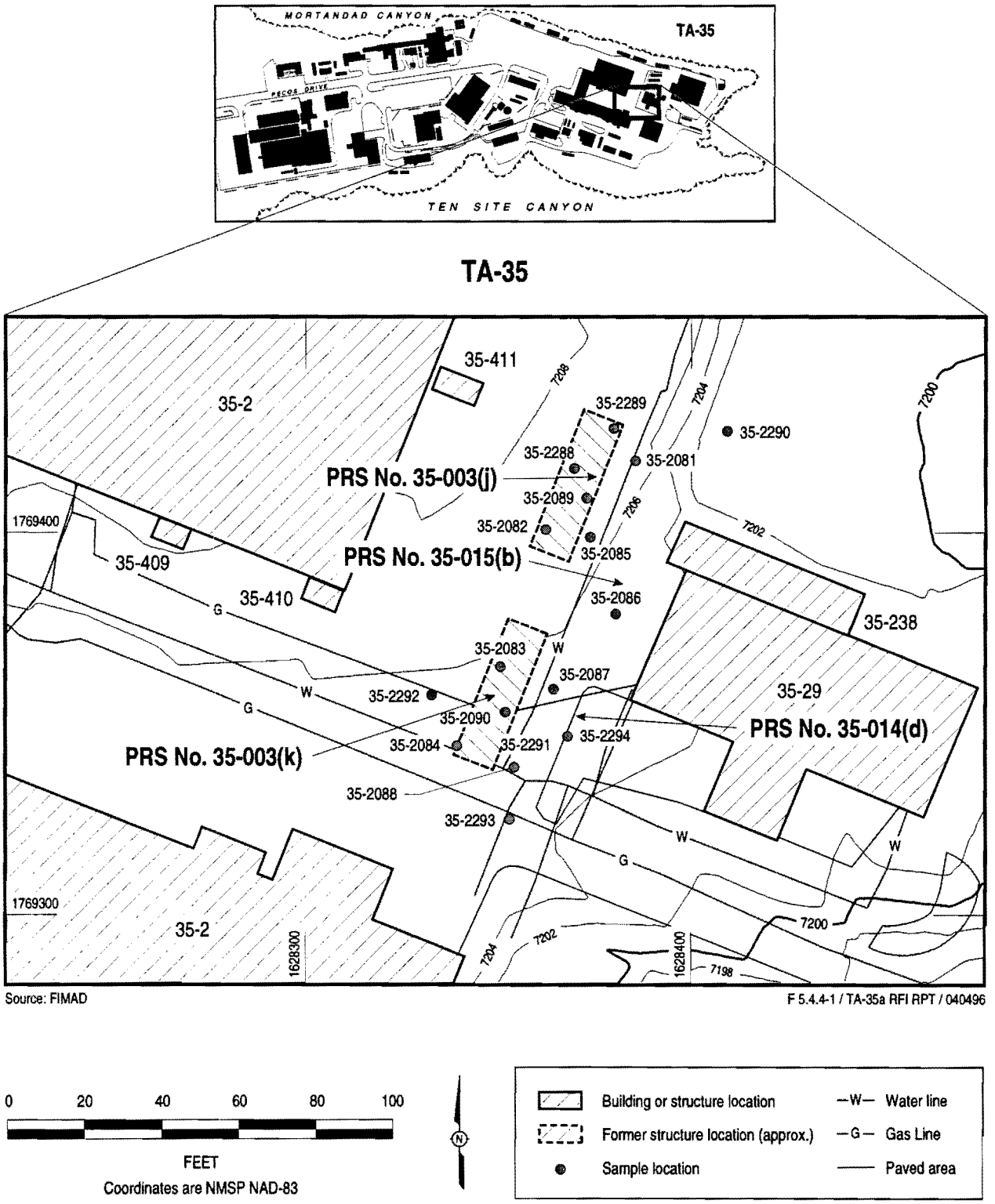


Figure 5.4.4-1. Locations of samples at PRS Nos. 35-003(j and k), 35-014(d), and 35-015(b).

TABLE 5.4.4-1

SUMMARY OF SAMPLES TAKEN AT PRS Nos. 35-003(j and k), 35-004(d), AND 35-015(b)

Location ID	Sample ID	Depth (ft)	Matrix	VOC Mobile Lab	VOC Fixed Lab	SVOC Fixed Lab	PCB Fixed Lab	TPH Fixed Lab	INORG Fixed Lab	Rad Van	Rad Fixed Lab
35-2081	AAA6366	1.5-2.0	Qbt3	16407	NR	16407	16407	16407	NR	16401	16400
35-2082	AAA6367	1.2-1.5	mixed soil	16407	NR	16407	16407	16407	NR	16401	16400
35-2083	AAA6368	1.9-2.2	mixed soil	NR	NR	16397	16397	NR	NR	16390	16389
35-2084	AAA6373	1.5-1.9	mixed soil	NR	NR	16397	16397	NR	NR	16390	16389
35-2085	AAA6374	1.6-2.1	mixed soil	16407	NR	16407	16407	16407	NR	16401	16400
35-2086	AAA6375	0-0.5	mixed soil	NR	NR	16397	16397	NR	NR	16390	16389
35-2087	AAA6376	1.4-1.9	mixed soil	NR	NR	16397	16397	NR	NR	16390	16389
35-2088	AAA6377	1.5-1.8	mixed soil	NR	NR	16397	16397	NR	NR	16390	16389
35-2089	AAA6385	0-1	mixed soil	16407	NR	16407	16407	16407	NR	16401	16400
35-2089	AAA6386	1-2	mixed soil	16407	NR	16407	16407	16407	NR	16401	16400
35-2089	AAA6387	2-3	mixed soil	16407	NR	16407	16407	16407	NR	16401	16400
35-2089	AAA6388	3-4	Qbt3	16407	NR	16407	16407	16407	NR	16401	16400
35-2089	AAA6389	4-5	Qbt3	16407	NR	16407	16407	NR	NR	16401	16400
35-2089	AAA6390	5-6	Qbt3	16407	NR	16407	16407	NR	NR	16401	16400
35-2090	AAA6391	0-1	mixed soil	16407	NR	16407	16407	16407	NR	16401	16400
35-2090	AAA6392	1-2	mixed soil	16407	NR	16407	16407	16407	NR	16401	16400
35-2090	AAA6393	2-3	mixed soil	16407	NR	16407	16407	NR	NR	16401	16400
35-2090	AAA6394	3-4	mixed soil	16407	NR	16407	16407	NR	NR	16401	16400
35-2090	AAA6395	4-5	mixed soil	16407	NR	16407	16407	NR	NR	16401	16400
35-2090	AAA6396	4-5	mixed soil	16407	NR	16407	16407	NR	NR	16401	16400
35-2090	AAA6397	5-6	mixed soil	16407	NR	16407	16407	16407	NR	16401	16400
35-2288	0435-95-0211	1-2	mixed soil	1701	1701	1701	1701	1701	1702	NR	1703
35-2288	0435-95-0212	3-4	mixed soil	1701	1701	1701	1701	1701	1702	NR	1703
35-2288	0435-95-0213	6-7	Qbt3	NR	NR	1701	1701	1701	1702	NR	1703
35-2288	0435-95-0214	9-10	Qbt3	NR	NR	1701	1701	1701	1702	NR	1703
35-2289	0435-95-0215	1-2	mixed soil	NR	NR	1701	NR	1701	NR	NR	NR
35-2289	0435-95-0216	3-4	mixed soil	NR	NR	1701	NR	1701	NR	NR	NR
35-2289	0435-95-0217	6-7	Qbt3	NR	NR	1701	NR	1701	NR	NR	NR
35-2289	0435-95-0218	9-10	Qbt3	NR	NR	1701	NR	1701	NR	NR	NR
35-2290	0435-95-0231	0-1	mixed soil	NR	NR	1701	NR	1701	NR	NR	NR
35-2290	0435-95-0232	1-2	Qbt3	NR	NR	1701	NR	1701	NR	NR	NR
35-2290	0435-95-0233	2-3	Qbt3	NR	NR	1701	NR	1701	NR	NR	NR
35-2291	0435-95-0219	1-2	mixed soil	1701	1701	1701	1701	1701	1702	NR	1703
35-2291	0435-95-0220	3-4	mixed soil	1701	1701	1701	1701	1701	1702	NR	1703
35-2291	0435-95-0221	6-7	Qbt3	NR	NR	1701	1701	1701	1702	NR	1703
35-2291	0435-95-0222	9-10	Qbt3	NR	NR	1701	1701	1701	1702	NR	1703
35-2292	0435-95-0223	1-2	mixed soil	NR	NR	1701	NR	1701	NR	NR	NR
35-2292	0435-95-0224	4-5	Qbt3	NR	NR	1701	NR	1701	NR	NR	NR
35-2292	0435-95-0225	6-7	Qbt3	NR	NR	1701	NR	1701	NR	NR	NR
35-2292	0435-95-0226	9-10	Qbt3	NR	NR	1701	NR	1701	NR	NR	NR
35-2293	0435-95-0227	1.5-2.5	mixed soil	NR	NR	1701	NR	1701	NR	NR	NR
35-2293	0435-95-0228	3-4	mixed soil	NR	NR	1701	NR	1701	NR	NR	NR
35-2293	0435-95-0229	6-7	Qbt3	NR	NR	1701	NR	1701	NR	NR	NR
35-2293	0435-95-0230	9-10	Qbt3	NR	NR	1701	NR	1701	NR	NR	NR
35-2294	0435-95-0234	0-1	mixed soil	NR	NR	1701	NR	1701	NR	NR	NR
35-2294	0435-95-0235	1-2	mixed soil	NR	NR	1701	NR	1701	NR	NR	NR
35-2294	0435-95-0236	2-2.5	mixed soil	NR	NR	1701	NR	1701	NR	NR	NR

Supplemental soil samples were collected on December 18, 1995. Two boreholes (Location ID Nos. 35-2288 and 35-2289) were drilled to a depth of 10 ft, and four samples were collected from each borehole. Three samples were collected from one hand-auger hole (Location ID No. 35-2290), which was drilled to a depth of 3 ft.

5.4.4.3.2 PRS No. 35-003(k)

On November 30, 1993, two surface soil samples were collected at Location ID Nos. 35-2083 and 35-2084. No organic vapor was detected at Location ID No. 35-2083. One hand-auger hole (Location ID No. 35-2090) was drilled to a depth of 6 ft, and six samples were collected at 1-ft intervals.

Supplemental soil samples were collected on December 18, 1995. Three boreholes (Location ID Nos. 35-2291, 35-2292, and 35-2293) were drilled to a depth of 10 ft, and four samples were collected from each borehole.

5.4.4.3.3 PRS No. 35-014(d)

On December 1, 1993, two surface soil samples were collected at Location ID Nos. 35-2087 and 35-2088. On December 19, 1995, one hand-auger hole (Location ID No. 35-2294) was drilled to a depth of 3 ft, and three samples were collected.

5.4.4.3.4 PRS No. 35-015(b)

One surface sediment sample was collected at Location ID No. 35-2086. The sample was collected from sediment that had accumulated under a metal grate in a storm drain near the west end of TA-35-29.

Table 5.4.4-1 summarizes all sampling for PRS Nos. 35-003(j and k), 35-014(d), and 35-015(b); Figure 5.4.4-1 shows the sample locations.

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. Eight soil samples from two separate locations were analyzed in a fixed-site laboratory for aluminum, arsenic, barium, beryllium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, sodium, 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 sample matrix varied in the upper intervals and included combinations of sand, clay, gravel, and cobbles. In deeper intervals, the sample matrix was predominantly tuff. The mixed-soil UTL values were used for background comparison for the 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. In Table 5.4.5-1, the values in the boxes indicate inorganic chemicals that were detected in soil at concentrations greater than or equal to their respective UTLs. These inorganic chemicals are also shown in Figure 5.4.5-1 and summarized below.

- Barium was detected in one sample at a concentration of 237 mg/kg, which is above the Qbt3 UTL of 28 mg/kg.
- Calcium was detected in two samples at two locations at maximum concentrations of 4,040 and 9,440 mg/kg. The first sample is above the Qbt3 UTL of 1,520 mg/kg; the second is above the mixed-soil UTL of 6,120 mg/kg.
- Chromium was detected in four samples at two locations at maximum concentrations of 5.7 and 3.3 mg/kg, which are above the Qbt3 UTL of 2.1 mg/kg.

TABLE 5.4.5-1

INORGANIC CONSTITUENTS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTL FOR PRS Nos. 35-003(j and k), 35-014(d), AND 35-015(b)

Location ID	Sample ID	Depth (ft)	Ba	Ca	Cr	Cu	Pb	Mg	Hg	Ni	V
SAL	N/A	N/A	5300	N.A.	210	2800	400	N.A.	23	1500	540
Mixed soil UTL	N/A	N/A	315	6120	19.3	30.7	23.3	4610	0.1	15.2	41.9
Qbt3 UTL	N/A	N/A	28	1520	2.1	2	16.2	628	N.A.	2.6	4.01
35-2288	0435-95-0211	1-2	20.7	530	2.7	<1.6	3	322	<0.06	2.1	3.2
35-2288	0435-95-0212	3-4	48.9	1170	3.4	2.6	8.6	713	0.07	5.3	8
35-2288	0435-95-0213	6-7	237	4040	5.7	2.3	2.8	1360	0.06	7.2	6.5
35-2288	0435-95-0214	9-10	17.2	540	4.1	1.5	2.2	472	<0.06	4.4	2.8
35-2291	0435-95-0219	1-2	85.6	9440	8.3	15.5	42.3	1170	0.55	7.4	13.4
35-2291	0435-95-0220	3-4	128	2320	8.8	4.9	11.3	1440	<0.06	7.2	21.9
35-2291	0435-95-0221	6-7	19.3	569	3.3	<1.7	1.7	157	<0.06	3.3	1.5
35-2291	0435-95-0222	9-10	17.5	437	2.2	<1.5	1.6	103	<0.06	2.4	1.2

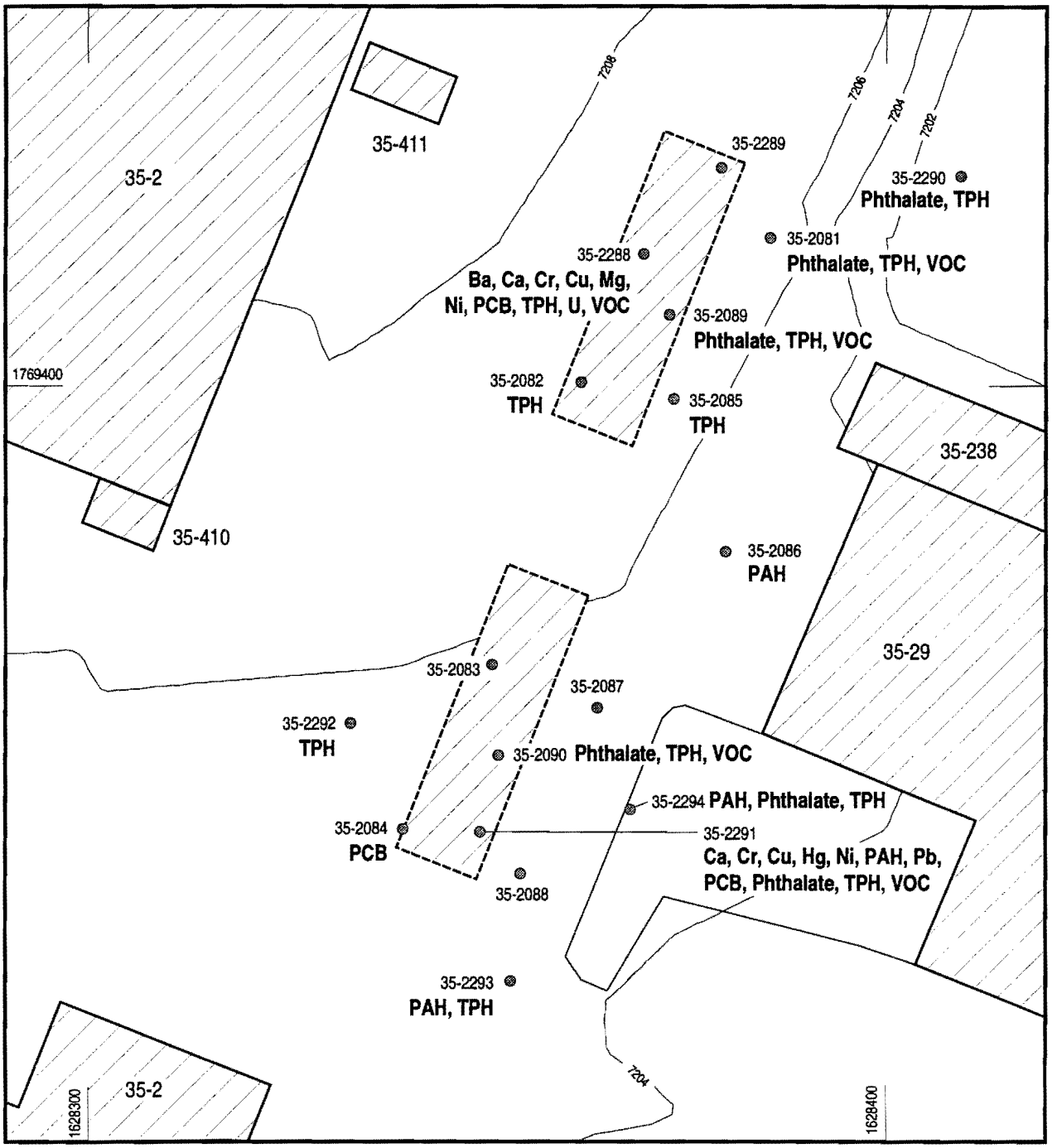
*mg/kg

- Copper was detected in two samples at concentrations of 2.3 mg/kg and 15.5 mg/kg. The first sample is slightly above the Qbt3 UTL of 2 mg/kg; the second is equal to the mixed-soil UTL of 15.5 mg/kg.
- Lead was detected in one sample at a concentration of 42.3 mg/kg, which is above the mixed-soil UTL of 23.3 mg/kg.
- Magnesium was detected in one sample at a concentration of 1,360 mg/kg, which is above the Qbt3 UTL of 628 mg/kg.
- Mercury was detected in one sample at a concentration of 0.55 mg/kg, which is above the mixed-soil UTL of 0.1 mg/kg.
- Nickel was detected in three samples at two locations at a maximum concentration of 7.2 mg/kg, which is above the Qbt3 UTL of 2.6 mg/kg.
- Vanadium was detected in one sample at a concentration of 6.5 mg/kg, which is slightly above the Qbt3 UTL of 4.01 mg/kg.

All inorganic chemicals measured at these PRSs have UTL values for both mixed-soil and tuff unit Qbt3.

5.4.6 Evaluation of Organic Constituents

The organic chemicals analyzed for at these PRSs include VOCs, SVOCs, PCBs, and TPH. Forty-seven soil samples, including one field duplicate, were analyzed for SVOCs. The samples were collected at seventeen separate locations. Twenty soil samples from seven locations were analyzed for VOCs; one sample was a field duplicate. Twenty-nine soil samples from twelve locations were analyzed for PCBs; one sample was a field duplicate. The laboratory analysis for PCBs included the following Aroclors: 1016, 1221, 1232, 1242, 1248, 1254, and 1260.



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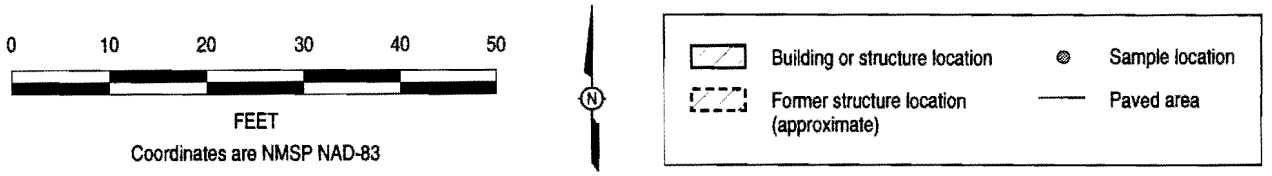
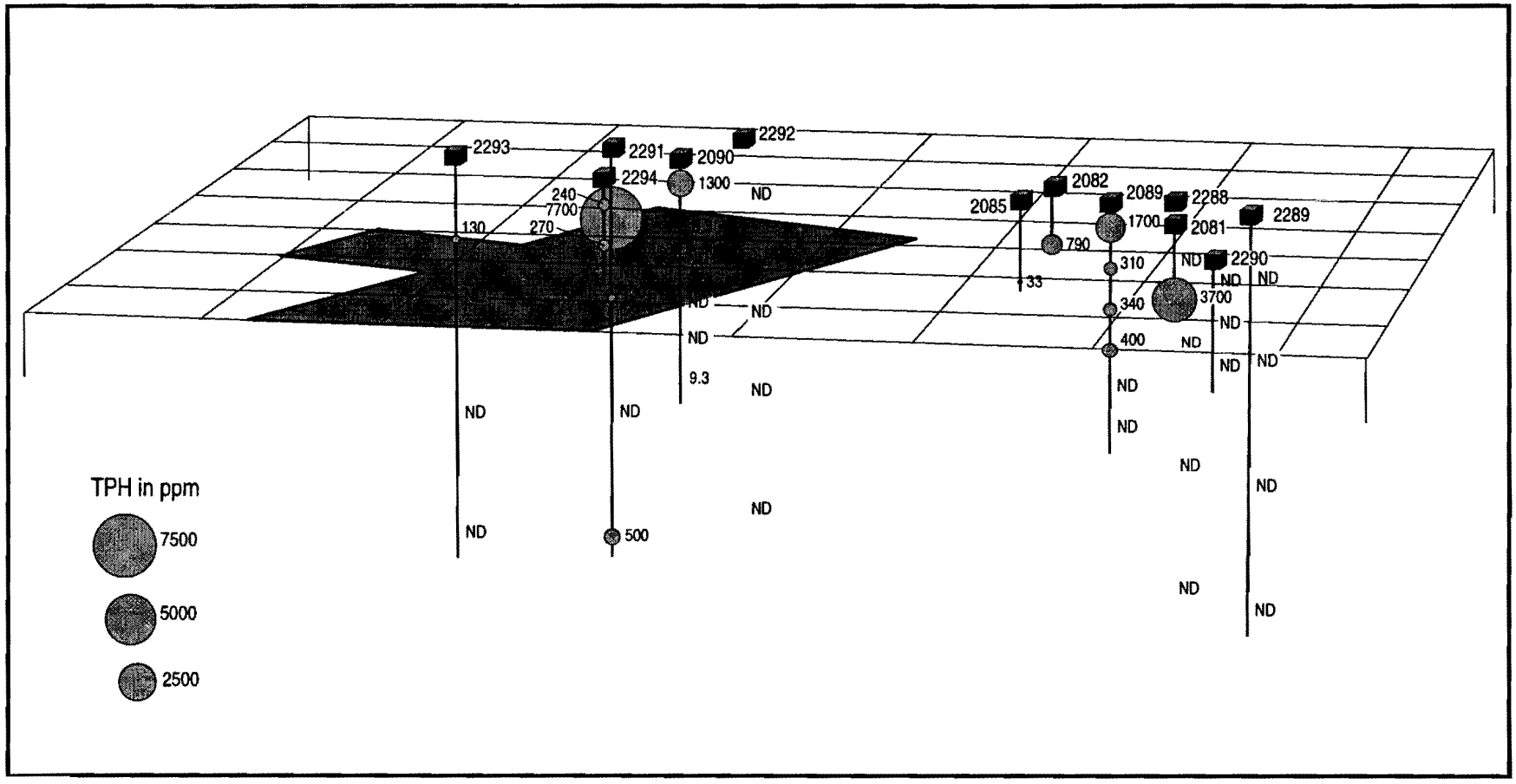


Figure 5.4.5-1. Locations of detected organic chemicals and analytes that exceed UTLs at PRS Nos. 35-003(j and k), 35-014(d), and 35-015(b).

Results of the Phase I sampling activities indicated that hydrocarbon contamination was present in several samples. TPH analyses on 10 of the initial samples resulted in estimated TPH concentrations as high as 3,700 mg/kg. Therefore, TPH analyses were specifically requested for an additional 26 soil samples from 7 locations. The results of the TPH analyses are graphically displayed in Figure 5.4.6-1.

The organic chemicals that were detected in soil are shown in Table 5.4.6-1 and Figure 5.4.5-1 and are summarized below.

- Acenaphthene was detected in one sample at an estimated concentration of 0.14 mg/kg.
- Acetone was detected in five samples at two locations at maximum concentrations of 0.19 and 0.12 mg/kg.
- Anthracene was detected in two samples at two locations at estimated concentrations of 0.047 and 0.022 mg/kg.
- Aroclor 1260 (evaluated as mixed Aroclor) was detected in three samples at three locations at concentrations of 0.095, 0.64, and 2.9 mg/kg.
- Benzo(a)anthracene was detected in three samples at two locations at maximum estimated concentrations of 0.045 and 0.26 mg/kg.
- Benzo(a)pyrene was detected in two samples at two locations at estimated concentrations of 0.047 and 0.023 mg/kg and in one sample at a third location at a concentration of 4 mg/kg.
- Benzo(b)fluoranthene was detected in two samples at two locations at estimated concentrations of 0.027 and 0.21 mg/kg and in one sample at a third location at a concentration of 5.6 mg/kg.
- Benzo(k)fluoranthene was detected in two samples at two at estimated concentrations of 0.043 and 0.2 mg/kg.
- Bis(2-ethylhexyl)phthalate was detected in three samples at three locations at estimated concentrations of 0.075, 0.065, and 0.21 mg/kg and in three samples at three locations at concentrations of 2.3, 0.85, and 0.77 mg/kg.
- Chrysene was detected in three samples at two locations at maximum estimated concentrations of 0.053 and 0.28 mg/kg.
- Di-n-butylphthalate was detected in one sample at an estimated concentration of 0.052 mg/kg.
- Fluoranthene was detected in two samples at two locations at estimated concentrations of 0.011 and 0.11 mg/kg and in one sample at a third location at a concentration of 6.7 mg/kg.
- Fluorene was detected in one sample at an estimated concentration of 0.13 mg/kg.
- Methylene chloride was detected in one sample at an estimated concentration of 0.004 mg/kg; methylene chloride was detected in two samples at two locations at concentrations of 0.013 and 0.018 mg/kg.
- Phenanthrene was detected in one sample at an estimated concentration of 0.12 mg/kg; phenanthrene was detected in three samples at two locations at maximum concentrations of 0.77 and 6.2 mg/kg.



Source: FIMAD G104514

F 5.4.6-1 / TA-35 RFI RPT / 043096

Building 35-29

Location ID

Grid-spacing: 20ft, viewer looking WSW
Vertical Exaggeration: 5

Figure 5.4.6-1. Extent of TPH contamination at PRS Nos. 35-003(j), 35-003(k), 35-014(d), and 35-015(b).

TABLE 5.4.6-1

PRS Nos. 35-003(j and k), 35-014(d), AND 35-015(b) SOIL CONCENTRATIONS* FOR DETECTED ORGANIC CONSTITUENTS

Location ID	Sample ID	Depth (ft)	Acenaphthene	Acetone	Anthracene	Mixed Aroclors	Benzo[a] anthracene	Benzo[b] fluoranthene	Benzo[k] fluoranthene	Benzo[a]pyrene	Bis(2-ethylhexyl) phthalate
SAL	N/A	N/A	360	2000	19	1	0.61	0.61	6.1	0.061	32
CRQL	N/A	N/A	0.33	0.02	0.33	0.033	0.33	0.33	0.33	0.33	0.33
35-2081	AAA6366	1.5-2.0	ND	ND	ND	ND	ND	ND	ND	ND	2.3
35-2082	AAA6367	1.2-1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND
35-2084	AAA6373	1.5-1.9	ND	NA	ND	0.64	ND	ND	ND	ND	ND
35-2085	AAA6374	1.6-2.1	ND	ND	ND	ND	ND	ND	ND	ND	ND
35-2086	AAA6375	0-.5	ND	NA	ND	ND	ND	5.6	ND	4	ND
35-2089	AAA6385	0-1	ND	ND	ND	ND	ND	ND	ND	ND	ND
35-2089	AAA6386	1-2	ND	ND	ND	ND	ND	ND	ND	ND	ND
35-2089	AAA6387	2-3	ND	ND	ND	ND	ND	ND	ND	ND	ND
35-2089	AAA6388	3-4	ND	ND	ND	ND	ND	ND	ND	ND	0.21 J
35-2089	AAA6390	5-6	ND	0.19	ND	ND	ND	ND	ND	ND	ND
35-2090	AAA6391	0-1	ND	0.12	ND	ND	ND	ND	ND	ND	0.85
35-2090	AAA6392	1-2	ND	0.054	ND	ND	ND	ND	ND	ND	ND
35-2090	AAA6395	4-5	ND	0.053	ND	ND	ND	ND	ND	ND	ND
35-2090	AAA6397	5-6	ND	0.049	ND	ND	ND	ND	ND	ND	ND
35-2288	0435-95-0211	1-2	ND	ND	ND	ND	ND	ND	ND	ND	ND
35-2288	0435-95-0212	3-4	ND	ND	ND	0.095	ND	ND	ND	ND	ND
35-2290	0435-95-0231	0-1	ND	NA	ND	ND	ND	ND	ND	ND	ND
35-2290	0435-95-0232	1-2	ND	NA	ND	ND	ND	ND	ND	ND	ND
35-2290	0435-95-0233	2-3	ND	NA	ND	ND	ND	ND	ND	ND	ND
35-2291	0435-95-0219	1-2	ND	ND	0.047 J	2.9	ND	ND	ND	ND	0.77
35-2291	0435-95-0220	3-4	ND	ND	ND	ND	ND	ND	ND	ND	ND
35-2291	0435-95-0221	6-7	ND	NA	ND	ND	ND	ND	ND	ND	ND
35-2291	0435-95-0222	9-10	ND	NA	ND	ND	ND	ND	ND	ND	0.075 J
35-2292	0435-95-0223	1-2	ND	NA	ND	ND	ND	ND	ND	ND	ND
35-2292	0435-95-0224	4-5	ND	NA	ND	ND	ND	ND	ND	ND	ND
35-2292	0435-95-0226	9-10	ND	NA	ND	ND	ND	ND	ND	ND	ND
35-2293	0435-95-0227	1.5-2.5	ND	NA	ND	ND	0.045 J	0.027 J	0.043 J	0.047 J	ND
35-2293	0435-95-0228	3-4	ND	NA	ND	ND	ND	ND	ND	ND	ND
35-2293	0435-95-0229	6-7	ND	NA	ND	ND	ND	ND	ND	ND	ND
35-2293	0435-95-0230	9-10	ND	NA	ND	ND	ND	ND	ND	ND	ND
35-2294	0435-95-0234	0-1	0.14 J	NA	0.022 J	ND	0.26 J	0.21 J	0.2 J	0.023 J	ND
35-2294	0435-95-0235	1-2	ND	NA	ND	ND	0.042 J	ND	ND	ND	ND
35-2294	0435-95-0236	2-2.5	ND	NA	ND	ND	ND	ND	ND	ND	0.065 J

*mg/kg

TABLE 5.4.6-1 (continued)

PRS Nos. 35-003(j and k), 35-014(d), AND 35-015(b) SOIL CONCENTRATIONS* FOR DETECTED ORGANIC CONSTITUENTS

Location ID	Sample ID	Depth (ft)	Chrysene	Di-n-butyl phthalate	Fluoranthene	Fluorene	Methylene chloride	Phenanthrene	Pyrene	TPH	Toluene
SAL	N/A	N/A	24	6500	2600	300	11	N.A.	2000	N.A.	1900
CRQL	N/A	N/A	0.33	0.33	0.33	0.33	0.005	0.33	0.33	5	0.005
35-2081	AAA6366	1.5-2.0	ND	ND	ND	ND	ND	ND	ND	3700 J	0.0067 J
35-2082	AAA6367	1.2-1.5	ND	ND	ND	ND	ND	ND	ND	790 J	ND
35-2084	AAA6373	1.5-1.9	ND	ND	ND	ND	NA	ND	ND	NA	NA
35-2085	AAA6374	1.6-2.1	ND	ND	ND	ND	ND	ND	ND	33 J	ND
35-2086	AAA6375	0-.5	ND	ND	6.7	ND	NA	6.2	8.3	NA	NA
35-2089	AAA6385	0-1	ND	ND	ND	ND	ND	ND	ND	1700 J	ND
35-2089	AAA6386	1-2	ND	ND	ND	ND	ND	ND	ND	310 J	ND
35-2089	AAA6387	2-3	ND	ND	ND	ND	ND	ND	ND	340 J	ND
35-2089	AAA6388	3-4	ND	ND	ND	ND	ND	ND	ND	400 J	ND
35-2089	AAA6390	5-6	ND	ND	ND	ND	ND	ND	ND	ND	ND
35-2090	AAA6391	0-1	ND	ND	ND	ND	ND	ND	ND	1300 J	ND
35-2090	AAA6392	1-2	ND	ND	ND	ND	ND	ND	ND	6.3 J	ND
35-2090	AAA6395	4-5	ND	ND	ND	ND	ND	ND	ND	ND	ND
35-2090	AAA6397	5-6	ND	ND	ND	ND	ND	ND	ND	9.3 J	ND
35-2288	0435-95-0211	1-2	ND	ND	ND	ND	0.004 J	ND	ND	79	ND
35-2288	0435-95-0212	3-4	ND	ND	ND	ND	0.013	ND	ND	<4.5	0.002 J
35-2290	0435-95-0231	0-1	ND	ND	ND	ND	NA	ND	ND	<4.5	NA
35-2290	0435-95-0232	1-2	ND	0.052 J	ND	ND	NA	ND	ND	<4.5	NA
35-2290	0435-95-0233	2-3	ND	ND	ND	ND	NA	ND	ND	<4.5	NA
35-2291	0435-95-0219	1-2	ND	ND	ND	ND	0.018	ND	ND	7700	0.012
35-2291	0435-95-0220	3-4	ND	ND	ND	ND	ND	ND	ND	130	ND
35-2291	0435-95-0221	6-7	ND	ND	ND	ND	NA	ND	ND	<5.0	NA
35-2291	0435-95-0222	9-10	ND	ND	ND	ND	NA	ND	ND	500	NA
35-2292	0435-95-0223	1-2	ND	ND	ND	ND	NA	ND	ND	<4.8	NA
35-2292	0435-95-0224	4-5	ND	ND	ND	ND	NA	ND	ND	<4.5	NA
35-2292	0435-95-0226	9-10	ND	ND	ND	ND	NA	ND	ND	<4.4	NA
35-2293	0435-95-0227	1.5-2.5	0.053 J	ND	0.011 J	ND	NA	0.12 J	0.096 J	130	NA
35-2293	0435-95-0228	3-4	ND	ND	ND	ND	NA	ND	ND	<4.8	NA
35-2293	0435-95-0229	6-7	ND	ND	ND	ND	NA	ND	ND	<4.8	NA
35-2293	0435-95-0230	9-10	ND	ND	ND	ND	NA	ND	ND	<4.7	NA
35-2294	0435-95-0234	0-1	0.280 J	ND	ND	0.13 J	NA	0.77	ND	240	NA
35-2294	0435-95-0235	1-2	0.038 J	ND	0.11 J	ND	NA	0.76	0.082 J	270	NA
35-2294	0435-95-0236	2-2.5	ND	ND	ND	ND	NA	ND	ND	<4.8	NA

*mg/kg

- Pyrene was detected in two samples at two locations at estimated concentrations of 0.096 and 0.082 mg/kg; pyrene was detected in one sample at a third location at a concentration of 8.3 mg/kg.

- Toluene was detected in two samples at two locations at estimated concentrations of 0.0067 and 0.002 mg/kg; toluene was detected in one sample at a third location at a concentration of 0.012 mg/kg.

As discussed above, several initial samples at these PRSs showed evidence of TPH contamination, and estimated concentrations are available for samples sent to a contract laboratory. Because of the TPH contamination, EQLs for the polycyclic aromatic hydrocarbons (PAHs) in these initial samples were sometimes elevated above the contract-required quantitation limit of 0.330 mg/kg. For example, EQLs for benzo(a)pyrene in these 21 samples exceeded 0.330 mg/kg in 10 samples; the maximum EQL was 3.3 mg/kg. For the later samples, PAH EQLs are generally much lower because the contract laboratory was informed of the potential presence of TPH. EQLs in these later samples ranged from 0.370 mg/kg to 0.520 mg/kg.

5.4.7 Human Health Assessment

5.4.7.1 Screening Assessment

Nine inorganic chemicals and 17 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. Chemical carcinogen COPCs are identified in Table 5.4.7-1 and are shown in Figure 5.4.7-1. Sample results that exceeded SAL values are highlighted with black in Table 5.4.7-1.

The MCE results for noncarcinogens and chemical carcinogens were 0.23 and 0.57, respectively. In each case, the result is a value below unity. Therefore, no additional COPCs are identified on the basis of possible additive effects.

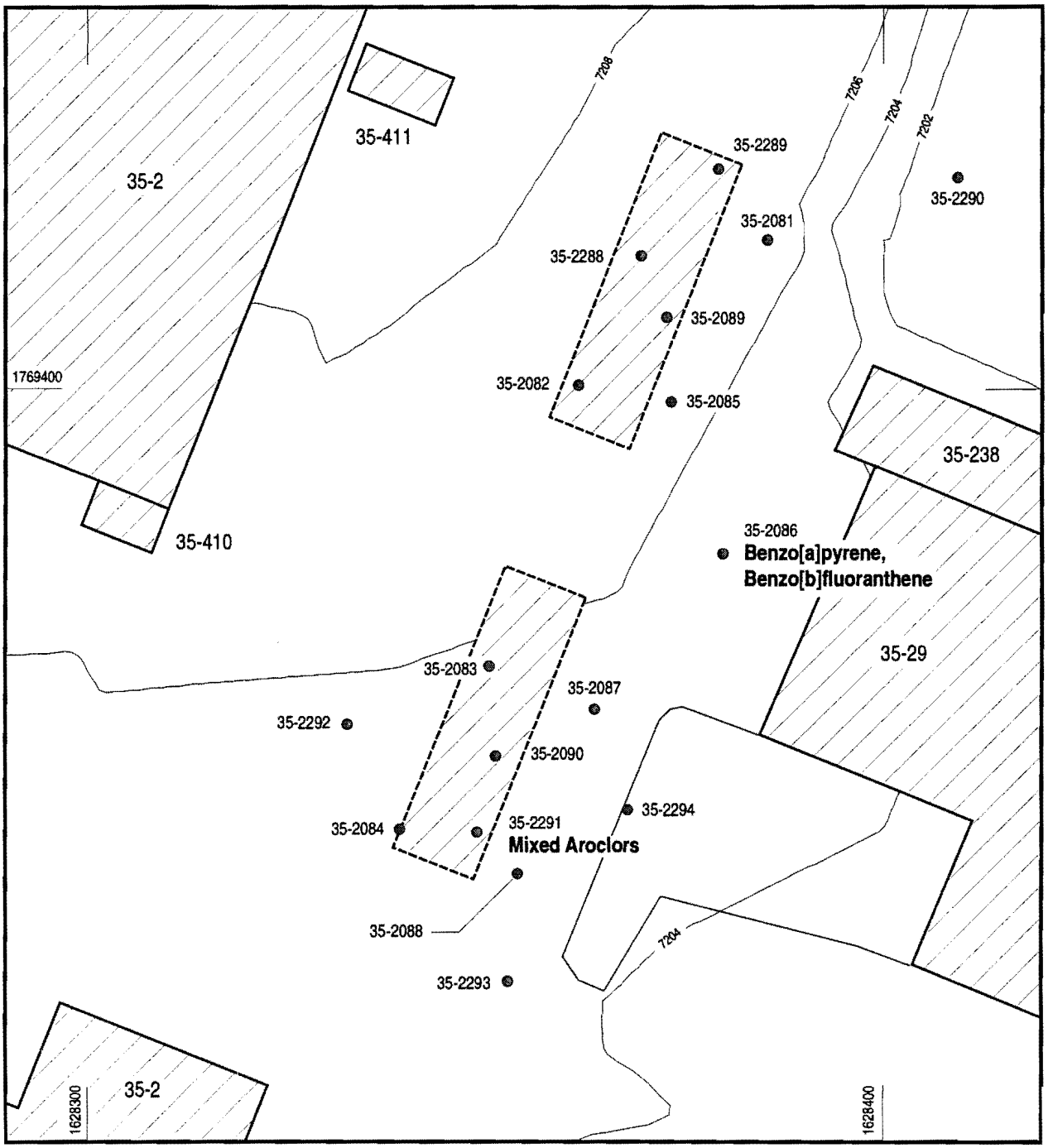
Four organic constituents (acenaphthene, anthracene, chrysene, and fluorene) were not included in the MCE because their SALs are not based on health effects. The SALs for these chemicals are equivalent to their saturation concentration in soil, calculated according to the equation provided in the EPA Region IX preliminary remediation goal (PRG) table (EPA 1995, 53970). The PRG values for residential exposure published in this table have been adopted by the Environmental Restoration (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 these chemicals 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

TABLE 5.4.7-1

PRS Nos. 35-003(j and k), 35-014(d), AND 35-015(b) CARCINOGENIC CONSTITUENTS WITH CONCENTRATIONS* IN SOIL THAT EXCEED SALs

Location ID	Sample ID	Matrix	Depth (ft)	Mixed Aroclors	Benzo[a]pyrene	Benzo[b]fluoranthene
SAL	N/A	N/A	N/A	1	0.061	0.61
I35-2086	AAA6375	Mixed Soil	0-0.5	ND	4	5.6
I35-2291	0435-95-0212	Mixed Soil	1-2	2.9	ND	ND

* mg/kg



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F 5.4.7-1 / TA-35a RFI RPT / 042996

0 10 20 30 40 50

FEET

Coordinates are NMSP NAD-83

N

Building or structure location

Former structure location (approximate)

Sample location

Paved area

Figure 5.4.7-1. Locations of analytes that exceed SALs at PRS Nos. 35-003(j and k), 35-014(d), and 35-015(b).

intake of volatile contaminants via inhalation because that model is not applicable beyond the soil saturation concentration. However, if the four organic constituents named above were included in the MCE calculation using their current SALs, the MCE values for noncarcinogens and chemical carcinogens would still be below unity.

Among the COPCs identified in Sections 5.4.5 and 5.4.6, the following do not have soil SALs for comparison: calcium, magnesium, and phenanthrene. Calcium and magnesium are both essential elements that are generally recognized as nontoxic and can be eliminated on the basis of professional judgment (EPA 1989, 8021). Phenanthrene is structurally similar to pyrene and, like pyrene, is not suspected to be a carcinogen. Phenanthrene was detected in only three samples at a maximum concentration of 6.2 mg/kg, well below pyrene's SAL of 2,000 mg/kg. On the basis of pyrene as a toxicity surrogate, phenanthrene is judged to present no human health risk at these PRSs and is not further evaluated.

An additional analyte for which a SAL is unavailable is TPH. Because TPH may contain a variety of saturated and unsaturated hydrocarbons, human health screening is performed on characteristic chemicals that may be present in TPH and for which toxicity values have been published. These characteristic chemicals, including substituted benzenes and PAHs, were analyzed as part of the VOC and SVOC suites. TPH contamination is discussed further in Section 5.4.9.

5.4.7.2 Risk Assessment

Three COPCs were identified in the screening assessment in Section 5.4.7.1. These COPCs are not proposed for further quantitative evaluation in this section because sufficient information exists, as described below, that these COPCs do not pose a human health threat.

The two PAHs, benzo(a)pyrene and benzo(b)fluoranthene, were detected above their respective SALs in only one sample. This sample, AAA6375, is a surface sample taken in an open drainage that collects surface water runoff from an area including these PRSs. Because the area draining into this swale is almost entirely covered with asphalt, the presence of PAHs in this sample, including two above SALs, is not unusual. The only other samples in which these PAHs were detected (0435-95-0227 and 0435-95-0234) are both near-surface samples that may also have been impacted by PAHs associated with the asphalt covering at this site. Although EQLs for some PAH analyses were elevated above the contract-required detection limit of 0.33 mg/kg, the 26 samples for which TPH analyses were specifically requested generally had EQLs below 0.4 mg/kg. It is concluded that these PAHs are not associated with the dielectric oil contamination at these PRSs; further evaluation of these COPCs is not proposed.

Like benzo(a)pyrene and benzo(b)fluoranthene, Aroclor 1260 was detected above its SAL value in only 1 sample. The concentration of Aroclor 1260 in this sample was approximately three times higher than its SAL value. Exceeding a residential soil SAL in 1 of 29 samples, with only 2 other measurements above detection limits, does not suggest a potential human health concern at an industrial facility such as TA-35. Therefore, additional evaluation of Aroclor 1260 for human health risk will not be pursued.

5.4.8 Ecological Assessment

The general landscape condition around these PRSs is highly developed and disturbed, and a low potential exists for receptors to come in contact with ecological COPCs associated with the site (see Table 2.4-1 in Chapter 2.0 of this RFI report). Therefore, no further ecological evaluation of this site is required.

5.4.9 Extent of Contamination

The extent of contamination at these PRSs has been well determined. The number of individual samples and sample locations for each analyte suite and for TPH are discussed in Sections 5.4.5 and 5.4.6. The extent of TPH contamination is graphically depicted in Figure 5.4.6-1. The SVOC analyte suite has the largest number of

samples: 47 samples at 17 locations. SVOCs were heavily sampled because it was considered feasible that the oil contamination could contain these chemicals. For similar reasons, a large number of PCB samples (29 samples at 12 locations) were also obtained.

TPH originating primarily at the two aboveground dielectric oil storage tanks is the characteristic contamination associated with these PRSs. TPH concentrations are highest near the former location of the two tanks and decrease with distance. In general, TPH concentrations also decrease with depth from the surface. An exception is Location ID No. 35-2291 where TPH concentrations decrease from the surface to 7 ft and then increase in the final interval of 9 to 10 ft. As described in Section 5.4.7, an evaluation of specific analytes does not indicate a potential human health hazard associated with the contamination at these PRSs.

The potential for surface and ground water impacts associated with the TPH contamination in soil below the asphalt covering the area at these PRSs was evaluated by the Laboratory's Water Quality and Hydrology group (ESH-18). It was determined that the migration potential for TPH at these PRSs is minimal, particularly because the area is covered with asphalt (Pratt 1996, 53462).

5.4.10 Conclusions and Recommendations

These sites are not likely to pose a significant human health or ecological risk.

The objective of the Phase I RFI at PRS Nos. 35-003(j and k), 35-014(d), and 35-015(b) was to determine the presence or absence of dielectric oil contamination associated primarily with the two aboveground storage tanks. The potential human health impacts associated with the COPCs identified in the screening assessment were qualitatively evaluated in Section 5.4.7.2. Based on the observed soil concentrations, frequencies of detection, and other considerations, the COPCs were determined to pose a negligible threat to human health under exposure conditions associated with an industrial facility such as TA-35.

Samples for specific analytes were collected at and adjacent to locations where the storage tanks, which are the source of oil contamination at these PRSs, were located. A potential human health risk has not been identified on the basis of the sample data. Because these sample locations were biased to identify areas where high levels of contaminants might exist, it is concluded that the extent of contamination has been determined for the purposes of human health risk characterization.

Samples have revealed the presence of hydrocarbon contamination in the areas where the storage tanks were located. As described in Section 5.4.9, data indicate that TPH concentrations decrease with distance from the historical location of the tanks. However, there is an anomaly at Location ID No. 35-2291 where TPH concentrations decrease from 7,700 parts per million (ppm) to below the detection limit in the first three vertical sample intervals and then return to 500 ppm in the final interval at 9 to 10 ft. Although a definitive explanation for this observation is unavailable, a similar phenomena was not observed in any of the several other boreholes where samples were taken at various depths. Therefore, it is concluded that for the purposes of this RFI report the areal and vertical extent of TPH contamination have been identified.

Based on NFA criterion number 4, a Class III permit modification is requested to remove PRS Nos. 35-003(j and k) and 35-015(b) from the HSWA Module of the Laboratory's RCRA operating permit. Based on NFA criterion number 4, PRS No. 35-014(d) will not be added to the HSWA Module of the Laboratory's RCRA operating permit, and it is proposed for removal from the ER Project list of PRSs. The size, location, and operational history of these PRSs and the available sample data indicate that these sites are not likely to pose a significant human health or ecological risk under continuing industrial land use now or in the foreseeable future.

5.5 PRS No. 35-003(r)

Results of the Phase I RFI and the SAP for further investigation at PRS No. 35-003(r) will be presented in a subsequent RFI report, which will be submitted on June 5, 1996.

5.6 PRS No. 35-004(b)

PRS No. 35-004(b) is an active container storage area located at the northeast corner of the Chemical Laser Facility (TA-35-85). Containers including drums, buckets, gas cylinders, and pallets have been stored at the site.

No COPCs were identified during the screening assessment. Copper and lead were measured slightly above background levels. No organic compounds were reported above the detection level in any sample.

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

Radiological sample results are not presented or 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 5.6.4.3.

5.6.1 History

PRS No. 35-004(b) is discussed in detail in Section 3.3.2 of the work plan and Section 7.25 of the June 1994 addendum to the work plan (LANL 1992, 7666; Pratt 1994, 43475).

Archival photographs from 1974 show that the pad for TA-35-85 was being put in place at that time. The container storage area has been used to store acetone, alcohol, solvents, oils, VOCs, and rags. It has probably been in use since the completion of TA-35-85 in 1977. During an ER Project site reconnaissance in 1988, oil stains were reported at this PRS, which were probably located on the asphalt (LANL 1992, 7666).

The contaminants that were potentially present include VOCs, SVOCs, metals, and PCBs.

5.6.2 Description

PRS No. 35-004(b) is an asphalt-paved container storage area approximately 25 ft wide and 35 ft long located about 10 ft from the northern edge of Ten Site Mesa. The PRS is located adjacent to a loading door on the east exterior wall of TA-35-85. A temporary metal storage building (TA-35-412), which houses a compressor, is located at the site. Photographs from 1986 confirm the presence of the asphalt-covered container storage and loading area where this PRS is located. Because the area is used for loading and thus receives truck traffic, it is likely that the asphalt has been in place since the building was first erected. The topography of the area is relatively flat and drains northward onto backfill soil material at the edge of the mesa.

5.6.3 Previous Investigations

No previous investigations have been performed at this site.

5.6.4 Field Investigation

The objective of the Phase I RFI was to determine 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. Two hand-auger holes were located in soil materials at the edge of 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 Hazco 1256 OVA, a Ludlum Model 39 alpha meter, and an Eberline ESP-1 beta/gamma meter. Using this instrumentation, background radiation measurements at TA-35 ranged 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 8, 1994. Beta/gamma radiation measurements ranged from 206 to 210 cpm, and the average was 197 cpm, which is within background levels.

Engineering surveys were performed from September 8, 1994, through September 12, 1994, and on March 10, 1995. The surveys consisted of reviews of archival information, oblique photographs, aerial photographs, 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, a few 6-in.-diameter oil stains were observed on the asphalt, but no significant spills or stains were noted. Several empty 42-gal. and 55-gal. drums were present, and a compressor was noted in TA-35-412. Two surface drainage pathways from the storage site were located, and the sample sites were staked in the surface drainage pathways at the edge of the asphalt.

The radiation grid survey was performed on September 9, 1994. The radiation grid locations included Location ID Nos. 35-7637 through 35-7660, which were spaced at approximately 20-ft intervals. Beta/gamma radiation measurements ranged from 182 to 304 cpm, and the average was 228 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 March 27, 1995. Six soil samples were collected (not including duplicate QA/QC samples). Two hand-auger holes (Location ID Nos. 35-2120 and 35-2121) were drilled to a depth of 3 ft. 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 186 to 282 cpm, which are within background levels.

Table 5.6.4-1 summarizes all sampling for PRS No. 35-004(b); Figure 5.6.4-1 shows the sample locations.

TABLE 5.6.4-1

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

Location ID	Sample ID	Depth (ft)	Matrix	VOC Mobile Lab	VOC Fixed Lab	PAH Mobile Lab	SVOC Fixed Lab	PCB Mobile Lab	INORG Mobile Lab	INORG Fixed Lab
35-2120	AAC1285	0-1	mixed soil	21673	NR	21673	NR	21675	21673	NR
35-2120	AAC1286	1-2	mixed soil	21673	NR	21673	NR	21675	21673	NR
35-2120	AAC1287	2-3	mixed soil	21673	NR	21673	NR	21675	21673	NR
35-2121	AAC1288	0-1	mixed soil	21675	NR	21675	NR	21675	21675	21675
35-2121	AAC1289	1-2	mixed soil	21673	NR	21673	NR	21675	21675	NR
35-2121	AAC1290	2-3	mixed soil	21673	21673	21673	21673	21673	21673	NR

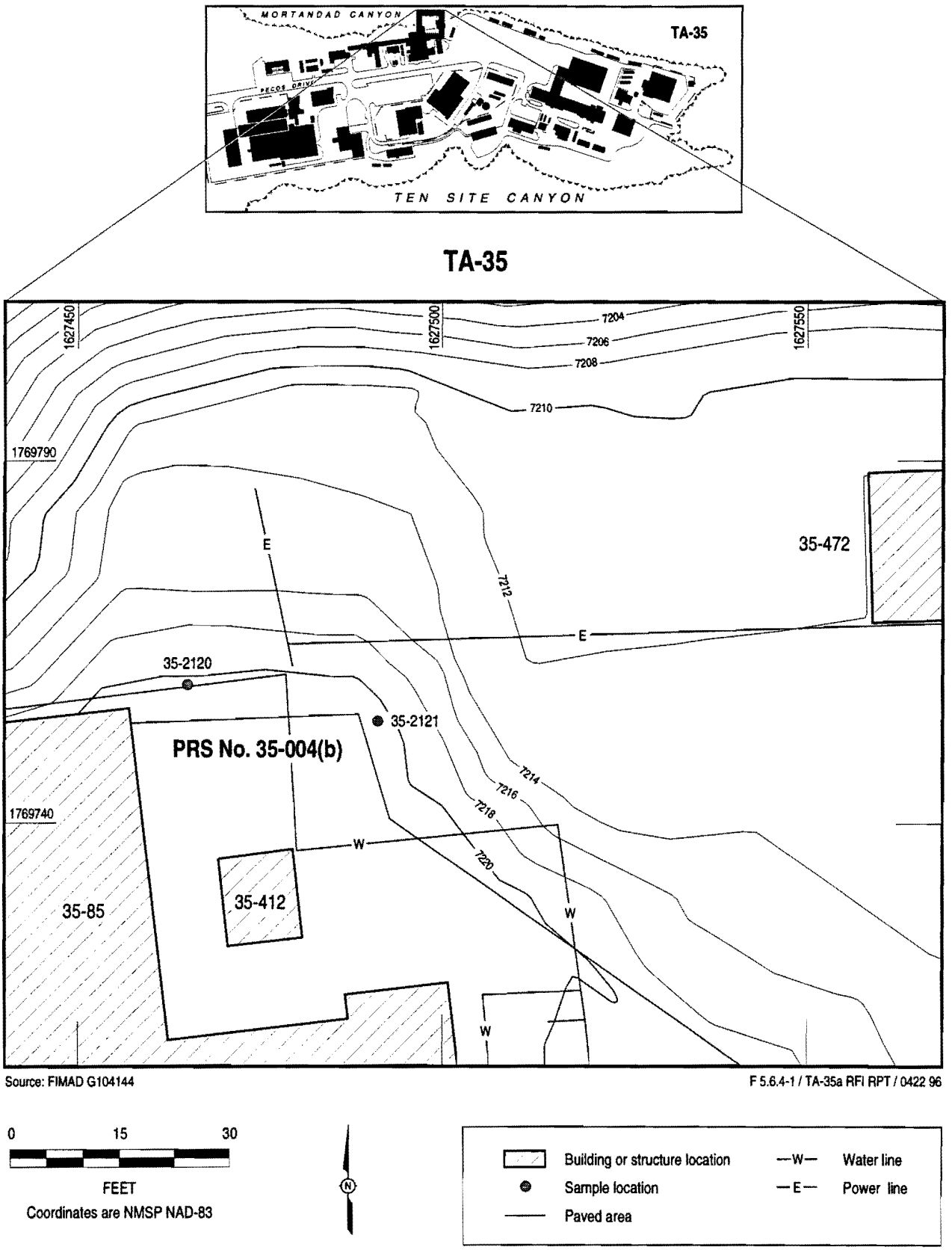


Figure 5.6.4-1. Locations of samples at PRS No. 35-004(b).

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 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.

Six soil samples from two hand-auger holes were analyzed by XRF in the mobile laboratory facility for an analyte suite that included antimony, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, mercury, manganese, nickel, potassium, selenium, thorium, titanium, uranium, and zinc. One sample collected in a 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, cobalt, copper, iron, lead, lithium, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, sodium, strontium, thallium, vanadium, and zinc using the EPA methods described in Section 3.1.1 in Chapter 3.0 of this RFI report.

The sample matrices consisted of clayey backfill and clay with cobbles. In Table 5.6.5-1, the values in the boxes indicate inorganic chemicals that were detected in soil at concentrations greater than or equal to their respective UTLs. The highest observed concentrations above background levels at each location are shown in Figure 5.6.5-1 and are summarized below.

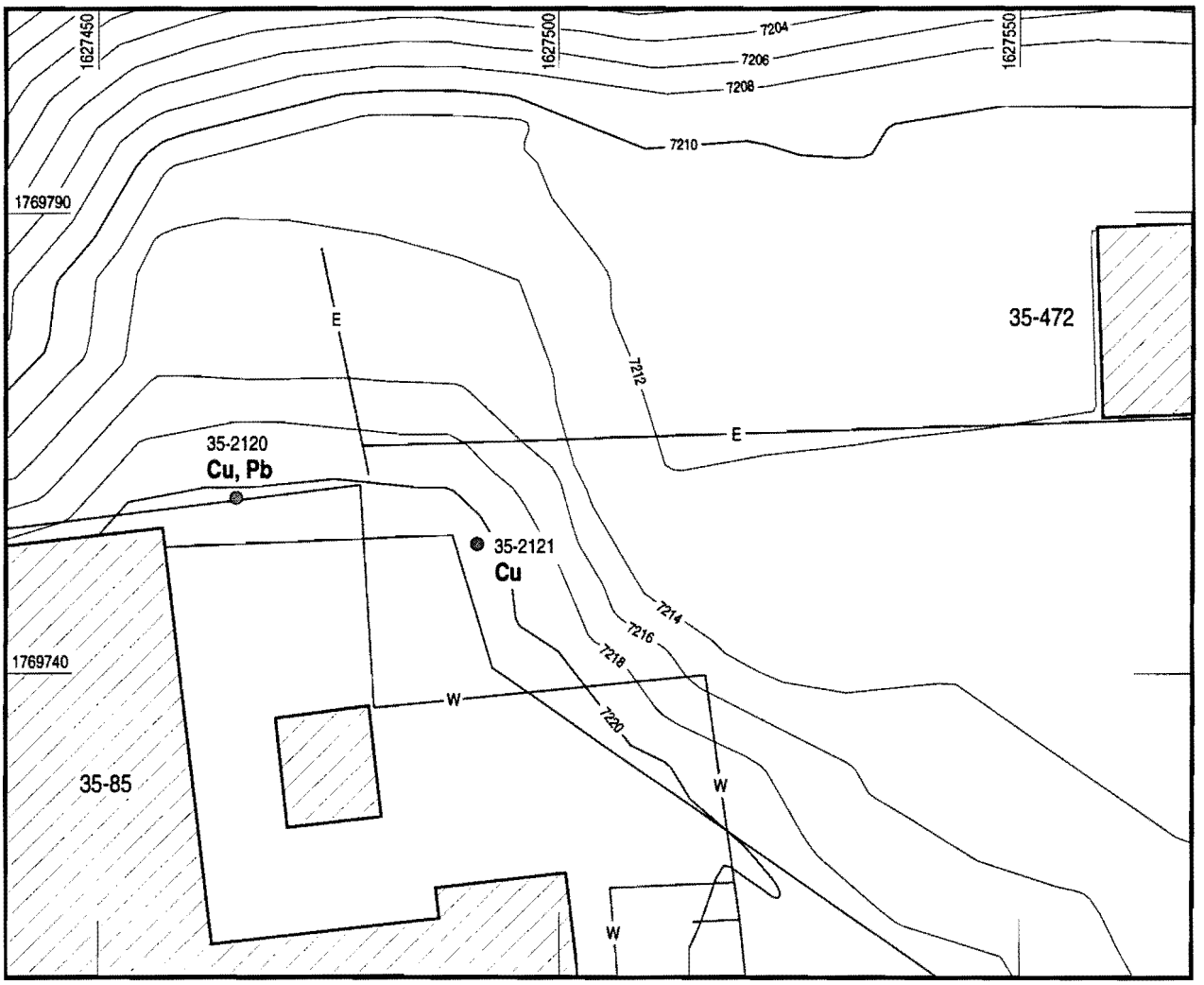
- Copper was detected in two samples at concentrations of 17 and 30.1 mg/kg, which are above the XRF UTL of 16.7 mg/kg. Copper was also detected in one sample at a concentration of 17.1 mg/kg, which is above the mixed-soil UTL of 15.5 mg/kg.
- Lead was detected in one sample at a concentration of 29 mg/kg, which is slightly above the XRF UTL of 28.4 mg/kg.

TABLE 5.6.5-1

INORGANIC CONSTITUENTS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTL FOR PRS No. 35-004(b)

Location ID	Sample ID	Depth (ft)	Ag	Cd	Cu	Hg	Pb	Sb	Se	Ti	Tl	U
SAL	N/A	N/A	383	38	2800	23	400	31	380	N.A.	N.A.	230
Mixed soil UTL	N/A	N/A	N.A.	2.7	15.5	0.1	23.3	1	1.7	N.A.	1	5.5
XRF UTL	N/A	N/A	N/A	N.A.	16.7	N.A.	28.4	N.A.	N.A.	N.A.	N.A.	5.3
35-2120	AAC1285	0-1	NA	<3	17	<5	29	<4	<4	2217	NA	<8
35-2120	AAC1286	1-2	NA	<3	8.35	<5	19	<4	<4	2027	NA	<8
35-2120	AAC1287	2-3	NA	<3	30.1	<5	26	<4	<4	2206	NA	<8
35-2121	AAC1288	0-1	<.32	<.09	17.1	<.12	16	<.5 UJ	<1.1	4226	<1.1	<8
35-2121	AAC1289	1-2	NA	<3	11.3	<5	21	<4	<4	2540	NA	<8
35-2121	AAC1290	2-3	NA	<3	10.4	<5	28	<4	<4	1934	NA	<8

*mg/kg



Source: FIMAD G104144

F 5.6.5-1 / TA-35a RFI RPT / 040796

Figure 5.6.5-1. Locations of analytes that exceed UTLs at PRS No. 35-004(b).

Attachment I of this RFI report shows distribution plots, which indicate that copper (Figure AI-6) and lead (Figure AI-2) failed statistical tests. The t-test and the gehan background comparison tests failed for copper. The t-test and the gehan and quantile background comparison tests failed for lead. Both copper and lead were carried forward to the screening assessment.

5.6.6 Evaluation of Organic Constituents

The organic chemicals analyzed for at this PRS include VOCs, SVOCs, PAHs, and PCBs. Six soil samples from two hand-auger holes were analyzed for VOCs, PAHs, and PCBs in the mobile laboratory facility. A sample collected in the 1- to 2-ft interval was analyzed for SVOCs and VOCs in a fixed-site laboratory. No organic chemical was detected in any soil sample.

5.6.7 Human Health Assessment

5.6.7.1 Screening Assessment

Two inorganic chemicals (copper and lead) 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 0.09. Because no chemical carcinogens were identified as COPCs in Sections 5.6.5 and 5.6.6, an MCE calculation for chemical carcinogens was not performed.

No COPCs are identified in the human health screening assessment. All the COPCs 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.

5.6.8 Ecological Assessment

The general landscape condition around this PRS is moderately developed and disturbed, and a moderate potential exists for receptors to come in contact with chemicals above background levels associated with the site (copper and lead) (Table 5.6.5-1). Therefore, this PRS will be included as a potential contaminant source in the ecological risk assessment. An ecological risk assessment will be conducted when that approach has been approved by the regulators. Threatened and endangered species and/or sensitive habitat listed in Chapter 2.0 of this RFI report will be evaluated in the ecological risk assessment.

5.6.9 Extent of Contamination

The samples were collected from two hand-auger holes drilled north of the container storage area in the path of surface water runoff. The hand-auger locations were biased to identify contaminants carried with runoff from possible spills in the container storage area. Soil adjacent to the asphalt-covered storage area, where surface

water runoff drains from the asphalt, is thus an appropriate location to collect biased samples. Because COPCs were not identified in the screening assessment at these locations, it is concluded that significant environmental contamination associated with this PRS has not occurred.

5.6.10 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(b) was to determine the presence or absence of contamination associated with the container storage area adjacent to TA-35-85. The area has been used to store acetone, oils, and various volatile organic liquids. No organic chemicals were measured above EQL values, and no COPCs were identified in the human health screening assessment.

The extent of contamination has been determined. Samples for specific analytes were collected where contaminants would be most likely to be observed in site soils today.

Based on NFA criterion number 4, a Class III permit modification is requested to remove PRS No. 35-004(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. The site data will be retained for an area-wide ecological assessment, as described in Section 5.6.8.

5.7 PRS No. 35-016(e)

PRS No. 35-016(e) is the site of an inactive, noncontact cooling water outfall located north of the Chemical Laser Facility (TA-35-85) on the north edge of Ten Site Mesa.

No COPCs were identified during the screening assessment. Chromium, copper, lead, nickel, and thorium were measured above background levels.

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

Radiological sample results are not presented or 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(e) is discussed in detail in Section 3.3.2 of the work plan and in Section 7.25 of the June 1994 addendum to the work plan (LANL 1992, 7666; Pratt 1994, 43475).

The two pipes that compose the outfall were installed in 1977 when TA-35-85 was constructed. The exact dates of discharge from the outfall are not known, but TA-35-85 operated from about 1977 until the early 1990s. Also, the volume of water that was discharged from the outfall is not known, but erosion of the backfill material near the edge of the mesa suggests that the outfall discharged enough water to cause significant erosion.

The contaminants that were potentially present include gross-alpha, -beta, and -gamma radiation; VOCs; SVOCs; metals; and PCBs.

5.7.2 Description

The outfall consists of two adjacent 2-in.-diameter pipes that originate from cooling towers on the roof of TA-35-85. The pipes extend down the exterior side of the building, along the surface of the backfill material adjacent to the building, to the edge of Ten Site Mesa about 15 ft north of the building.

The PRS is located on the very steep north side of Ten Site Mesa (which has a slope of about 70%) and extends down the mesa slope for 20 to 50 ft. The upper mesa edge is composed of backfill material of cobble-sized tuff that extends from the edge of the mesa down the slope about 30 ft. Bedrock tuff is present on the edge of the mesa below the backfill material. The ground surface is covered with grasses and shrubs, a few pine trees, pine needle debris, and leaves. Drainage from the outfall and from the surface area around the outfall flows northward into Mortandad Canyon. 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 constituents 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 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 associated with this PRS, 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 Hazco 1256 OVA, a Ludlum Model 39 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 Survey

The H&S radiation survey was performed on September 8, 1994. Beta/gamma radiation measurements ranged from 157 to 218 cpm, which are within background levels.

The engineering surveys were performed from September 8, 1994, through September 12, 1994, and on March 10, 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 directly below the outfall, and the hand-auger hole was located about 15 ft below the outfall.

The results of the engineering surveys revealed that the outfall comprises two steel pipes that are insulated with fiberglass and wrapped with a protective aluminum coating. The pipes extend across the surface of the mesa and over the edge. The flow from the pipes has eroded the backfill material at the edge of the mesa into a small washout, and the edge of the mesa has retreated about 6 ft at the outfall. Several lengths of insulated pipe lie in the bottom of the washout, which is evidence that the pipes once extended farther to the former mesa edge. Asphalt rip-rap has been placed in the washout to deter additional erosion of the channel.

The radiation grid survey was performed on June 8, 9, and 10, 1994. The radiation grid locations included Location ID Nos. 35-7172 through 35-7362, which were spaced at approximately 20-ft intervals. Beta/gamma radiation measurements ranged from 137 to 295 cpm, and the average was 210 cpm, which is within background levels. An environmental survey was performed on June 17, 1994. As part of the environmental survey, an OVA survey was performed using the grid locations established for the radiation grid survey.

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 March 24, 1995. Four soil samples were collected (not including duplicate QA/QC samples). One surface soil sample was collected (Location ID No. 35-2152), and one hand-auger hole was drilled (Location ID No. 35-2153). The hand-auger hole was drilled to a depth of 3 ft, and three soil samples were collected. 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 159 to 282 cpm, which are within background levels.

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

TABLE 5.7.4-1

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

Location ID	Sample ID	Depth (ft)	Matrix	VOC Mobile Lab	VOC Fixed Lab	PAH Mobile Lab	PCB Mobile Lab	INORG Mobile Lab	Rad Van
35-2152	AAC1291	0-0.5	mixed soil	21665	NR	21665	21665	21666	21664
35-2153	AAC1292	0-1	mixed soil	21665	NR	21665	21665	21666	21664
35-2153	AAC1293	1-2	mixed soil	21665	NR	21665	21665	21666	21664
35-2153	AAC1294	2-3	mixed soil	21655	21659	21665	21665	21666	21664

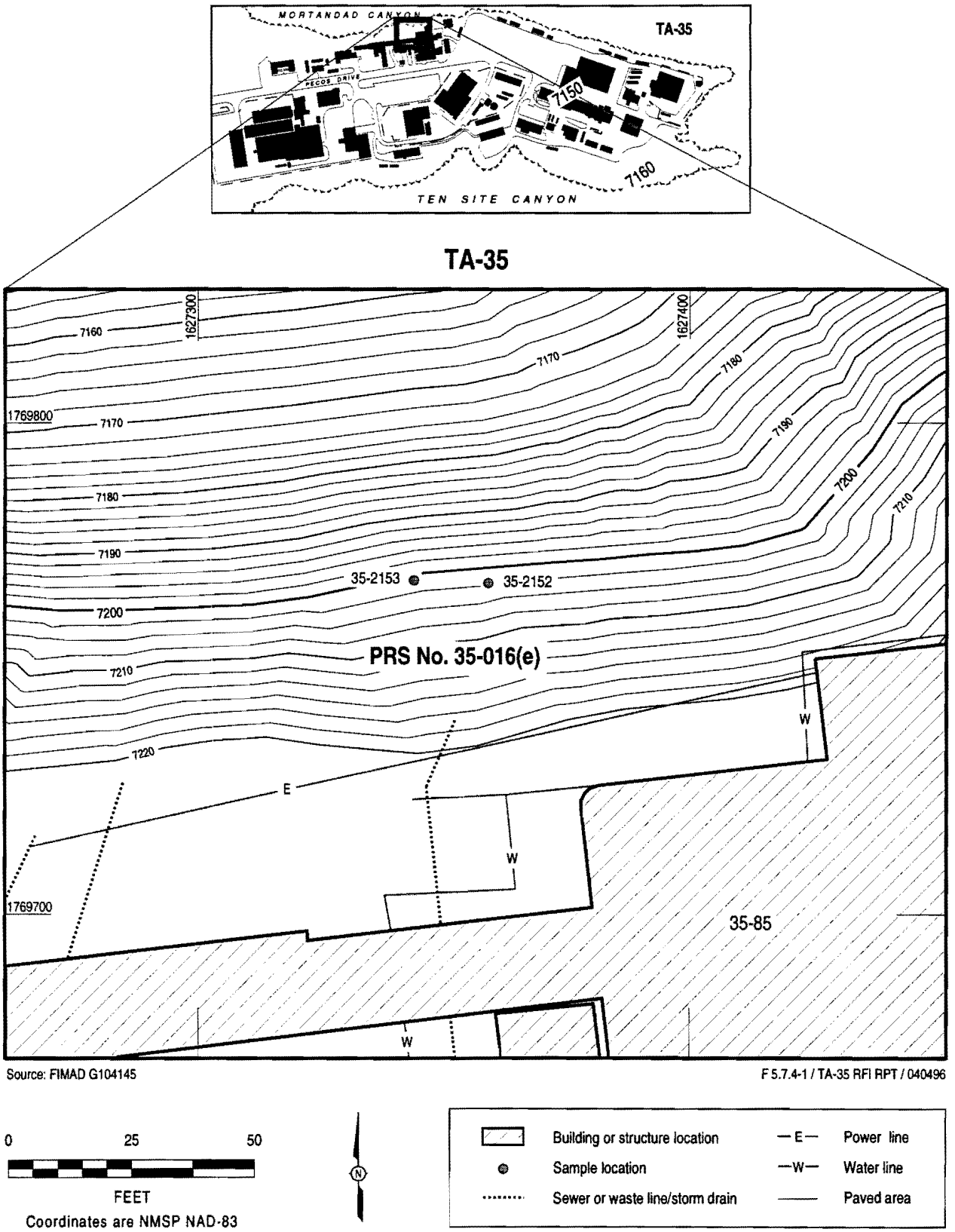


Figure 5.7.4-1. Locations of samples at PRS No. 35-016(e).

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. Inorganic chemicals were 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.

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, mercury, manganese, nickel, potassium, selenium, thorium, titanium, uranium, and zinc. Samples were collected in 0.5-ft or 1-ft vertical intervals.

The sample matrices consisted of sandy backfill and clayey soil. In Table 5.7.5-1, the values in the boxes indicate inorganic chemicals that were detected in soil at concentrations greater than or equal to their respective XRF UTLs. The highest observed concentrations above background levels at each location are shown in Figure 5.7.5-1 and are summarized below.

- Chromium was detected in two samples at one location at a maximum concentration of 71.8 mg/kg, which is above the XRF UTL of 45.1 mg/kg.
- Copper was detected in one sample at a concentration of 19.1 mg/kg, which is above the XRF UTL of 16.7 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.
- Lead was detected in one sample at a concentration of 29.7 mg/kg, which is slightly above the XRF UTL of 28.4 mg/kg.
- Thorium was detected in one sample at a concentration of 23.8 mg/kg, which is slightly above the XRF UTL of 22.1 mg/kg.

Attachment I of this RFI report shows distribution plots, which indicate that only chromium (Figure AI-5) failed the statistical tests (t-test, gehan, and quantile). Chromium was carried forward to the human health screening assessment.

TABLE 5.7.5-1

INORGANIC CONSTITUENTS WITH CONCENTRATIONS*
GREATER THAN BACKGROUND UTL FOR PRS No. 35-016(e)

Location ID	Sample ID	Depth (ft)	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Th	Ti	U
SAL	N/A	N/A	38	210	2800	23	1500	400	31	380	N.A.	N.A.	230
Mixed soil UTL	N/A	N/A	N.A.	45	16.7	0.1	22.5	28	1.5	N.A.	23	N.A.	5.5
XRF UTL	N/A	N/A	N.A.	45.1	16.7	N.A.	22.5	28.4	N.A.	N.A.	22.1	N.A.	5.3
35-2152	AAC1291	0-.5	<3	<12	8.99	<5	<13	21	<4	<4	<8	1916	<8
35-2153	AAC1292	0-1	<3	40	19.1	<5	27.2	29.7	<4	<4	23.8	2132	<8
35-2153	AAC1293	1-2	<3	48	<8	<5	<13	20	<4	<4	13	1837	<8
35-2153	AAC1294	2-3	<3	71.8	<8	<5	13.7	18	<4	<4	13	1809	<8

*mg/kg

Source: FIMAD G104145

F 5.7.5-1 / TA-35a RFI RPT / 040796

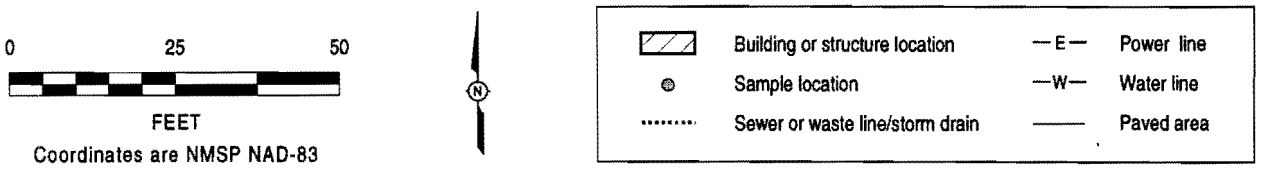


Figure 5.7.5-1. Locations of analytes that exceed UTLs at PRS No. 35-016(e).

5.7.6 Evaluation of Organic Constituents

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

No target analytes were detected in any sample. Petroleum hydrocarbons (in the C_{10} to C_{20} range) were reported in the surface sample at Location ID No. 35-2152 at an estimated level of 190 mg/kg. The hydrocarbon contamination was detected in the PAH analysis of this sample at the mobile laboratory facility.

5.7.7 Human Health Assessment

5.7.7.1 Screening Assessment

Five inorganic chemicals were carried forward from the background comparison. 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.

No sample results for any chemical exceeded SAL values at this PRS. The MCE result for noncarcinogens was 0.10. 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 COPCs identified in the background comparison in Section 5.7.5 except thorium have soil SALs for comparison. Thorium was measured above its XRF UTL value in only one of four samples, and at a concentration just 10% higher than the UTL. Therefore, additional evaluation of thorium is not proposed.

An analyte for which a SAL is unavailable is TPH. Because TPH may contain a variety of saturated and unsaturated hydrocarbons, human health screening is performed on characteristic chemicals that may be present in TPH and for which toxicity values have been published. These characteristic chemicals, including substituted benzenes and PAHs, were analyzed for as part of the VOC and PAH suites.

The only 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. Therefore, further evaluation of titanium is not proposed.

5.7.7.2 Risk Assessment

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

5.7.8 Ecological Assessment

The general landscape condition around this PRS is moderately developed and disturbed, and a high potential exists for receptors to come in contact with chemicals above background levels associated with the site (chromium, copper, lead, nickel, and thorium) (Table 5.7.5-1). Therefore, this PRS will be included as a potential contaminant source in the ecological risk assessment. An ecological risk assessment will be conducted when that approach has been approved by the regulators. Threatened and endangered species and/or sensitive habitat listed in Chapter 2.0 of this RFI report will be evaluated in the ecological risk assessment.

5.7.9 Extent of Contamination

Chemicals were identified above UTL values at this PRS, as shown in Figure 5.7.5-1. The sampling sites were selected based on the assumption that contaminants released with outfall water would remain in soils near the discharge point. However, it is also likely that contamination released into the outfall has been carried down the outfall drainage with discharge water and deposited in sediments on canyon wall benches or carried to the main channel in Mortandad Canyon.

Although the extent of contamination cannot be defined with certainty based on existing samples, additional sampling in the outfall drainage is not proposed. The hand-auger sample was located in the area of the drainage where settlement was likely to occur. Contaminant concentration in discharge water was not sufficiently high to result in identification of risk-based COPCs in soils at the hand-auger location. The likelihood of observing higher soil concentrations at a more distant location is low because pollutant concentrations generally decrease with distance from a release site. However, even if sediment depositional patterns were to result in higher contaminant concentrations at a specific location away from the outfall, it is unlikely that these concentrations would present unacceptable human health risks because of the low exposure frequency associated with areas such as drainages on canyon walls.

5.7.10 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(e) was to determine the presence or absence of contamination associated with the inactive outfall that discharged noncontact cooling water from TA-35-85. 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 at concentrations of human health concern has not occurred.

Based on NFA criterion number 4, PRS No. 35-016(e) will not be added to the HSWA Module of the Laboratory's RCRA operating permit, and it is proposed for removal from the ER Project list of PRSs. The sample data indicate that this site is not likely to pose a significant human health risk now or in the foreseeable future. The site data will be retained for an area-wide ecological assessment, as described in Section 5.7.8.

5.8 PRS No. 35-009(a)

PRS No. 35-009(a) is an abandoned sanitary septic system that served building TA-35-2 and the associated buildings at the southeastern portion of TA-35. Structures associated with the PRS include a 1,500-gal. septic tank (TA-35-14), a dosing chamber (TA-35-15), a distribution box (TA-35-16), and the leach field.

No COPCs were identified during the screening assessment. Aluminum, chromium, copper, lead, nickel, uranium, and zinc were measured above background levels. Bis(2-ethylhexyl)phthalate and diethyl phthalate were the only organic chemicals detected above EQL values.

PRS No. 35-009(a) is recommended for NFA based on NFA criterion number 4 (LANL 1995, 53863).

Radiological sample results are not presented or 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 5.8.4.3.

5.8.1 History

PRS No. 35-009(a) is discussed in detail in Sections 3.3.2 and 7.10 of the work plan (LANL 1992, 7666).

The septic system was installed in 1951 and was abandoned in place in 1975 when new sanitary sewer lines were routed to the new sewage lagoons in the canyon east of TA-35. The septic system was a gravity flow system that handled sanitary wastes from various laboratory buildings at TA-35 and may have received a variety of industrial wastes including radionuclides. Specific information concerning waste streams introduced to the septic system is not available.

During the engineering survey, the leach field was found to comprise three drain lines south of building TA 35-236. Archival information indicated that this leach field had previously been "daylighted" (LANL 1992, 7666). It was apparent from the engineering surveys that portions of the leach field filter bed material and the outfall drain lines had been excavated and removed during past decommissioning operations. The drain lines and the covering filter bed material may have been left in place when most of the filter bed material was excavated.

The contaminants that were potentially present include gross-alpha, -beta, and -gamma radiation; VOCs; SVOCs; and metals.

5.8.2 Description

The septic tank and dosing chamber are located in an asphalt driveway southwest of building TA-35-34. They are buried about 4 ft beneath the fill material. Access is accomplished through a 2.5-ft-diameter manhole and a 4-ft vertical corrugated metal pipe. The tanks are made of steel or steel-lined concrete. They are about 10 ft long by 4 ft wide and may be about 5 ft deep.

The distribution box is located south of the southern TA-35 access road about 90 ft south of the septic tanks. The distribution box leads to three leach field drain lines in a filter bed near the southern edge of Ten Site Mesa. The filter bed covered an area about 6,000 ft^2. The apparent ends of the drain lines are marked by 4-in.-diameter vitrified clay pipe vents that are located near the end of long, narrow, earthen mounds, which are probably composed of filter bed material. No outfall drain lines from the leach field were found during the investigation. The drain lines, if present, may have been removed with the filter bed material.

The topography of the area slopes moderately southward toward the edge of Ten Site Mesa. The septic tank area is covered with asphalt, whereas vegetation in the leach field consists of scrub oak brush, grasses, and ponderosa pine. No natural water courses are defined within the PRS, although two natural storm-water surface drainage channels drain the leach field southward toward Ten Site Canyon.

5.8.3 Previous Investigations

No previous investigations have been performed at this site.

5.8.4 Field Investigation

The objective of the Phase I RFI was to characterize the nature of potential contamination released from the septic system.

The conceptual model for the RFI did not predict that hazardous constituents were released to the environment even though they were present at the PRS. The conceptual model predicted that if a release occurred from the site, evidence of the release may be found in the subsurface soils immediately adjacent and downgradient from the septic tank, dosing chamber, distribution box, leach field, and outfall. Therefore, a judgmental sampling approach was used, and the sampling activities were biased toward areas where residual contamination was expected to occur.

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 Hazco 1256 OVA, a Ludlum Model 39 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 December 6, 1993. Beta/gamma radiation measurements ranged from 116 to 300 cpm, and the average was 200 cpm, which is within background levels.

Engineering surveys were performed on December 6, 7, and 28, 1993, and January 3, 1994. The surveys consisted of a field site inspection, archival document review, and utility mark-out before drilling. During the surveys, three leach field drain lines were identified south of TA-35-236. The areas between the drain lines appear to have been scraped down to bedrock. The results of the surveys confirmed that the leach field had previously been "daylighted" and that portions of the leach field had been excavated and removed during past decommissioning operations. Two surface water drainage channels that drain the leach field were located at the edge of the mesa, but no outfall pipelines were found. Water was found to be present in the septic tank and dosing chamber.

The radiation grid survey was performed on December 8, 1993. A total of 42 radiation measurements were obtained from grid Location ID Nos. 35-6035 through 35-6076. Grid locations were spaced at 10-ft intervals in the septic tank area and 20-ft intervals in the leach field. Beta/gamma radiation measurements ranged from 160 to 300 cpm, and the average was 200 cpm, which is within background levels.

5.8.4.2 Deviations from the Sampling and Analysis Plan

The original SAP is described in Section 7.10 of the work plan (LANL 1992, 7666). However, the SAP was modified based on information gathered during the engineering surveys. The changes to the SAP, which are summarized below, are documented in the January 4, 1994, memorandum to the Operable Unit 1129 file (Koch 1994, 46226).

During the engineering survey performed on December 6, 1993, three leach field drain lines were identified as part of PRS No. 35-009(a). Two additional boreholes (Location ID Nos. 35-2221 and 35-2222) were located in the leach field so that each leach field drain line could be appropriately sampled. The boreholes originally planned for the leach field were relocated to accommodate the new sampling strategy.

Two obvious surface drainage channels that drain the leach field southward to Ten Site Canyon were found during the engineering survey performed on December 7, 1993. These drainage channels may have acted as natural outfalls for the leach field; therefore, two surface soil samples (Location ID Nos. 35-2223 and 35-2224) were added to collect sediment from the drainage channels below the leach field. During the engineering survey conducted on December 28, 1993, liquid was found in the dosing chamber; therefore, a water sample was added.

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 from December 9, 1993, through January 19, 1994. A total of 11 locations were sampled, and 41 samples were collected: 1 water sample, 2 surface soil samples, and 38 subsurface soil samples (not including duplicate QA/QC samples). Eight boreholes were drilled to a depth of 20 ft. The sample collection intervals are shown in Table 5.8.4-1.

TABLE 5.8.4-1

SUMMARY OF SAMPLES TAKEN AT PRS No. 35-009(a)

Location ID	Sample ID	Depth (ft)	Matrix	SVOC Mobile Lab	SVOC Fixed Lab	INORG Mobile Lab	INORG Fixed Lab	Rad Van	Rad Fixed Lab
35-2033	AAA6417	7-8	Qbt3	16641	NR	16636	NR	16653	16635
35-2033	AAA6418	12-13	Qbt3	16641	NR	16636	NR	16653	16635
35-2033	AAA6419	16-17	Qbt3	16641	NR	16636	NR	16653	16635
35-2034	AAA6420	5.5-6.5	Qbt3	16641	NR	16636	NR	16653	16635
35-2034	AAA6421	13.5-14.5	Qbt3	16641	16645	16636	16637	16653	16635
35-2034	AAA6422	19-20	Qbt3	16641	NR	16636	NR	16653	16635
35-2035	AAA6381	1.5-2.5	mixed soil	NR	16470	NR	16518	16523	16522
35-2035	AAA6382	8.8-9.8	mixed soil	NR	16470	NR	16518	16523	16522
35-2035	AAA6383	14-15	Qbt3	NR	16470	NR	16518	16523	16522
35-2035	AAA6384	17.5-18.7	Qbt3	NR	16470	NR	16518	16523	16522
35-2036	AAA6401	0-1.1	mixed soil	NR	16470	NR	16518	16523	16522
35-2036	AAA6402	7.4-8.4	Qbt3	NR	16470	NR	16518	16523	16522
35-2036	AAA6403	14.2-15	Qbt3	NR	16470	NR	16518	16523	16522
35-2036	AAA6404	19-20	Qbt3	NR	16470	NR	16518	16523	16522
35-2037	AAA6429	3-4	mixed soil	NR	16470	NR	16518	16523	16522
35-2037	AAA6430	9-10	Qbt3	NR	16470	NR	16518	16523	16522
35-2037	AAA6431	13-14	Qbt3	NR	16470	NR	16518	16523	16522
35-2037	AAA6432	19-20	Qbt3	NR	16470	NR	16518	16523	16522
35-2037	AAA6433	3-4	mixed soil	NR	16470	NR	16518	16523	16522
35-2038	AAA6437	2.5-3.5	Qbt3	NR	16471	NR	16519	16533	16532
35-2038	AAA6438	9-10	Qbt3	NR	16471	NR	16519	16533	16532
35-2038	AAA6439	14-15	Qbt3	NR	16471	NR	16519	16533	16532
35-2038	AAA6440	19-20	Qbt3	NR	16471	NR	16519	16533	16532
35-2221	AAA6441	4-5	mixed soil	NR	16471	NR	16519	16533	16532
35-2221	AAA6442	8.8-10	Qbt3	NR	16471	NR	16519	16533	16532
35-2221	AAA6443	14-15	Qbt3	NR	16471	NR	16519	16533	16532
35-2221	AAA6444	19-20	Qbt3	NR	16471	NR	16519	16533	16532
35-2221	AAA6445	19-20	Qbt3	NR	16471	NR	16519	16533	16532
35-2222	AAA6446	3-4	mixed soil	NR	16471	NR	16519	16533	16532
35-2222	AAA6447	9-10	Qbt3	NR	16471	NR	16519	16533	16532
35-2222	AAA6448	14-15	Qbt3	NR	16471	NR	16519	16533	16532
35-2222	AAA6449	19-20	Qbt3	NR	16471	NR	16519	16533	16532
35-2223	AAA6453	0-0.5	mixed soil	16641	NR	16640	16637	16653	16635
35-2224	AAA6454	0-0.5	mixed soil	16641	16645	16640	NR	16653	16635

Two boreholes (Location ID Nos. 35-2033 and 35-2034) were drilled adjacent to the dosing chamber. Both boreholes encountered sand and clay fill to about 6 ft and bedrock tuff from about 6 to 20 ft. Three soil samples were collected from each borehole. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 190 to 250 cpm, which are within background levels.

The remaining six boreholes were drilled in the leach field, and four soil samples were collected from each borehole. Boreholes 35-2035 and 35-2036 were drilled in the eastern drain line area of the leach field. Borehole 35-2035 encountered bedrock tuff at 2 ft; borehole 35-2036 encountered bedrock tuff at 0.4 ft. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 210 to 280 cpm, which are within background levels. Boreholes 35-2037 and 35-2038 were drilled in the middle drain line area of the leach field. Borehole 35-2037 encountered bedrock tuff at 3.5 ft; borehole 35-2038 encountered bedrock at the surface. Boreholes 35-2221 and 35-2222 were drilled in the western drain line of the leach field. Borehole 35-2221 encountered bedrock at about 4 ft; borehole 35-2222 encountered bedrock at 3 ft. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 190 to 280 cpm, which are within background levels.

Two surface soil samples (Location ID Nos. 35-2223 and 35-2224) were collected from surface water drainage areas below the leach field. One unfiltered water sample (Location ID No. 35-2225) was collected from the dosing chamber. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 190 to 270 cpm, which are within background levels.

Table 5.8.4-1 summarizes all sampling for PRS No. 35-009(a); Figure 5.8.4-1 shows the sample locations.

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 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.

Twenty-eight soil samples from eight locations were 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, lithium, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, sodium, strontium, thallium, vanadium, and zinc using the EPA methods described in Section 3.1.1 in Chapter 3.0 of this RFI report. Zinc data were not reported for two sample delivery groups (15618 and 15619), which resulted in limited zinc data for this PRS. The implications of this are discussed in Section 5.8.7.2. Two of the 28 samples were field duplicates. In addition, eight 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.

The highest detected value for each analyte was used for the background comparison. The sample matrix varied in the upper intervals and included combinations of sand, clay, and humus. In deeper intervals, the sample matrix was predominantly tuff. The mixed-soils UTL values were used for background comparison for the 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. In Table 5.8.5-1, the values in the boxes indicate inorganic chemicals that were detected in soil at concentrations greater than or equal to their respective UTLs. These inorganic chemicals are also shown in Figure 5.8.5-1. The highest observed concentrations above background at each location are summarized below.

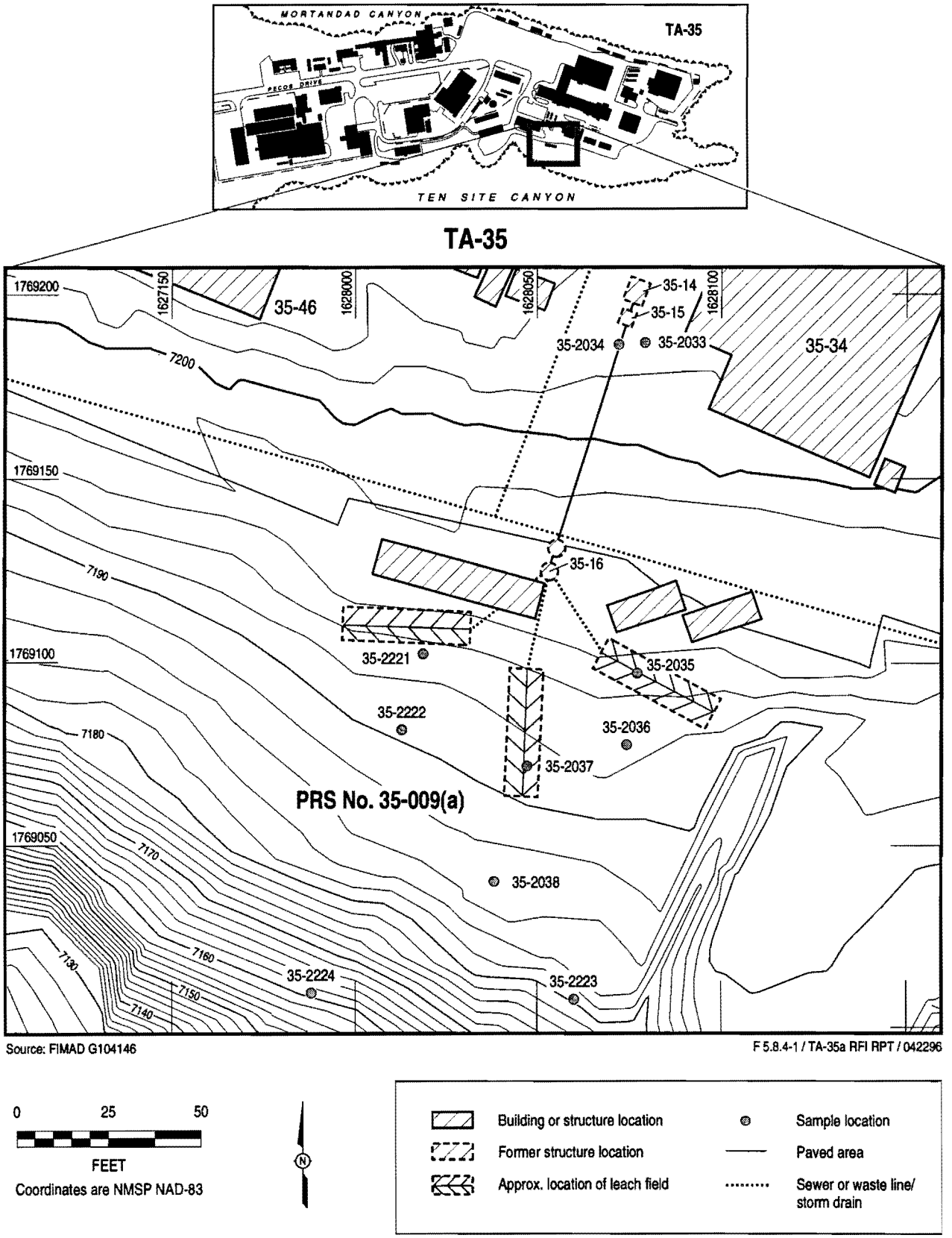


Figure 5.8.4-1. Locations of samples at PRS No. 35-009(a).

TABLE 5.8.5-1

INORGANIC CONSITUENTS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTL FOR PRS No. 35-009(a)

Location ID	Sample ID	Depth (ft)	Ag	Al	Ba	Cd	Cr	Cu	Hg	Li
SAL	N/A	N/A	383	77000	5300	38	210	2800	23	1500
Mixed soil UTL	N/A	N/A	N.A.	38700	315	2.7	19	15.5	0.1	N.A.
Qbt3 UTL	N/A	N/A	1.9	3700	28	N.A.	2.1	2	N.A.	N.A.
XRF UTL	N/A	N/A	N/A	N/A	561	N.A.	45	16.7	N.A.	N/A
35-2033	AAA6417	7-8	NA	NA	223	<3	<12	<8	<5	NA
35-2033	AAA6418	12-13	NA	NA	232	<3	<12	<8	<5	NA
35-2033	AAA6419	16-17	NA	NA	135	<3	<12	<8	<5	NA
35-2034	AAA6420	5.5-6.5	NA	NA	153	<3	<12	<8	<5	NA
35-2034	AAA6421	13.5-14.5	<1	3300	22	<1	3.1	3.4	<5	<.4
35-2034	AAA6422	19-20	NA	NA	133	<3	<12	<8	<5	NA
35-2035	AAA6381	1.5-2.5	<.63	4360	43.6	<.63	3.2	<4.5	NA	<4
35-2035	AAA6382	8.8-9.8	14	15800	66.5	1.2	8.1	7.7	NA	<9.4
35-2035	AAA6383	14-15	<.63	3140	<17	<.63	<1.1	<3.7	NA	<2.5
35-2035	AAA6384	17.5-18.7	<.65	4200	<23.1	<.65	<1.8	<2.4	NA	<1.7
35-2036	AAA6401	0-1.1	<.64	5310	<38.8	<.64	2.9	<2.5	NA	<3.5
35-2036	AAA6402	7.4-8.4	<.65	1960	<21.6	<.65	<1.5	<2.4	NA	<2
35-2036	AAA6403	14.2-15	<.63	1740	<14.7	<.63	<1.1	<2	NA	<1.1
35-2036	AAA6404	19-20	<.64	1010	<10.1	<.64	<1.1	<1	NA	<1.5
35-2037	AAA6429	3-4	<.75	1590	<13.9	<.64	<1.1	<4.9	NA	<3
35-2037	AAA6430	9-10	<.61	432	<9.1	<.61	<1	<1.7	NA	<2.9
35-2037	AAA6431	13-14	<.62	1100	<9.4	<.62	<1	<3	NA	<4.5
35-2037	AAA6432	19-20	<.67	391	<6.7	<.63	<1	<.85	NA	<1
35-2038	AAA6437	2.5-3.5	<.62	4310	<24.8	<.87	3.3	<4.8	NA	<4.9
35-2038	AAA6438	9-10	<.61	432	<5	<.61	<1	<.61	NA	<1.5
35-2038	AAA6439	14-15	<.61	538	<7.3	<.61	<1.7	<.87	NA	<2.3
35-2038	AAA6440	19-20	<.61	1510	<12.4	<.61	<1.4	<.61	NA	<4.4
35-2221	AAA6441	4-5	<.62	2300	<13.7	<.62	3.9	12.7	NA	<3
35-2221	AAA6442	8.8-10	<.63	1040	<12.1	<.63	<1.6	<.63	NA	<2
35-2221	AAA6443	14-15	<.66	4610	<37	<.66	3.7	<1.4	NA	<3.4
35-2221	AAA6444	19-20	<.64	514	<6.7	<.64	<1.2	<.64	NA	<6.7
35-2222	AAA6446	3-4	<1.3	2100	<20.4	<.61	7.9	39.1	NA	<3.6
35-2222	AAA6447	9-10	<.61	1050	<8.5	<.61	<1.5	<1.1	NA	<2.5
35-2222	AAA6448	14-15	<.61	481	<7.6	<.61	<1.7	<.61	NA	<1.6
35-2222	AAA6449	19-20	<.62	306	<5.1	<.62	<1.2	<.62	NA	<2.5
35-2223	AAA6453	0-.5	<1	1700	18	<1	1.4	3.2	<5	<.4
35-2224	AAA6454	0-.5	NA	NA	204	<3	17	160	<5	NA

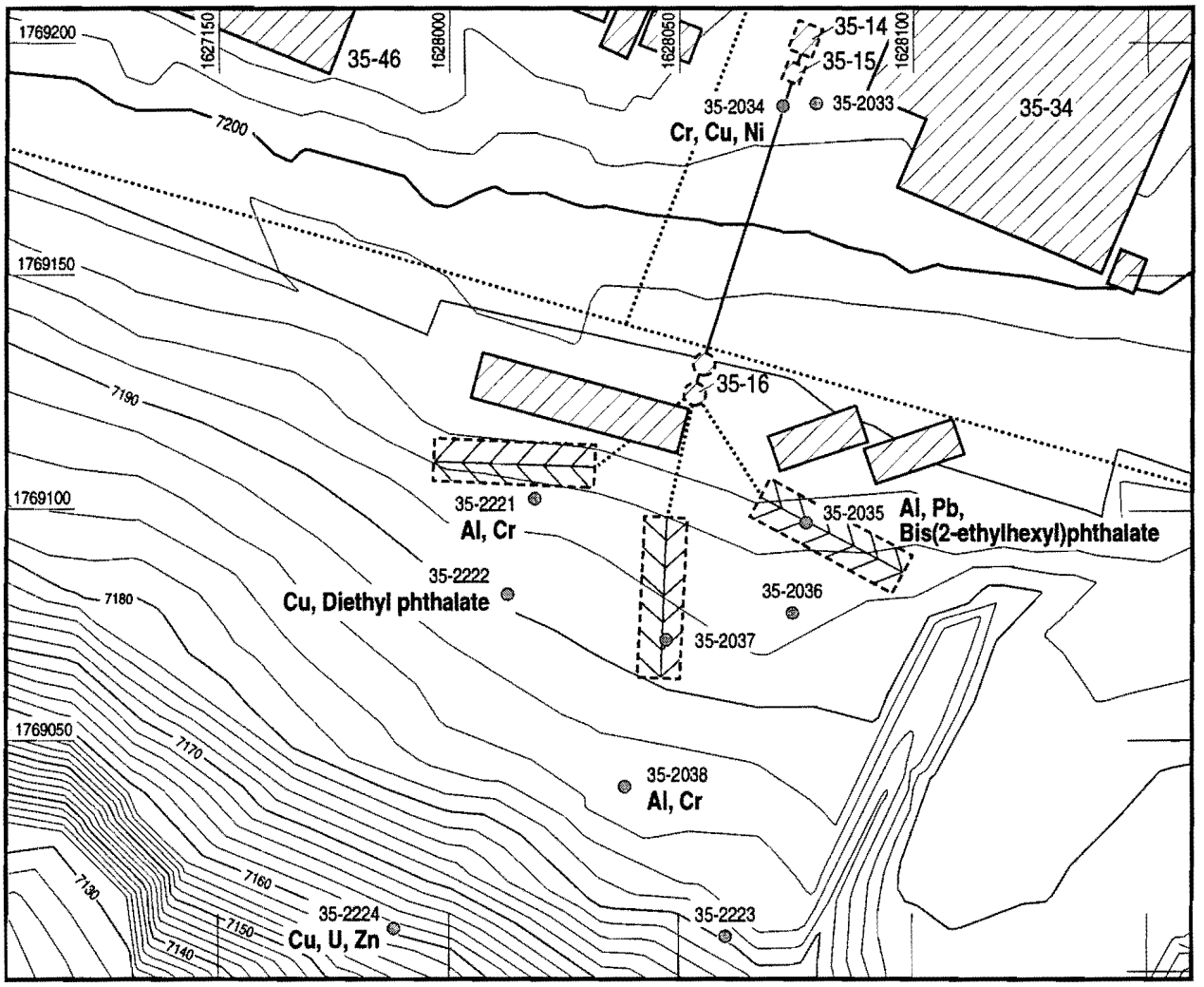
*mg/kg

TABLE 5.8.5-1 (continued)

INORGANIC CONSITUENTS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTL FOR PRS No. 35-009(a)

Location ID	Sample ID	Depth (ft)	Mg	Mo	Ni	Pb	Sb	Se	Sr	Ti	U	V	Zn
SAL	N/A	N/A	N.A.	380	1500	400	31	380	46000	N.A.	230	540	23000
Mixed soil UTL	N/A	N/A	4610	N.A.	15.2	23.3	1	1.7	N.A.	N.A.	5.5	42	50.8
Qbt3 UTL	N/A	N/A	628	N.A.	2.6	16.2	0.4	N.A.	N.A.	N.A.	4.4	4	55.5
XRF UTL	N/A	N/A	N/A	N/A	22.5	28.4	1.5	N.A.	N/A	N.A.	5.33	N.A.	76.6
35-2033	AAA6417	7-8	NA	NA	<13	14	<4	<4	NA	661	<8	NA	35
35-2033	AAA6418	12-13	NA	NA	<13	12	<4	<4	NA	613	<8	NA	47
35-2033	AAA6419	16-17	NA	NA	<13	9	<4	<4	NA	629	<8	NA	31
35-2034	AAA6420	5.5-6.5	NA	NA	<13	14	<4	<4	NA	554	<8	NA	41
35-2034	AAA6421	13.5-14.5	620	<2	3.4	<6	<.1	<.2	6.1	654	<8	3.2	32
35-2034	AAA6422	19-20	NA	NA	<13	13	<4	<4	NA	531	<8	NA	28
35-2035	AAA6381	1.5-2.5	<743	<6.1	<4.2	7	<1.1	<.42	<8.2	NA	NA	<6.5	NA
35-2035	AAA6382	8.8-9.8	3220	<6.6	<8.4	35.3	<1.1	<.46	<22.9	NA	NA	16	NA
35-2035	AAA6383	14-15	<367	<6.1	<1.9	71.2	<1.1	<.42	<2.8	NA	NA	<2.7	NA
35-2035	AAA6384	17.5-18.7	<723	<6.3	<4.2	6.9	<1.5	<.44	<4.3	NA	NA	<3.3	NA
35-2036	AAA6401	0-1.1	<703	<6.1	<4.1	7.9	<1.1	<.42	<7.6	NA	NA	<6.5	NA
35-2036	AAA6402	7.4-8.4	<474	<6.3	<3.7	2.6	<1.1	<.43	<4.6	NA	NA	<1.9	NA
35-2036	AAA6403	14.2-15	<293	<6.1	<2.5	2.5	<1.1	<.42	<2.6	NA	NA	<1.3	NA
35-2036	AAA6404	19-20	<220	<6.2	<1.9	1.9	<1.1	<.43	<1.4	NA	NA	<1.3	NA
35-2037	AAA6429	3-4	<321	<6.2	<2.7	4.3	<1.1	<.43	<3.5	NA	NA	<2.8	NA
35-2037	AAA6430	9-10	<146	<5.9	<1.8	1.5	<1	<.41	<1	NA	NA	<1.2	NA
35-2037	AAA6431	13-14	<243	<6	<1.9	2.1	<1	<.41	<1.7	NA	NA	<1.2	NA
35-2037	AAA6432	19-20	<90.8	<6.1	<2.9	1.4	<1	<.42	<.88	NA	NA	<1.3	NA
35-2038	AAA6437	2.5-3.5	<644	<6	<2.6	4.8	<1	<.42	<7.1	NA	NA	<6.9	NA
35-2038	AAA6438	9-10	<73	<5.9	<1.8	2.2	<1	<.45	<1.3	NA	NA	<1.2	NA
35-2038	AAA6439	14-15	<131	<5.9	<2.8	2	<1	<.41 UJ	<1.1	NA	NA	<1.2	NA
35-2038	AAA6440	19-20	<268	<5.9	<1.8	3.5	<1	<.41 UJ	<1.6	NA	NA	<1.2	NA
35-2221	AAA6441	4-5	<374	<6	<4.1	3.2	<1	<.41 UJ	<2.9	NA	NA	<5.5	NA
35-2221	AAA6442	8.8-10	<194	<6.1	<1.9	2	<1.1	<.46	<1.7	NA	NA	<2.2	NA
35-2221	AAA6443	14-15	<820	<6.4	<5.4	3.3	<1.1	<.44	<5.4	NA	NA	<4.9	NA
35-2221	AAA6444	19-20	<241	<6.2	<1.9	1.7	<1.1	<.58	<1.2	NA	NA	<1.6	NA
35-2222	AAA6446	3-4	<378	<5.9	<2.4	5.9	<1	<.41	<5.3	NA	NA	<5.5	NA
35-2222	AAA6447	9-10	<192	<5.9	<1.8	1.2	<1	<.47	<1.5	NA	NA	<1.2	NA
35-2222	AAA6448	14-15	<133	<5.9	<1.8	1.1	<1	<.41 UJ	<1.1	NA	NA	<1.2	NA
35-2222	AAA6449	19-20	<98.6	<6	<1.8	1.2	<1	<.7	<.61	NA	NA	<1.2	NA
35-2223	AAA6453	0-.5	340	<2	<4	4	<.1	0.5	3.8	793	<8	2.9	24
35-2224	AAA6454	0-.5	NA	NA	<13	27	<4	<4	NA	1020	14	NA	123

*mg/kg



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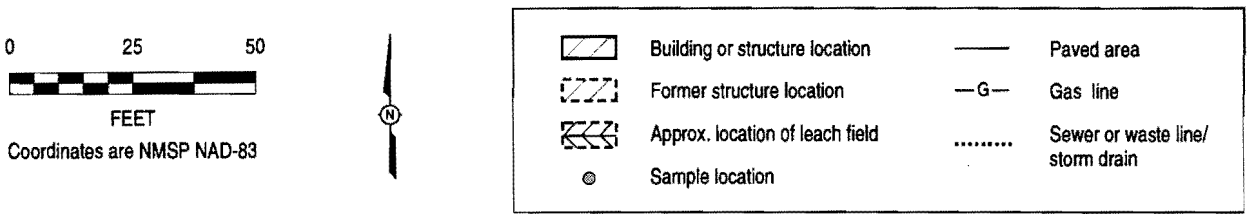


Figure 5.8.5-1. Locations of detected organic chemicals and analytes that exceed UTLs at PRS No. 35-009(a).

- Aluminum was detected in three samples at three locations at maximum concentrations of 4,200, 4,310, and 4,610 mg/kg, respectively, which are above the Qbt3 UTL of 3,700 mg/kg.
- Chromium was detected in three samples at three locations at maximum concentrations of 3.1, 3.3, and 3.7 mg/kg, respectively, which are above the Qbt3 UTL of 2.1 mg/kg.
- Copper was detected in two samples at two locations at maximum concentrations of 3.4 and 39.1 mg/kg. One sample was above the Qbt3 UTL of 2 mg/kg; the second sample was above the mixed soil UTL of 15.5 mg/kg. Copper was also detected in one sample at a third location at 160 mg/kg, which is above the XRF UTL of 16.7 mg/kg.
- Lead was detected in two samples at one location at maximum concentrations of 35.3 and 71.2 mg/kg. One sample was above the mixed soil UTL of 23.3 mg/kg; the second sample was above the Qbt3 UTL of 16.2 mg/kg.
- Nickel was detected in one sample at a concentration of 3.4 mg/kg, which is above the Qbt3 UTL of 2.6 mg/kg.
- Uranium was detected in one sample at a concentration of 14 mg/kg, which is above the XRF UTL of 5.33 mg/kg.
- Zinc was detected in one sample at a concentration of 123 mg/kg, which is above the XRF UTL of 76.6 mg/kg.

5.8.6 Evaluation of Organic Constituents

SVOCs were the only organic constituents analyzed for at this PRS. Twenty-eight soil samples, including two field duplicates, were analyzed for SVOCs. The samples were collected at eight locations.

The SVOCs that were detected in soil with concentrations above EQL values are shown in Table 5.8.6-1 and Figure 5.8.5-1 and are summarized below.

- Bis(2-ethylhexyl)phthalate was detected in one sample at an estimated concentration of 4.8 mg/kg.
- Diethyl phthalate was detected in one sample at a concentration of 0.18 mg/kg.

TABLE 5.8.6-1

PRS No. 35-009(a) SOIL CONCENTRATIONS* FOR DETECTED ORGANIC CONSTITUENTS

Location ID	Sample ID	Depth (ft)	Bis(2-ethylhexyl)phthalate	Diethyl phthalate
SAL	N/A	N/A	32.0	52000
CRQL	N/A	N/A	0.33	0.33
35-2035	AAA6381	1.5-2.5	4.8 J	ND
35-2222	AAA6448	14-15	ND	0.18

*mg/kg

5.8.7 Human Health Assessment

5.8.7.1 Screening Assessment

Seven inorganic chemicals were carried forward from the background comparison. The two organic chemicals that were detected above their respective EQL values were also carried forward. 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 exceeded SALs at this PRS. The MCE result for noncarcinogens was 0.4 and for carcinogens was 0.17. Because these values are below unity, additive effects among chemicals present above background levels do not represent a potential human health risk. All the COPCs identified in Sections 5.8.5 and 5.8.6 have soil SALs for comparison. No analytes that have neither a UTL nor a SAL value were measured above detection limits.

Although zinc data were reported in the results of only two SW-846 analyses and in results of eight XRF analyses, sufficient information exists to eliminate zinc from additional consideration at this PRS. Zinc exceeded its UTL values in only 1 of the 10 samples, and the highest measured value was less than 1% of the SAL. Therefore, it is highly improbable that zinc would be a COPC in this risk assessment if the missing data were available.

5.8.7.2 Risk Assessment

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

5.8.8 Ecological Assessment

The general landscape condition around this PRS is moderately developed and disturbed, and a high potential exists for receptors to come in contact with chemicals above background levels and detected organics associated with the site (copper and diethyl phthalate) (Table 5.8.5-1 and Table 5.8.6-1). Therefore, this PRS will be included as a potential contaminant source in the ecological risk assessment. An ecological risk assessment will be conducted when that approach has been approved by the regulators. Threatened and endangered species and/or sensitive habitat listed in Chapter 2.0 of this RFI report will be evaluated in the ecological risk assessment.

5.8.9 Extent of Contamination

The extent of contamination at this PRS has been well determined for inorganic chemicals and SVOCs. The number of individual samples and sample locations for each analyte suite are discussed in Sections 5.8.5 and 5.8.6. Both analyte suites consisted of approximately 34 samples at 10 locations. VOCs were not sampled for. However, gross VOC contamination in the site samples has been ruled out by field screening during sample collection using hand-held instruments. Furthermore, VOCs are generally not persistent contaminants in soil media, and more than 20 years has elapsed since the septic system has been active.

The samples collected were biased by location to areas where contamination released with septic liquids would be expected. These areas include borehole locations adjacent to the dosing chamber, borehole locations within and adjacent to the three leach fields, and surface sample locations in drainages below the leach fields. As described in Section 5.8.7.1, the maximum concentrations of contaminants observed at these biased sample locations do not indicate a potential human health threat. Therefore, it is concluded that the extent of contamination has been adequately determined relative to exposure on the site.

The data collected at this PRS will be incorporated with data from other PRSs in this vicinity for a future evaluation of ecological risk in an ecological exposure unit, as discussed in Section 5.8.8.

5.8.10 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. 35-009(a) was to determine the presence or absence of contamination associated with the sanitary septic system that served TA-35-2. No COPCs were identified in the human health screening assessment.

Samples for specific analytes were collected at and adjacent to locations where contaminants present in the sanitary waste stream would be most likely to occur. A potential human health risk has not been identified on the basis of the sample data. Because these sample locations were biased to identify areas where high levels of contaminants might exist, it is concluded that the extent of contamination has been determined for the purposes of human health risk characterization.

Based on NFA criterion 4, a Class III permit modification is requested to remove PRS No. 35-009(a) 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. The site data will be retained for an area-wide ecological assessment, as described in Section 5.8.8.

5.9 PRS No. 35-009(b)

PRS No. 35-009(b) is an abandoned sanitary septic system located near the southern edge of Ten Site Mesa, south of building TA-35-67. The PRS includes a septic tank (TA-35-76), a dosing chamber (TA-35-77), a distribution box, and an associated leach field.

No COPCs were identified during the screening assessment. Antimony, lead, thorium, uranium, and zinc were measured above background levels. Diethyl phthalate was the only organic chemical detected above EQL values.

PRS No. 35-009(b) is recommended for NFA based on NFA criteria number 4 (LANL 1995, 53863).

Radiological sample results are not presented or 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 5.9.4.3.

5.9.1 History

PRS No. 35-009(b) is discussed in detail in Section 3.3.2 of the work plan (LANL 1992, 7666).

This septic system served various laboratory buildings at TA-35 from 1966 to 1975. The septic system was abandoned in place when new sanitary sewer lines were routed to the new sewage lagoons in the canyon east of TA-35. The septic system handled sanitary wastes and may have received a variety of industrial wastes including radionuclides. Specific information concerning waste streams introduced to the septic system is not available.

The contaminants that were potentially present include gross-alpha, -beta, and -gamma radiation; VOCs; SVOCs; and metals.

5.9.2 Description

The entire septic system is now covered by asphalt, and only the septic tank, dosing chamber, and distribution box manholes are exposed. The manholes for each structure are located at the south edge of a relatively flat parking area adjacent to TA-35-67. The ground surface drops steeply downward about 8 ft at the south side of the manholes.

The septic tank is located about 30 ft south of TA-35-67 and is accessed through a 2-ft square steel-lined shaft that extends to a depth of 6 ft. The septic tank is a steel or steel-lined concrete tank approximately 4 ft wide by 4 ft long by 4 ft deep. The base of the tank is located about 10 ft below the surface.

The dosing chamber is located adjacent and west of the septic tank. The dosing chamber is accessed through a 1.5-ft-square concrete shaft that extends to a depth of 6 ft. The dimensions are not known, but the bottom of the chamber is located about 10 ft below the surface. The chamber contained about 3 ft of water at the time of the investigation.

The distribution box is located about 20 ft west of the dosing chamber. It is a 15-ft-deep manhole lined with corrugated metal pipe, which was dry at the time of the investigation .

The leach field is located southwest of the septic tank on the lower ground surface. The site is used as a parking and equipment storage area. A temporary storage structure (TA-35-390) is located there. No sign of the leach field is apparent at the surface, but the results of drilling and subsurface sampling confirmed its location. No outfall pipes were found during the engineering surveys, and it is not known if outfall pipes were part of the leach field design. No natural water courses are defined within the PRS, although the leach field drains southward toward Ten Site Canyon.

5.9.3 Previous Investigations

No previous investigations have been performed at this site.

5.9.4 Field Investigation

The objective of the Phase I RFI was to characterize the nature of potential contamination associated with the septic system.

The conceptual model for the RFI did not predict that hazardous constituents were released to the environment. The conceptual model predicted that if a release occurred from the site, evidence of the release may be found in the subsurface soils immediately adjacent and downgradient from the septic tank, the dosing chamber, and the distribution box and in the leach field. Therefore, a judgmental sampling approach was used, and the sampling activities were biased toward areas where residual contamination was expected to occur.

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 Hazco 1256 OVA, a Ludlum Model 39 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.

5.9.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed on December 6, 1993. Beta/gamma radiation measurements ranged from 150 to 290 cpm, and the average was 200 cpm, which is within background levels.

The engineering surveys were performed from December 6, 1993, through December 28, 1993. The field observations of this septic system did not coincide with drawings in the work plan SAP, which apparently were based on an incorrect drawing of the site. Historic engineering drawings of the septic system were located, which showed the correct location of the leach field and septic system structures. The leach field was determined to be located south of TA-35-67, southwest of the septic tanks, and partly under temporary structure TA-35-390. Water was noted in the septic system tanks.

The radiation grid survey was performed on December 21, 1993. The radiation grid locations included Location ID Nos. 35-6077 through 35-6112, which were spaced at approximately 20-ft intervals. Beta/gamma radiation measurements ranged from 180 to 350 cpm, and the average was 242 cpm, which is within background levels.

5.9.4.2 Deviations from the Sampling and Analysis Plan

The original SAP is described in Section 7.10 of the work plan (LANL 1992, 7666). However, the SAP was modified based on information gathered during the engineering surveys. The changes to the SAP, which are summarized below, are documented in a January 11, 1994, memorandum to the Operable Unit 1129 file (Koch 1994, 46385).

A water sample was collected from the dosing chamber and two boreholes were relocated. The two boreholes planned for the leach field (Location ID Nos. 35-2041 and 35-2042) were relocated because the site surveys and review of an engineering drawing of the site showed that the dosing chamber and the leach field are located west and southwest, respectively, of the septic tank. However, during the sample collection activities, the water sample was not collected from the dosing chamber because of collection constraints encountered in the field. The water sample was actually collected from the septic tank.

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

5.9.4.3 Sampling Activities

Phase I sampling was performed on January 19 and 20, 1994, and December 8, 1995. A total of six locations were sampled, and 17 samples were collected: 1 water sample and 16 subsurface soil samples (not including duplicate QA/QC samples). Four boreholes were drilled to a depth 20 ft: two in the septic tank area (Location ID Nos. 35-2039 and 35-2040) and two in the leach field (Location ID Nos. 35-2041 and 35-2042).

One borehole (Location ID No. 35-2039) was drilled at the west side of the septic tanks; it encountered fill to a depth of 5 ft and bedrock tuff from 5 to 20 ft. One borehole (Location ID No. 35-2040) was drilled at the east side of the septic tanks; it encountered damp fill material to a depth of 7 ft and bedrock tuff from 7 to 20 ft. Three soil samples were collected from each borehole, and the sample collection intervals are shown in Table 5.9.4-1. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 160 to 200 cpm, which are within background levels.

One borehole (Location ID No. 35-2041) was drilled in the eastern part of the leach field; it encountered damp layers of sand and tuff cobbles to a depth of 5 ft, which probably represent filter bed material. One borehole (Location ID No. 35-2042) was drilled in the western part of the leach field; it encountered damp sand and tuff cobbles to a depth of 6 ft, which also probably represent filter bed material. Three samples were collected from each borehole, and the sample collection intervals are shown in Table 5.9.4-1. Because VOCs were not detected during field screening of the samples, samples were not collected for VOC analyses. Beta/gamma

TABLE 5.9.4-1

SUMMARY OF SAMPLES TAKEN AT PRS No. 35-009(b)

Location ID	Sample ID	Depth (ft)	Matrix	SVOC Mobile Lab	SVOC Fixed Lab	INORG Mobile Lab	INORG Fixed Lab	Rad Van	Rad Fixed Lab
35-2039	AAA6409	5-6	Qbt3	16641	NR	16640	NR	16653	16635
35-2039	AAA6410	11-12	Qbt3	16641	16645	16640	NR	16653	16635
35-2039	AAA6411	19-20	Qbt3	16641	NR	16640	NR	16653	16635
35-2040	AAA6412	6.5-7.5	mixed soil	16641	NR	16640	16637	16653	16635
35-2040	AAA6413	14-15	Qbt3	16641	NR	16640	NR	16653	16635
35-2040	AAA6414	19-20	Qbt3	16641	NR	16640	NR	16653	16635
35-2041	AAA6461	4-5	mixed soil	16641	NR	16640	NR	16653	16635
35-2041	AAA6462	9-10	Qbt3	16641	16645	16640	NR	16653	16635
35-2041	AAA6463	14-15	Qbt3	NR	16645	16640	NR	16653	16635
35-2278	0435-95-0197	5-6	mixed soil	NR	1701	NR	NR	NR	NR
35-2041	AAA6471	9-10	Qbt3	NR	NR	16640	NR	16653	16635
35-2041	AAA6474	19-20	Qbt3	16641	NR	16640	NR	16653	16635
35-2042	AAA6464	4-5	mixed soil	NR	16645	16640	NR	16653	16635
35-2042	AAA6465	6-7	mixed soil	16641	NR	16640	16637	16653	16635
35-2042	AAA6466	14-15	Qbt3	NR	16645	16640	NR	16653	16635
35-2042	AAA6467	19-20	Qbt3	NR	16645	16640	NR	16653	16635

radiation measurements obtained during field screening of the samples ranged from 160 to 200 cpm, which are within background levels.

One unfiltered water sample was collected from the septic tank (Location ID No. 35-2226).

Supplemental sampling was performed in December 8, 1995, because one soil sample was lost by the analytical laboratory or because analytical results could not be provided by the analytical laboratory. One hand-auger hole (Location ID No. 35-2278) was added to collect one subsurface soil sample adjacent to another hand-auger hole (Location ID No. 35-2041). The supplemental hand-auger hole was drilled to a depth of 6 ft in soft sand that probably represents filter bed material. One subsurface soil sample was collected from the 5- to 6-ft interval. The sample was analyzed for SVOCs with tentatively identified compounds. The beta/gamma radiation measurement obtained during field screening of the sample was 100 cpm, which is within background levels.

Table 5.9.4-1 summarizes all sampling for PRS No. 35-009(b); Figure 5.9.4-1 shows the sample locations.

5.9.5 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.

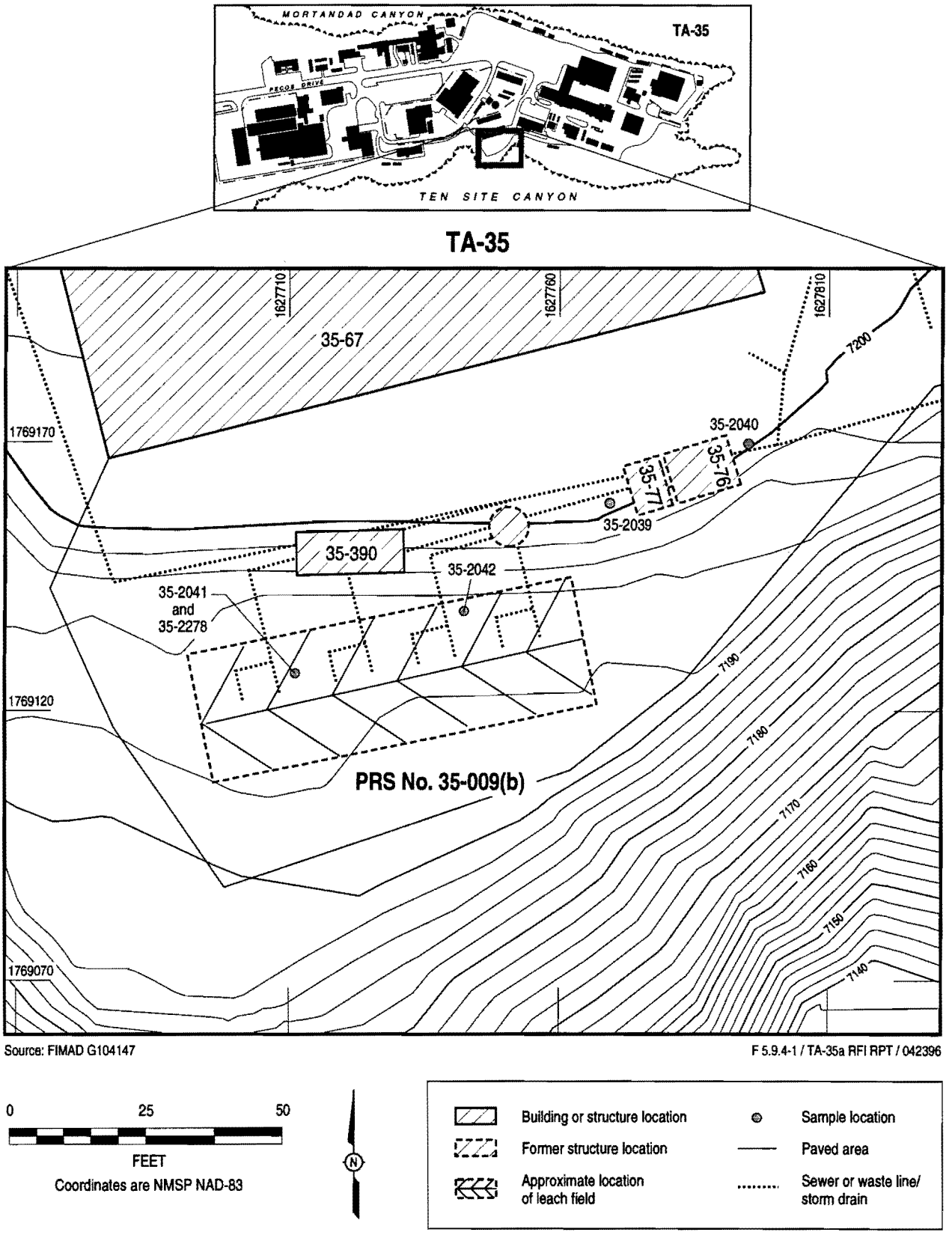


Figure 5.9.4-1. Locations of samples at PRS No. 35-009(b).

Fifteen samples from four locations, including one field duplicate, 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. Two soil samples from two locations were 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, lithium, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, sodium, strontium, thallium, vanadium, and zinc using the EPA methods described in Section 3.1.1 in Chapter 3.0 of this RFI report.

The sample matrix in the upper intervals generally consisted of sand or a mixture of sand and tuff. In deeper intervals, the sample matrix was predominantly tuff. The mixed-soil UTLs were used for background comparison for the 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. In Table 5.9.5-1, values in the boxes indicate inorganic chemicals that were detected in soil at concentrations greater than or equal to their respective UTLs. The highest observed concentrations above background levels at each location are shown in Figure 5.9.5-1.

- Antimony was detected in one sample at a concentration of 5 mg/kg, which is above the XRF UTL of 1.45 mg/kg.
- Lead was detected in one sample at a concentration of 46 mg/kg, which is above the XRF UTL of 28.4 mg/kg.
- Thorium was detected in one sample at a concentration of 39 mg/kg, which is above the XRF UTL of 22.1 mg/kg.
- Uranium was detected in three samples at one location at a maximum concentration of 19 mg/kg, which is above the XRF UTL of 5.33 mg/kg.
- Zinc was detected in one sample at a concentration of 119 mg/kg, which is above the XRF UTL of 76.6 mg/kg.

5.9.6 Evaluation of Organic Constituents

The only organic chemicals analyzed for at this PRS were SVOCs. Six soil samples from three locations were analyzed for SVOCs in a fixed-site laboratory. Ten soil samples from four locations, including two samples at the same depth and locations as fixed-site laboratory samples, were analyzed for SVOCs in the mobile laboratory facility.

Organic chemicals detected at this PRS are shown in Table 5.9.6-1 and Figure 5.9.5-1. Only one SVOC was detected in soil at a concentration exceeding its EQL value. This SVOC is listed below.

- Diethyl phthalate was detected in one sample in the 11- to 12-ft interval at a concentration of 0.41 mg/kg.

5.9.7 Human Health Assessment

5.9.7.1 Screening Assessment

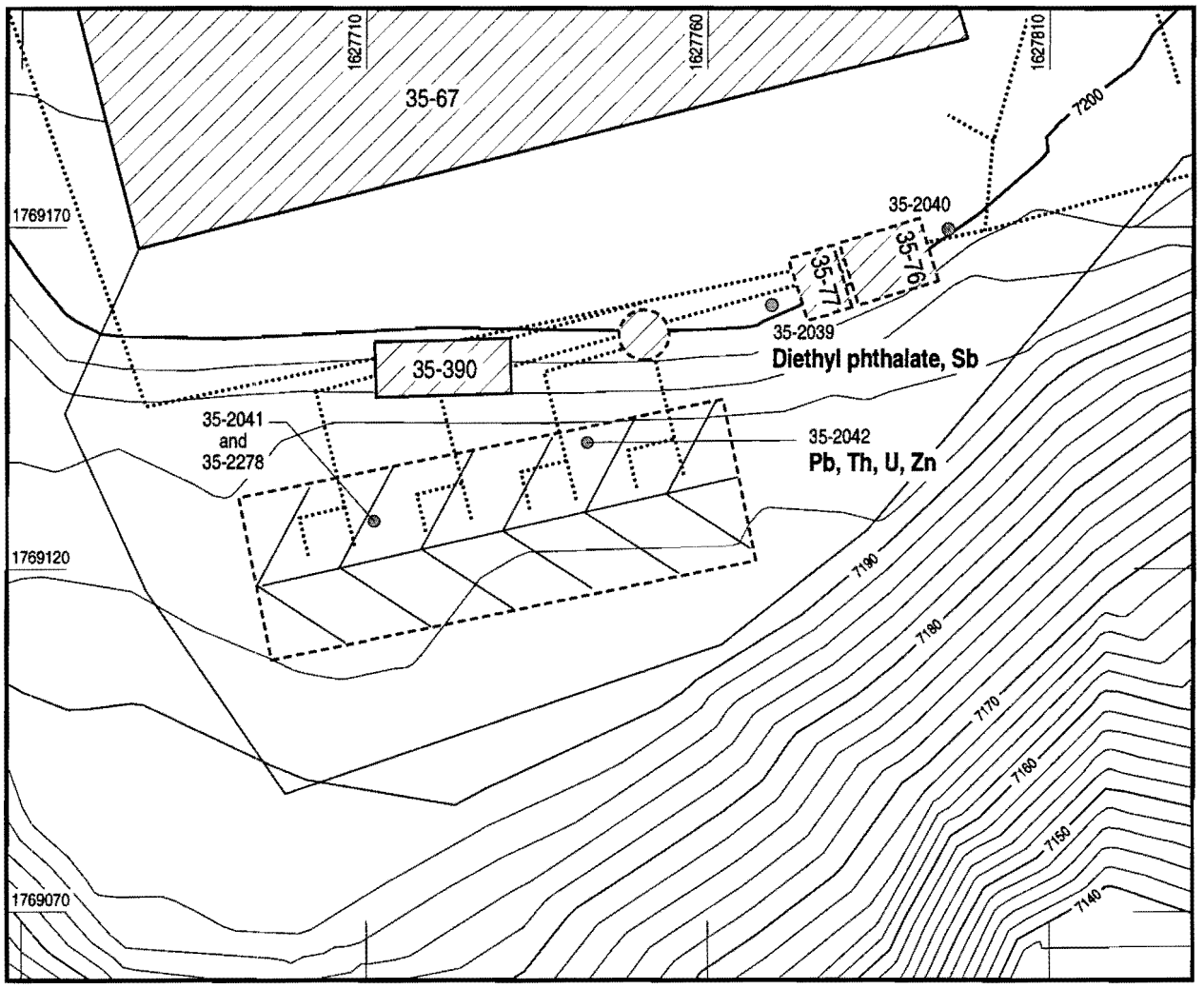
Five inorganic chemicals and one organic chemical were carried forward from the background and EQL comparisons. As described in Section 3.4.1 in Chapter 3.0 of this RFI report, analytes are divided into two classes (noncarcinogens and chemical carcinogens) for the screening assessment, depending on which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

TABLE 5.9.5-1

INORGANIC CONSTITUENTS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTL FOR PRS No. 35-009(b)

Location ID	Sample ID	Depth (ft)	Ag	Cd	Hg	Li	Mo	Pb	Sb	Se	Sr	Th	Ti	U	Zn
SAL	N/A	N/A	383	38	23	1500	380	400	31	380	46000	N.A.	N.A.	230	23000
Mixed soil UTL	N/A	N/A	N.A.	2.7	0.1	N.A.	N.A.	23.3	1	1.7	N.A.	22.6	N.A.	5.45	50.8
Qbt3 UTL	N/A	N/A	1.9	N.A.	N.A.	N.A.	N.A.	16.2	0.4	N.A.	N.A.	16.3	N.A.	4.37	55.5
XRF UTL	N/A	N/A	N/A	N.A.	N.A.	N/A	N/A	28.4	1.45	N.A.	N/A	22.1	N.A.	5.33	76.6
35-2039	AAA6409	5-6	NA	<3	<5	NA	NA	12	5	<4	NA	11	574	<8	24
35-2039	AAA6410	11-12	NA	<3	<5	NA	NA	14	<4	<4	NA	16	610	<8	38
35-2039	AAA6411	19-20	NA	<3	<5	NA	NA	15	<4	<4	NA	14	546	<8	37
35-2040	AAA6412	6.5-7.5	<1	<1	<5	2.7	<2	3	<.1	<.2	7.4	12	793	<8	44
35-2040	AAA6413	14-15	NA	<3	<5	NA	NA	13	<4	<4	NA	12	538	<8	39
35-2040	AAA6414	19-20	NA	<3	<5	NA	NA	18	<4	<4	NA	17	578	<8	42
35-2041	AAA6461	4-5	NA	<3	<5	NA	NA	18	<4	<4	NA	17	547	<8	37
35-2041	AAA6462	9-10	NA	<3	<5	NA	NA	14	<4	<4	NA	21	564	<8	44
35-2041	AAA6463	14-15	NA	<3	<5	NA	NA	11	<4	<4	NA	11	590	<8	38
35-2041	AAA6474	19-20	NA	<3	<5	NA	NA	18	<4	<4	NA	19	905	<8	53
35-2042	AAA6464	4-5	NA	<3	<5	NA	NA	46	<4	<4	NA	39	276	19	119
35-2042	AAA6465	6-7	<1	<1	<5	25	<2	2	<.1	0.3	2.7	15	639	12	32
35-2042	AAA6466	14-15	NA	<3	<5	NA	NA	13	<4	<4	NA	17	682	<8	46
35-2042	AAA6467	19-20	NA	<3	<5	NA	NA	16	<4	<4	NA	16	640	9	44

*mg/kg



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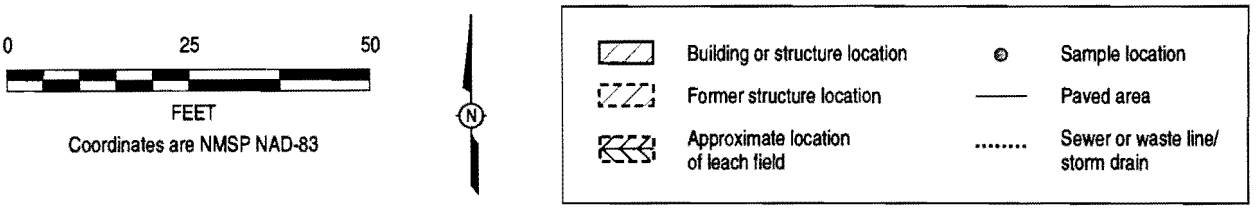

Figure 5.9.5-1. Locations of detected organic chemicals and analytes that exceed UTLs at PRS No. 35-009(b).

TABLE 5.9.6-1

PRS No. 35-009(b) SOIL CONCENTRATIONS* FOR DETECTED ORGANIC CONSTITUENTS

Location ID	Sample ID	Depth (ft)	Diethyl phthalate
SAL	N/A	N/A	52000
CRQL	N/A	N/A	0.33
35-2039	AAA6410	11-12	0.410

*mg/kg

No sample results for any chemical exceeded SAL values at this PRS. The MCE results for noncarcinogens was 0.38. No chemical carcinogens were measured above UTL or EQL values. Therefore, no COPCs are identified in the human health screening assessment.

All the COPCs identified in Sections 5.9.5 and 5.9.6 (except thorium) have soil SALs for comparison. Thorium was measured above its UTL in only 1 of 14 samples; therefore, it is not proposed for additional evaluation. No analytes that have neither a UTL nor a SAL were measured above detection limits.

5.9.7.2 Risk Assessment

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

5.9.8 Ecological Assessment

The general landscape condition around the PRS is highly developed and disturbed, and a low potential exists for receptors to come in contact with ecological COPCs associated with the site (see Table 2.4-1 in Chapter 2.0 of this RFI report). Therefore, no further ecological evaluation of this site is required.

5.9.9 Extent of Contamination

The extent of contamination at this PRS has been defined for inorganic chemicals and SVOCs near the septic tank and the leach field. The number of individual samples and sample locations for each analyte suite are discussed in Sections 5.9.5 and 5.9.6. Analyte suites consisted of approximately 15 samples at four locations. VOCs were not sampled. However, gross VOC contamination in the samples has been ruled out by field screening during sample collection using hand-held instruments. Furthermore, VOCs are generally not persistent contaminants in soil media, and more than 20 years has elapsed since the septic system has been active.

Chemicals identified above UTL values are shown in Figure 5.9.5-1. The samples collected at this PRS were biased by location to areas where contamination released with septic liquids would be expected to occur. Two boreholes were located adjacent to the septic tank, and two boreholes were located within the leach field. Inorganic contaminants were measured above background levels primarily in the 4- to 5-ft interval at Location ID No. 35-2042; uranium was also measured above background levels in the 6- to 7-ft and 19- to 20-ft intervals. However, no evidence of contamination above background levels was observed in the other leach field sample location, which indicates that widespread contamination is unlikely. As described in Section 5.9.7.1, the maximum concentrations of contaminants observed at these biased sample locations were below human health screening levels.

No evidence of outfalls was found during the field investigation. Because no discharge points or drainages were identified and none are known to exist based on historical records, surface samples were not collected. Nevertheless, it is likely that if significant quantities of chemical contaminants were released at this site, soil concentrations would probably be as high or higher near the septic tanks and leach fields than in surface water

drainages on the side of Ten Site Canyon. It is therefore concluded that the extent of contamination has been adequately determined relative to human health risk.

The data collected at this PRS will be incorporated with data from other PRSs in this vicinity for a future evaluation of ecological risk in an ecological exposure unit, as discussed in Section 5.9.8.

5.9.10 Conclusions and Recommendations

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

The objective of the Phase I RFI at PRS No. 35-009(b) was to determine the presence or absence of contamination associated with the sanitary septic system that served TA-35-67 and perhaps other buildings. No COPCs were identified in the human health screening assessment.

Samples for specific analytes were collected from boreholes adjacent to the septic tank and within the leach field. These are the locations where contaminants present in the sanitary waste stream would be most likely to occur in site soils today. Because these sample locations were biased to identify areas where high levels of contamination might exist, it is concluded that the extent of contamination has been determined for the purposes of human health risk characterization. In addition, this site is the subject of a voluntary corrective action (LANL 1996, 52894) in which the septic tank will be filled in place, as a good management practice, to prevent any future release of contaminants from the septic tank.

Based on NFA criterion number 4, a Class III permit modification is requested to remove PRS No. 35-009(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 or ecological risk now or in the foreseeable future.

5.10 PRS No. 35-009(c)

PRS No. 35-009(c) is an abandoned sanitary septic system. Structures associated with this PRS include a septic tank (TA-35-44), a distribution box (TA-35-45), a cleanout manhole, and a leach field.

COPCs identified as a result of the screening assessment include manganese, which was detected above background level in one sample; its XRF UTL value is greater than its risk-based screening value. Other COPCs identified as a result of the screening assessment include antimony, Aroclor 1254, lead, and uranium. No sample results exceeded SALs. COPCs were identified as a result of the MCE and are evaluated in the risk assessment in Section 5.10.7.2.

PRS No. 35-009(c) is recommended for NFA based on NFA criteria number 4 (LANL 1995, 53863).

Radiological sample results are not presented or 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 5.10.4.3.

5.10.1 History

PRS No. 35-009(c) is discussed in detail in Section 3.3.2 of the work plan (LANL 1992, 7666).

The septic system served TA-35 between 1961 and 1990. It handled sanitary wastes from buildings TA-35-2 and TA-35-253 and may have received a variety of industrial wastes including radionuclides. Specific information concerning waste streams introduced to the septic system is not available.

The contaminants that were potentially present include gross-alpha, -beta, and -gamma radiation; VOCs; SVOCs; and metals.

5.10.2 Description

The septic system is located in an industrialized area at TA-35. The septic tank and the leach field are located near the northern edge of Ten Site Mesa. The septic tank is a 1,290-gal., steel-lined, reinforced concrete tank that is approximately 8 ft wide by 12 ft long by 5 ft deep. It is buried beneath 2 ft of fill material. The leach field is parallel to the edge of the mesa and is located beneath the dirt access road leading to portable building TA-35-261. The leach field comprises three drain lines that cover an area of approximately 1,600 ft^2. Consolidated bedrock tuff is present at depths of from 3 to 5 ft in the leach field.

The topography of the site slopes gently north-northeast toward the edge of the mesa. Vegetation is typical of TA-35 and consists of scrub oak brush, grasses, and ponderosa pine. No natural water courses are defined within the PRS, although surface runoff and discharge from the leach field flow northward and eastward toward Mortandad Canyon.

5.10.3 Previous Investigations

No previous investigations have been performed at this site.

5.10.4 Field Investigation

The objective of the Phase I RFI was to characterize the nature of potential contamination associated with this septic system.

The conceptual model for the RFI did not predict that hazardous constituents were released to the environment. The conceptual model predicted that if a release occurred from the site, evidence of the release may be found in the subsurface soils immediately beneath and down the slope from the septic tank, distribution box, leach field, and outfall. Therefore, a judgmental sampling approach was used, and the sampling activities were biased toward areas where residual contamination was expected.

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 were performed using a Hazco 1256 OVA, a Ludlum Model 39 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 was detected. Organic vapors were detected, as noted below.

5.10.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed on December 22, 1993. Beta/gamma radiation measurements ranged from 110 to 300 cpm, and the average was 222 cpm, which is within background levels.

The engineering surveys were performed during December 1993 and January 1994. The surveys of the septic system found that water was present in the septic tank, but the clean-out manhole and the distribution box were dry. The western outfall pipeline from the leach field could not be located, so an electromagnetic pipe finder, the Fisher M-Scope Model TW-6 Pipe and Cable Locator, was used in an unsuccessful attempt to locate this outfall. The eastern outfall was located on the side of the mesa north of building TA-35-261 about 10 ft below the edge of the mesa. The outfall is from a 4-in. cast iron pipe that leads directly from the leach field. Another outfall associated with PRS No. 35-016(o) was located about 10 ft east of the leach field outfall. The locations of both outfalls were surveyed and included in the radiation grid survey.

The radiation grid survey was performed on January 3, 1994, and February 14, 1994. The radiation grid locations included Location ID Nos. 35-6113 through 35-6152, which were spaced at approximately 20-ft intervals. Two additional grid locations were established at the two outfalls near the east end of the leach field. Location ID No. 35-6401 was located at the eastern outfall pipeline from the leach field, and Location ID No. 35-6402 was located at the PRS No. 35-016(o) outfall. Beta/gamma radiation measurements ranged from 90 to 350 cpm, and the average was 233 cpm. Beta/gamma radiation measurements at Location ID Nos. 35-6401 and 35-6402 were both 200 cpm. All beta/gamma radiation measurements are within background levels.

5.10.4.2 Deviations from the Sampling and Analysis Plan

The original SAP is described in Section 7.10 of the work plan (LANL 1992, 7666). However, the SAP was modified based on information gathered during the engineering surveys. The changes to the SAP are documented in a January 28, 1994, memorandum to the Operable Unit 1129 file (Koch 1994, 46384) and in a February 1, 1994, memorandum to the Operable Unit 1129 file (Koch 1994, 46648).

The western outfall from the leach field could not be located, so surface soil samples were not collected in association with this outfall. The location of the eastern outfall from the leach field was identified 10 ft west of the original location, so the surface samples associated with this outfall were relocated and collected below the actual leach field outfall. Three samples from the outfall drainages that were originally assigned to PRS No.35-009(c) have been reassigned to an outfall associated with PRS No. 35-016(o).

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

5.10.4.3 Sampling Activities

Phase I sampling was performed between January 24, 1994, and January 27, 1994, and on December 7, 1995. A total of 13 locations were sampled, and 36 samples were collected: 3 surface soil samples and 33 subsurface soil samples (not including duplicate QA/QC samples). Eight hand-auger holes (Location ID Nos. 35-2049 through 35-2056) were drilled to a depth of 20 ft, and four samples were collected from each hand-auger hole. The sample collection intervals are shown in Table 5.10.4-1. Three surface samples (Location ID Nos. 35-2043, 35-2044, and 35-2045) were collected from beneath the eastern outfall. These samples were later determined to be associated with an outfall belonging to Aggregate S. During sample collection at Location ID No. 35-2051, organic vapors were detected from the core samples at the 15-ft interval and recorded at 1.5 units. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 200 to 280 cpm, which are within background levels.

Supplemental sampling was performed on December 7, 1995, to resample one hand-auger hole (Location ID No. 35-2053) because the original sample material was lost at the analytical laboratory. The second hand-auger hole (Location ID No. 35-2279) was drilled adjacent to the first one to collect SVOC and VOC data that was lost from the 3- to 4-ft interval. One soil sample was collected. Field screening measurements for beta/gamma radiation were below background levels. Because the sample location and depth for the supplemental sample are identical to the first sample, Location ID No. 35-2279 is not included as a separate sample in the summary described in Section 5.10.5.

Table 5.10.4-1 summarizes all sampling for PRS No. 35-009(c); Figure 5.10.4-1 shows the sample locations.

5.10.5 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

TABLE 5.10.4-1

SUMMARY OF SAMPLES TAKEN AT PRS No. 35-009(c)

Location ID	Sample ID	Depth (ft)	Matrix	VOC Mobile Lab	VOC Fixed Lab	SVOC Mobile Lab	SVOC Fixed Lab	PCB Fixed Lab	INORG Mobile Lab	INORG Fixed Lab	Rad Van	Rad Fixed Lab
35-2049	AAA6495	8-9	Qbt3	16670	NR	16670	16672	16672	16706	NR	16666	16669
35-2049	AAA6496	12-13	Qbt3	16670	NR	16670	NR	NR	16706	16704	16666	16669
35-2049	AAA6497	19-20	QBt3	16670	16672	16670	NR	NR	16706	NR	16666	16669
35-2050	AAA6498	9-10	Qbt3	16670	NR	16670	NR	NR	16706	NR	16666	16669
35-2050	AAA6499	11.5-12.5	Qbt3	16670	NR	16670	NR	NR	16706	NR	16666	16669
35-2050	AAA6500	19-20	Qbt3	16670	NR	16670	NR	NR	16706	NR	16666	16669
35-2051	AAA6525	3.5-4.5	mixed soil	16674	NR	16674	NR	NR	16681	NR	16686	16683
35-2051	AAA6526	9-10	Qbt3	16674	NR	16674	NR	NR	16681	NR	16686	16683
35-2051	AAA6527	14-15	Qbt3	16674	NR	16674	NR	NR	16681	NR	16686	16683
35-2051	AAA6528	17-18	Qbt3	16674	NR	16674	NR	NR	16681	NR	16686	16683
35-2052	AAA6529	4-5	mixed soil	16674	NR	16674	NR	NR	16681	NR	16686	16683
35-2052	AAA6530	9-10	mixed soil	16674	NR	16674	NR	NR	16681	NR	16686	16683
35-2052	AAA6531	14-15	Qbt3	16674	NR	16674	NR	NR	16681	NR	16686	16683
35-2052	AAA6532	18.8-20	Qbt3	16674	16673	16674	16673	NR	16681	16680	16686	16683
35-2052	AAA6533	18.8-20	Qbt3	16674	NR	16674	NR	NR	16681	NR	16686	16683
35-2053	AAA6508	3-4	mixed soil	16670	NR	16670	NR	NR	16706	NR	16666	16669
35-2053	AAA6509	3-4	mixed soil	NR	NR	NR	NR	NR	16706	NR	16666	16669
35-2053	AAA6510	9-10	Qbt3	16670	NR	16670	NR	NR	16706	16704	16666	16669
35-2053	AAA6511	14-15	Qbt3	16670	16672	16670	NR	NR	16706	NR	16666	16669
35-2053	AAA6512	17.5-18.5	Qbt3	16670	NR	16670	NR	NR	16706	NR	16666	16669
35-2054	AAA6513	4-5	mixed soil	16670	NR	16670	16672	16672	16706	NR	16666	16669
35-2054	AAA6514	8-9	mixed soil	16670	NR	16670	NR	NR	16706	NR	16666	16669
35-2054	AAA6515	14-15	Qbt3	16670	NR	16670	NR	NR	16706	NR	16666	16669
35-2054	AAA6516	19-20	Qbt3	16670	NR	16670	NR	NR	16706	NR	16666	16669
35-2055	AAA6480	4-5	mixed soil	16684	NR	16684	NR	NR	16699	NR	NR	16685
35-2055	AAA6481	9-10	mixed soil	16684	NR	16684	NR	NR	16699	NR	17096	16685
35-2055	AAA6482	14-15	Qbt3	16684	NR	16684	NR	NR	16699	NR	17096	16685
35-2055	AAA6483	19-20	Qbt3	16684	NR	16684	16671	NR	16699	NR	17096	16685
35-2056	AAA6484	4-5	mixed soil	16684	16671	16684	NR	NR	16699	16703	17096	16685
35-2056	AAA6485	6-7	mixed soil	16684	NR	16684	NR	NR	16699	NR	17096	16685
35-2056	AAA6486	13-14	Qbt3	16684	NR	16684	NR	NR	16699	NR	17096	16685
35-2056	AAA6487	19-20	Qbt3	16684	NR	16684	NR	NR	16699	NR	17096	16685
35-2279	0435-95-0194	3-4	mixed soil	NR	1701	NR	1701	NR	0	NR	NR	NR

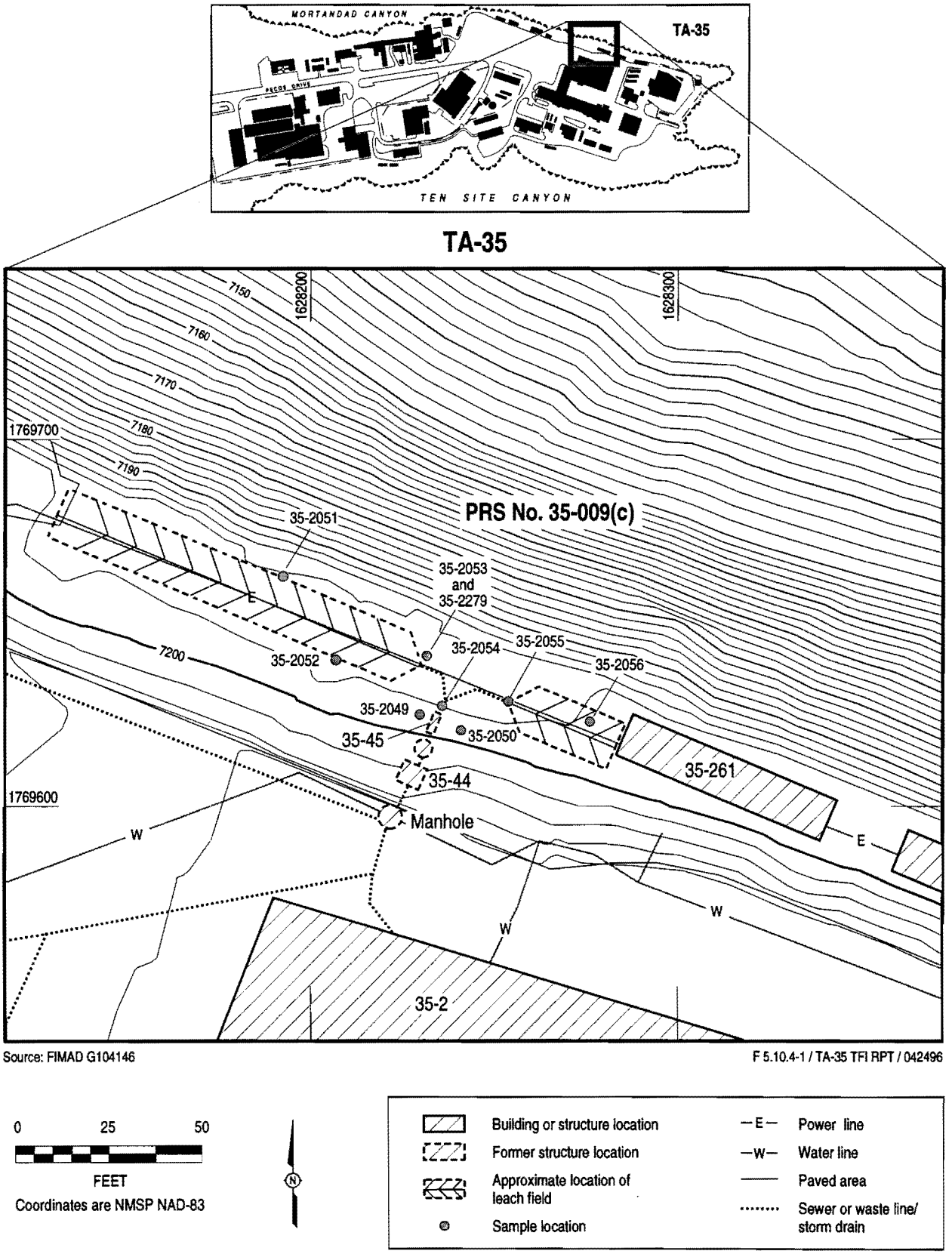

Figure 5.10.4-1. Locations of samples at PRS No. 35-009(c).

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.

Thirty-two samples from eight locations, including two field duplicates, 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. Four soil samples from four locations were 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, lithium, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, sodium, strontium, thallium, vanadium, and zinc using the EPA methods described in Section 3.1.1 in Chapter 3.0 of this RFI report.

The sample matrix in the upper intervals generally consisted of sand, clay, cobbles or a mixture of these materials, and tuff. In deeper intervals, the sample matrix was predominantly tuff. The mixed-soil UTL values were used for background comparison for the 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. In Table 5.10.5-1, the values in the boxes indicate inorganic chemicals that were detected in soil at concentrations greater than or equal to their respective UTLs. These chemicals are shown in Figure 5.10.5-1. The highest observed concentrations above background at each location are summarized below.

- Aluminum was detected in one sample at a concentration of 5,290 mg/kg, which is above the Qbt3 UTL of 3,700 mg/kg.
- Antimony was detected in one sample at a concentration of 5 mg/kg, which is above the XRF UTL of 1.45 mg/kg.
- Chromium was detected in two samples at two locations at concentrations of 5 and 3.9 mg/kg, which are 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.
- Nickel was detected in one sample at a concentration of 27 mg/kg, which is above the XRF UTL of 22.5 mg/kg.
- Lead was detected in three samples at three locations at concentrations of 34, 31, and 90 mg/kg, which are above the XRF UTL of 28.4 mg/kg.
- Manganese was detected in one sample at a concentration of 748 mg/kg, which is above the XRF UTL of 681 mg/kg.
- Thorium was detected in three samples at three locations at concentrations of 25, 26, and 23 mg/kg, which are above the XRF UTL of 22.1 mg/kg.
- Uranium was detected in four samples at four locations at concentrations of 15, 12, 12, and 10 mg/kg, which are above the XRF UTL of 5.33 mg/kg.
- Zinc was detected in one sample at a concentration of 100 mg/kg, which is above the XRF UTL of 76.6 mg/kg.

TABLE 5.10.5-1

INORGANIC CONSTITUENTS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTL FOR PRS No. 35-009(c)

Location ID	Sample ID	Depth (ft)	Ag	Al	Cd	Cr	Cu	Hg	Li	Mg	Mn	Mo
SAL	N/A	N/A	383	77000	38	210	2800	23	1500	N.A.	N.A.	380
Mixed soil UTL	N/A	N/A	N.A.	38700	2.7	19.3	30.7	0.1	N.A.	4610	714	N.A.
Qbt3 UTL	N/A	N/A	1.9	3700	N.A.	2.1	2	N.A.	N.A.	628	426	N.A.
XRF UTL	N/A	N/A	N/A	N/A	N.A.	45.1	16.7	N.A.	N/A	N/A	681	N/A
35-2049	AAA6495	8-9	NA	NA	<3	13	17	<5	NA	NA	462	NA
35-2049	AAA6496	12-13	<.63	5290	<.63	5	<1.9	<5	<7.6	<954	152	<6.1
35-2049	AAA6497	19-20	NA	NA	<3	<12	9	<5	NA	NA	295	NA
35-2050	AAA6498	9-10	NA	NA	<3	<12	<8	<5	NA	NA	257	NA
35-2050	AAA6499	11.5-12.5	NA	NA	<3	<12	<8	<5	NA	NA	601	NA
35-2050	AAA6500	19-20	NA	NA	<3	<12	<8	<5	NA	NA	311	NA
35-2051	AAA6525	3.5-4.5	NA	NA	<3	<12	<8	<5	NA	NA	343	NA
35-2051	AAA6526	9-10	NA	NA	<3	<12	11	<5	NA	NA	355	NA
35-2051	AAA6527	14-15	NA	NA	<3	<12	11	<5	NA	NA	362	NA
35-2051	AAA6528	17-18	NA	NA	<3	<12	9	<5	NA	NA	630	NA
35-2052	AAA6529	4-5	NA	NA	<3	<12	<8	<5	NA	NA	338	NA
35-2052	AAA6530	9-10	NA	NA	<3	<12	13	<5	NA	NA	174	NA
35-2052	AAA6531	14-15	NA	NA	<3	<12	<8	<5	NA	NA	255	NA
35-2052	AAA6532	18.8-20	<1	510	<.4	3.9	1.4	<5	7.4	160	210	<2
35-2053	AAA6508	3-4	NA	NA	<3	<12	<8	<5	NA	NA	412	NA
35-2053	AAA6510	9-10	<.96	805	<.96	<1.6	<7	<5	<3.3	<183	108	<9.3
35-2053	AAA6511	14-15	NA	NA	<3	<12	15	<5	NA	NA	370	NA
35-2053	AAA6512	17.5-18.5	NA	NA	<3	<12	<8	<5	NA	NA	421	NA
35-2054	AAA6513	4-5	NA	NA	<3	<12	<8	<5	NA	NA	376	NA
35-2054	AAA6514	8-9	NA	NA	<3	<12	<8	<5	NA	NA	259	NA
35-2054	AAA6515	14-15	NA	NA	<3	<12	<8	<5	NA	NA	258	NA
35-2054	AAA6516	19-20	NA	NA	<3	<12	<8	<5	NA	NA	409	NA
35-2055	AAA6480	4-5	NA	NA	<3	<12	<8	<5	NA	NA	320	NA
35-2055	AAA6481	9-10	NA	NA	<3	<12	<8	<5	NA	NA	362	NA
35-2055	AAA6482	14-15	NA	NA	<3	<12	<8	<5	NA	NA	372	NA
35-2055	AAA6483	19-20	NA	NA	<3	<12	<8	<5	NA	NA	354	NA
35-2056	AAA6484	4-5	<.66	9519	<.83	6.4	<4.8	<5	<7	1537	208	<6.4
35-2056	AAA6485	6-7	NA	NA	<3	14	<8	<5	NA	NA	748	NA
35-2056	AAA6486	13-14	NA	NA	<3	<12	<8	<5	NA	NA	627	NA
35-2056	AAA6487	19-20	NA	NA	<3	<12	<8	<5	NA	NA	505	NA

*mg/kg

TABLE 5.10.5-1 (continued)

INORGANIC CONSTITUENTS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTL FOR PRS No. 35-009(c)

Location ID	Sample ID	Depth (ft)	Ni	Pb	Sb	Se	Sr	Th	Ti	U	V	Zn
SAL	N/A	N/A	1500	400	31	380	46000	N.A.	N.A.	230	540	23000
Mixed soil UTL	N/A	N/A	15.2	23.3	1	1.7	N.A.	22.6	N.A.	5.45	41.09	50.8
Qbt3 UTL	N/A	N/A	2.6	16.2	0.4	N.A.	N.A.	16.3	N.A.	4.37	4.01	55.5
XRF UTL	N/A	N/A	22.5	28.4	1.45	N.A.	N/A	22.1	N.A.	5.33	N.A.	76.6
35-2049	AAA6495	8-9	27	34	<4	<4	NA	22	1330	<8	NA	100
35-2049	AAA6496	12-13	<3.2	15	<1	<.42	<8.4	14	801	<8	<4.9	70
35-2049	AAA6497	19-20	<13	19	<4	<4	NA	17	593	<8	NA	46
35-2050	AAA6498	9-10	<13	15	<4	<4	NA	13	575	<8	NA	48
35-2050	AAA6499	11.5-12.5	<13	17	<4	<4	NA	14	600	<8	NA	51
35-2050	AAA6500	19-20	<13	11	<4	<4	NA	9	580	15	NA	47
35-2051	AAA6525	3.5-4.5	<13	21	<4	<4	NA	16	897	<8	NA	42
35-2051	AAA6526	9-10	<13	18	5	<4	NA	19	710	<8	NA	42
35-2051	AAA6527	14-15	<13	<7	<4	<4	NA	19	690	<8	NA	39
35-2051	AAA6528	17-18	<13	20	<4	<4	NA	25	986	<8	NA	63
35-2052	AAA6529	4-5	<13	15	<4	<4	NA	14	792	<8	NA	57
35-2052	AAA6530	9-10	<13	19	<4	<4	NA	16	757	<8	NA	40
35-2052	AAA6531	14-15	<13	16	<4	<4	NA	14	560	<8	NA	48
35-2052	AAA6532	18.8-20	<2	<5	<.25	<.2	1.1	20	602	12	2.1	45
35-2053	AAA6508	3-4	<13	21	<4	<4	NA	17	1220	<8	NA	46
35-2053	AAA6510	9-10	<2.9	3.5	<1.6	<.64	<1.2	18	567	<8	<1.9	48
35-2053	AAA6511	14-15	<13	17	<4	<4	NA	18	785	<8	NA	50
35-2053	AAA6512	17.5-18.5	<13	26	<4	<4	NA	26	709	12	NA	72
35-2054	AAA6513	4-5	<13	31	<4	<4	NA	17	1320	<8	NA	49
35-2054	AAA6514	8-9	<13	28	<4	<4	NA	18	936	<8	NA	56
35-2054	AAA6515	14-15	<13	22	<4	<4	NA	20	562	<8	NA	47
35-2054	AAA6516	19-20	<13	19	<4	<4	NA	16	607	<8	NA	45
35-2055	AAA6480	4-5	<13	26	<4	<4	NA	17	1770	<8	NA	32
35-2055	AAA6481	9-10	<13	9	<4	<4	NA	10	588	10	NA	55
35-2055	AAA6482	14-15	<13	14	<4	<4	NA	19	567	<8	NA	31
35-2055	AAA6483	19-20	<13	14	<4	<4	NA	19	562	<8	NA	43
35-2056	AAA6484	4-5	<3.5	13	<1.1	<.44 UJ	<17.2	17	2270	<8	15	37
35-2056	AAA6485	6-7	<13	90	<4	<4	NA	18	2790	<8	NA	64
35-2056	AAA6486	13-14	<13	18	<4	<4	NA	13	740	<8	NA	50
35-2056	AAA6487	19-20	<13	19	<4	<4	NA	23	689	<8	NA	52

*mg/kg

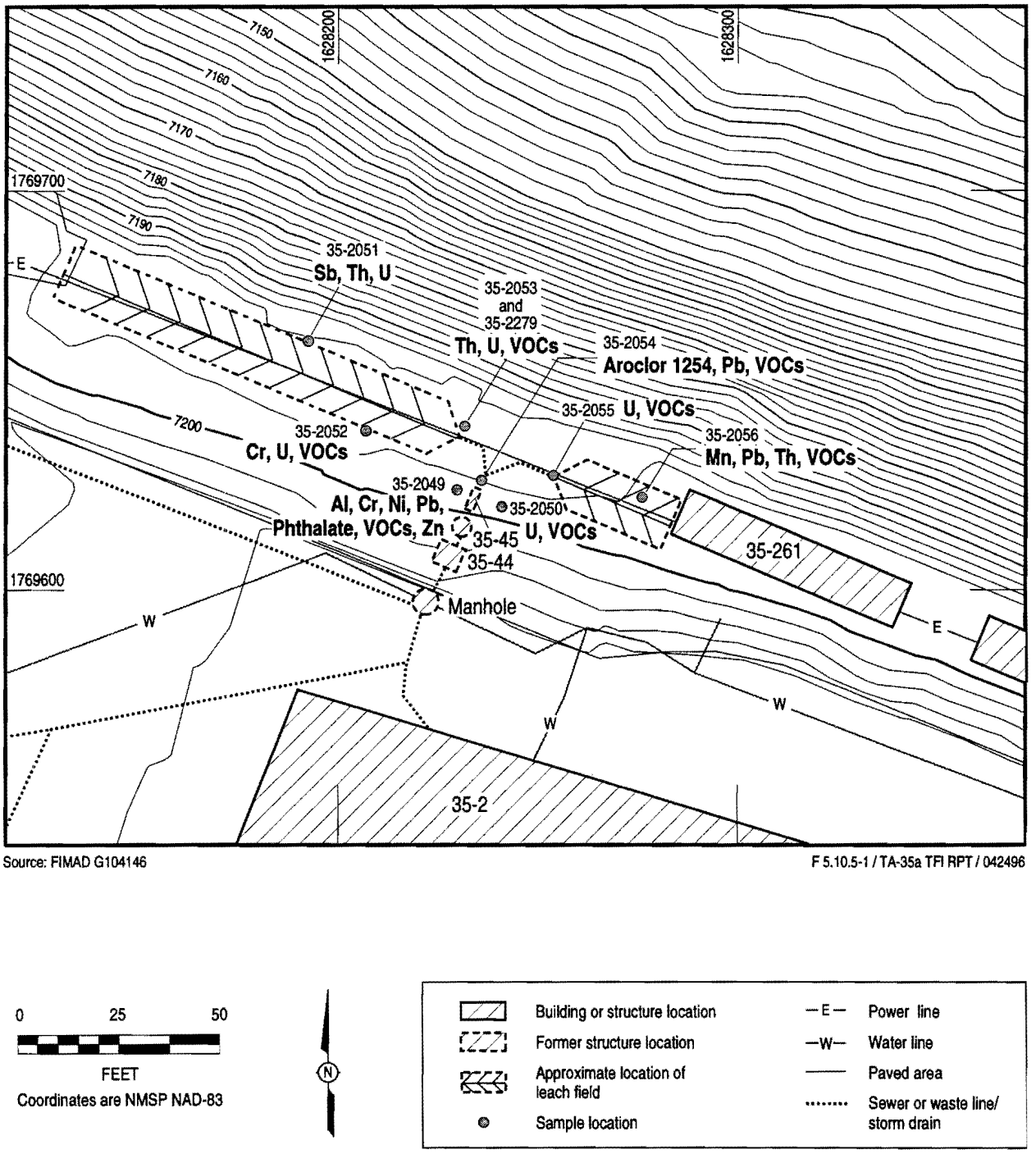

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Figure 5.10.5-1. Locations of detected organic chemicals and analytes that exceed UTLs at PRS No. 35-009(c).

5.10.6 Evaluation of Organic Constituents

The organic chemicals analyzed at for at this PRS include VOCs, SVOCs, and PCBs. Thirty-one soil samples from eight locations, including one field duplicate, were analyzed for VOCs and SVOCs in the mobile laboratory facility. Five soil samples from five locations were also analyzed for VOCs and SVOCs in a fixed-site laboratory. Two soil samples at two locations were analyzed for PCBs in a fixed-site laboratory.

Organic chemicals detected in soil are shown in Table 5.10.6-1 and Figure 5.10.5-1 and are summarized below.

- Acetone was detected in 17 mobile laboratory facility samples at concentrations ranging from 0.025 to 0.21 mg/kg.
- Aroclor 1254 was detected in one fixed-site laboratory sample at an estimated concentration of 0.93 mg/kg.
- 2-Butanone was detected in two fixed-site laboratory samples at two locations at concentrations of 0.029 and 0.066 mg/kg.

TABLE 5.10.6-1

PRS No. 35-009(c) SOIL CONCENTRATIONS* FOR DETECTED ORGANIC CONSTITUENTS

Location ID	Sample ID	Depth (ft)	Acetone	Aroclor 1254	Mixed Aroclors	2-Butanone	Diethyl phthalate	4-Isopropyl toluene	4-Methyl-2-pentanone
SAL	N/A	N/A	2000	1.4	1	8700	52000	N.A.	5200
CRQL	N/A	N/A	0.02	0.05	0.05	0.02	0.33	0.005	0.02
35-2049	AAA6495	8-9	0.086 S	ND	ND	ND	ND	ND	ND
35-2049	AAA6496	12-13	0.05 S	ND	ND	ND	ND	ND	ND
35-2049	AAA6497	19-20	ND	ND	ND	ND	7.9 S, J-	ND	ND
35-2050	AAA6498	9-10	0.053 S	ND	ND	ND	ND	ND	ND
35-2050	AAA6499	11.5-12.5	0.06 S	ND	ND	ND	ND	ND	ND
35-2050	AAA6500	19-20	0.079 S	ND	ND	ND	ND	ND	ND
35-2052	AAA6532	18.8-20	ND	ND	ND	0.029	ND	ND	ND
35-2053	AAA6508	3-4	0.025 S	ND	ND	ND	ND	ND	ND
35-2053	AAA6510	9-10	0.042 S	ND	ND	ND	ND	ND	ND
35-2053	AAA6511	14-15	ND	ND	ND	0.066	ND	0.0055	0.022
35-2053	AAA6512	17.5-18.5	0.045 S	ND	ND	ND	ND	ND	ND
35-2054	AAA6513	4-5	0.047 S	0.93 J	0.93 J	ND	ND	ND	ND
35-2054	AAA6514	8-9	0.059 S	ND	ND	ND	ND	ND	ND
35-2054	AAA6515	14-15	0.054 S	ND	ND	ND	ND	ND	ND
35-2054	AAA6516	19-20	0.06 S	ND	ND	ND	ND	ND	ND
35-2055	AAA6481	9-10	0.21 S	ND	ND	ND	ND	ND	ND
35-2055	AAA6482	14-15	0.032 S	ND	ND	ND	ND	ND	ND
35-2055	AAA6483	19-20	0.053 S	ND	ND	ND	ND	ND	ND
35-2056	AAA6486	13-14	0.11 S	ND	ND	ND	ND	ND	ND
35-2056	AAA6487	19-20	0.094 S	ND	ND	ND	ND	ND	ND

*mg/kg

- Diethyl phthalate was detected in one mobile laboratory facility sample at an estimated concentration, with a likely low bias, of 7.9 mg/kg.
- Isopropyltoluene was detected in one fixed-site laboratory sample at a concentration of 0.0055 mg/kg.
- 4-Methyl-2-pentanone was detected in one fixed-site laboratory sample at a concentration of 0.022 mg/kg.

5.10.7 Human Health Assessment

5.10.7.1 Screening Assessment

Ten inorganic chemicals and six 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.

No sample results for any chemical exceeded SAL values at this PRS. However, manganese was detected above background level in one sample and its XRF UTL value is greater than its risk-based screening value. Therefore, manganese is identified as a COPC in the screening assessment. The MCE results for noncarcinogens and carcinogens were 1.2 and 0.95, respectively. The MCE value for noncarcinogens indicates that additive effects among chemicals present above background levels may represent a potential human health risk. The sample locations where COPCs are identified in the screening assessment are shown in Figure 5.10.7-1. In Table 5.10.7-1, the values in the boxes indicate noncarcinogens that were identified as COPCs based on the results of the MCE.

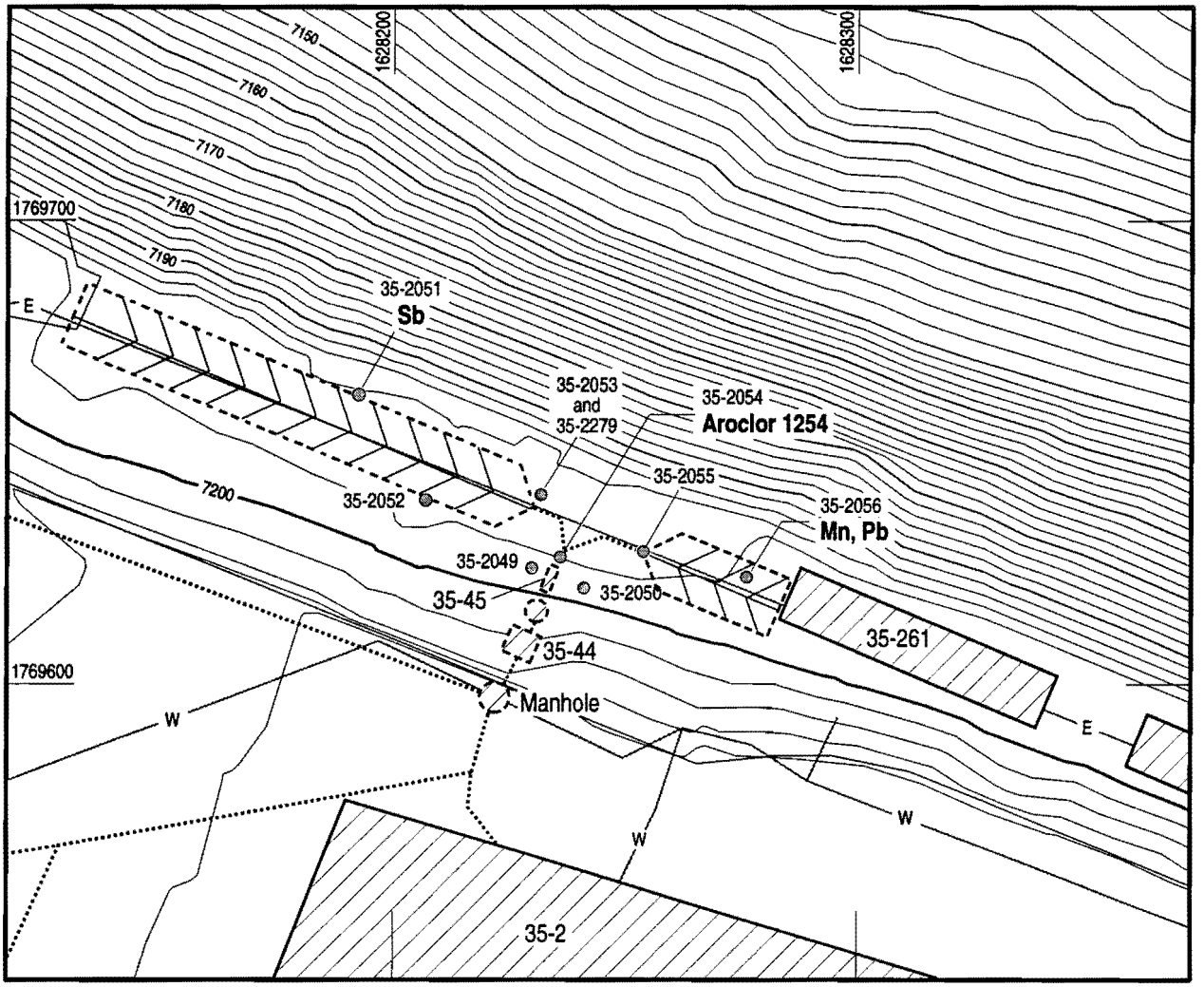
All the COPCs identified in Sections 5.10.5 and 5.10.6 except manganese, isopropyltoluene, and thorium have soil SALs for comparison. The only analyte measured above detection limits that has neither a UTL nor a SAL value is isopropyltoluene. The maximum concentration of thorium was only 20% greater than the XRF UTL, which indicates that the three detects may be indistinguishable from natural background levels. Because the frequency of detection for thorium was only 10% and the measured concentrations were low relative to background, additional evaluation of thorium is not proposed. Isopropyltoluene was found in only 1 of the 36 samples analyzed for VOCs, and it was measured at a very low concentration. Additional evaluation of isopropyltoluene is also unwarranted. Manganese will be discussed in the following section.

5.10.7.2 Risk Assessment

Three inorganic chemicals and one organic chemical were identified as COPCs in the screening assessment in Section 5.10.7.1. These COPCs are not proposed for further quantitative evaluation in this section because sufficient information exists, as described below, that these COPCs do not pose a human health threat.

The four chemicals identified as COPCs are antimony, Aroclor 1254, lead, and manganese. Although lead and manganese are both known to have a deleterious effect on the nervous system, a common toxicity endpoint is not shared among the three chemicals identified as chemicals of concern (COCs) on the basis of the MCE (Amdur et al. 1991, 53961). The MCE assumes additivity in toxic endpoints as an initial screening. Because the assumption of simple additivity is not toxicologically defensible for antimony, Aroclor 1254, and lead, these chemicals should not be considered COCs at this PRS.

An additional argument for eliminating the COPCs identified in the MCE can be made on the basis of the location of the maximum values used in the screening assessment. The values above 10% of the SAL value for each COPC identified in the MCE were measured at different locations at this PRS and at varying depths: 4 to 5 ft for Aroclor 1254, 6 to 7 ft for lead, and 9 to 10 ft for antimony. In a practical sense, simultaneous exposure to



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0 25 50

FEET

Coordinates are NMSP NAD-83

N

Building or structure location

Former structure location

Approximate location of leach field

Sample location

—E— Power line

—W— Water line

Paved area

Sewer or waste line/ storm drain

Figure 5.10.7-1. Locations of risk-based COPCs at PRS No. 35-009(c).

TABLE 5.10.7-1

PRS No. 35-009(c) NONCARCINOGENIC CONSTITUENTS WITH CONCENTRATIONS[a] IN SOIL THAT EXCEED SALs[b]

Location ID	Sample ID	Matrix	Depth (ft)	Aroclor 1254	Pb	Sb
SAL	N/A	N/A	N/A	1.4	400	31
F35-2050	AAA6500	Qbt3	19-20	NA	11	<4
F35-2051	AAA6526	Qbt3	9-10	NA	18	5
F35-2052	AAA6532	Qbt3	18.8-20	NA	<5	<.25
F35-2053	AAA6512	Qbt3	17.5-18.5	NA	26	<4
F35-2054	AAA6513	Mixed Soil	4-5	0.93 J	31	<4
F35-2055	AAA6481	Mixed Soil	9-10	NA	9	<4
F35-2056	AAA6485	Mixed Soil	6-7	NA	90	<4

a. mg/kg
b. MCE = 1.67

these points is impossible. Furthermore, antimony concentrations at this PRS were not significantly different from background levels as shown in Figure AI-13 in Attachment I of this RFI report.

Manganese was detected above UTL in only 1 of the 32 samples analyzed for metals by XRF, or approximately 3% of the samples. Although the single value measured was about 10% above the XRF UTL, the value is not representative of manganese concentrations across the PRS. Furthermore, some fraction of samples are expected to exceed the UTL value for any particular analyte simply because the UTL is a statistic, not a maximum possible value. As shown in Figure AI-10 in Attachment I of this RFI report, the distribution of manganese at this PRS is not significantly different from background distribution. Therefore, it is highly likely that manganese concentrations at this PRS are representative of natural background levels and that the single observation above the UTL value is a natural event. Additional evaluation of manganese is not proposed.

5.10.8 Ecological Assessment

The general landscape condition around this PRS is moderately developed and disturbed, and a high potential exists for receptors to come in contact with some of the chemicals above background levels and detected organic chemicals associated with the site (lead and Aroclors) (Table 5.10.5-1 and Table 5.10.6-1). Therefore, this PRS will be included as a potential contaminant source in the ecological risk assessment. An ecological risk assessment will be conducted when that approach has been approved by the regulators. Threatened and endangered species and/or sensitive habitat listed in Chapter 2.0 of this RFI report will be evaluated in the ecological risk assessment.

5.10.9 Extent of Contamination

The extent of contamination at this PRS has been defined for inorganic chemicals, VOCs, and SVOCs near the septic tank, distribution box, and leach fields. The number of individual samples and sample locations for each analyte suite are discussed in Sections 5.10.5 and 5.10.6. Analyte suites consisted of approximately 35 samples at eight locations. PCB samples were collected at only two locations (Location ID Nos. 35-2049 and 35-2054).

The locations of samples where COPCs were identified in the human health screening assessment are shown in Figure 5.10.7-1. The samples collected at this PRS were biased by location to areas where contamination released with septic liquids would be expected to occur.

Inorganic chemical COPCs were measured above 10% of their SAL value in only one sample each. Antimony was not measured above the detection limit in any other sample, and lead concentrations were three times lower in the other two samples where this analyte was measured above its detection limit. (Manganese was discussed in Section 5.10.7.2.) As described in Section 5.10.7.2, these data indicate that, some COPCs identified in the screening assessment are likely to be present only at naturally occurring concentrations. In any case, the extent of possible contamination associated with these chemicals has been well defined relative to both background and human health screening values.

Although the work plan (LANL 1992, 7666) does not specify the collection of PCB samples at this PRS, two samples were collected. One sample showed a trace amount (below 1 mg/kg) of Aroclor 1254. Although PCBs are widely recognized as ubiquitous environmental contaminants, the origin of a PCB in this septic system is unknown because the system reportedly serviced sanitary wastes from TA-35-2. Further investigation of PCB contamination at this site is not proposed because historical and operational evidence suggest such wastes should not be present at appreciable concentrations.

No evidence of outfalls was found during the field investigation. Because no discharge points or drainages specific to this PRS were identified, surface samples were not collected. Nevertheless, it is likely that if significant quantities of chemical contaminants were released at this site, soil concentrations would probably be as high or higher in the area of the septic tanks and leach fields than in surface water drainages on the side of Mortandad Canyon. It is therefore concluded that the extent of contamination has been adequately determined relative to human health risk.

The data collected at this PRS will be incorporated with data from other PRSs in this vicinity for a future evaluation of ecological risk in an ecological exposure unit, as discussed in Section 5.10.8.

5.10.10 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. 35-009(c) was to determine the presence or absence of contamination associated with a sanitary septic system that served TA-35-2. COPCs identified in the human health screening assessment included antimony, Aroclor 1254, lead, and manganese. These COPCs were further evaluated in Section 5.10.7.2 and were determined not to present a significant human health risk.

Samples for specific analytes were collected from boreholes adjacent to the distribution box and the septic tank and within the leach fields. These are the locations where contaminants present in the sanitary waste stream would be most likely to occur in site soils today. Because these sample locations were biased to identify areas where high levels of contamination might exist, it is concluded that the extent of contamination has been determined for the purposes of human health risk characterization. In addition, this site is the subject of a voluntary corrective action (LANL 1996, 52894) in which the septic tank will be filled in place, as a good management practice, to prevent any future release of contaminants from the septic tank.

Based on NFA criterion number 4, a Class III permit modification is requested to remove PRS No. 35-009(c) 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. The site data will be retained for an area-wide ecological assessment, as described in Section 5.10.8.

5.11 PRS No. 35-009(d)

PRS No. 35-009(d) is an abandoned sanitary septic system. The PRS includes a clean-out manhole (TA-35-64), a 1,600-gal. septic tank (TA-35-65), and a leach field.

No COPCs were identified during the screening assessment. Aluminum, antimony, barium, calcium, chromium, copper, lead, magnesium, nickel, thorium, uranium, vanadium, and zinc were detected above background levels. Acetone, carbon disulfide, and 2-hexanone were the only organic chemicals detected above EQL values.

PRS No. 35-009(d) is recommended for NFA based on NFA criterion number 4 (LANL 1995, 53863).

Radiological sample results are not presented or 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 5.11.4.3.

5.11.1 History

PRS No. 35-009(d) is discussed in detail in Section 3.3.2 of the work plan (LANL 1992, 7666).

The septic system served TA-35 between 1966 and 1990. It handled sanitary wastes from building TA-35-27 and possibly other laboratory buildings and may have received a variety of industrial wastes including radionuclides. Specific information concerning waste streams introduced to the septic system is not available.

The contaminants that were potentially present include gross-alpha, -beta, and -gamma radiation; VOCs; SVOCs; and metals.

5.11.2 Description

PRS No. 35-009(d) is located in a nonindustrialized area of TA-35. The septic tank and the leach field are located on a small finger-like mesa that extends eastward from the northeast end of Ten Site Mesa. The leach field consists of fine- to coarse-grained sandstone and cobble filter bed material. Consolidated tuff is reached at depths from 8 to 10 ft in the leach field.

The topography of the mesa top slopes gently eastward toward the edge of the mesa where steep mesa-side slopes extend to Ten Site Canyon on the south and Mortandad Canyon on the north. Storm-water runoff from the site and effluent from the septic system flows southeast toward Ten Site Canyon. Vegetation is typical of TA-35 and consists of scrub oak brush, grasses, and ponderosa pine. The surface is covered with grasses, pine needles, and leaf debris.

5.11.3 Previous Investigations

No previous investigations have been performed at this site.

5.11.4 Field Investigation

The objective of the Phase I RFI was to characterize the nature of potential contamination associated with the septic system.

The conceptual model for the RFI did not predict that hazardous constituents were released to the environment. The conceptual model predicted that if a release occurred from the site, evidence of the release may be found in the subsurface soils immediately beneath and down the slope from the tank, the drain field, or outfall. Therefore, a judgmental sampling approach was used, and the sampling activities were biased toward areas where residual contamination was expected.

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 Hazco 1256 OVA, a Ludlum Model 39 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 was detected. Organic vapors were detected as noted below.

5.11.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed on December 22, 1993. Beta/gamma measurements ranged from 190 to 300 cpm, and the average was 244 cpm, which is within background levels.

The engineering surveys were performed on December 22, 23, and 29, 1994. High-voltage overhead power lines were found over the septic tank area, which precluded the use of a drill rig to obtain samples from the original borehole locations at the western section of the PRS. Also, water was found in the septic tank. The outfall from the septic tank was located east of the leach field, and the three surface sample locations below the outfall were appropriately established. Borehole sample locations were staked in the septic tank and leach field. Utility mark-outs were performed on January 31, 1994.

The radiation survey was performed on January 6, 1994. The radiation grid locations included Location ID Nos. 35-6153 through 35-6184, which were spaced at approximately 20-ft intervals. Beta/gamma radiation measurements ranged from 200 to 340 cpm, and the average was 263 cpm, which is within background levels.

5.11.4.2 Deviations from the Sampling and Analysis Plan

The original SAP is described in Section 7.10 of the work plan (LANL 1992, 7666). However, the SAP was modified based on information gathered during the engineering surveys. The changes to the SAP, which are summarized below, are documented in a January 28, 1994, memorandum to the Operable Unit 1129 file (Koch 1994, 46383).

The engineering surveys revealed that two boreholes (Location ID Nos. 35-2057 and 35-2058) were situated beneath high-voltage power lines and tower guy wires. It was determined that a drill rig could not operate safely at these sample locations. Therefore, these holes were drilled using a power-assisted hand-auger to depths of 15.2 ft and 18.2 ft, respectively, instead of to the planned depths of 20 ft. The engineering surveys also revealed that liquid was present in the septic tank; therefore, a water sample was collected.

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

5.11.4.3 Sampling Activities

Phase I sampling was performed from February 2, 1994, through February 10, 1994, and on December 7, 1995. A total of 11 locations were sampled, and 26 samples were collected: 1 water sample, 3 surface soil samples, and 22 subsurface soil samples (not including duplicate QA/QC samples). During the initial sampling in February, four boreholes (Location ID Nos. 35-2059, 35-2060, 35-2061, and 35-2062) were drilled to a depth of 20 ft, and four samples were collected from each borehole. Sample collection intervals are shown in Table 5.11.4-1. One hand-auger hole (Location ID No. 35-2057) was drilled to a depth of 15.2 ft, and one hand-auger hole (Location ID No. 35-2058 was drilled to a depth of 18.2 ft. Three samples were collected from each hand-auger hole. Three surface samples (Location ID Nos. 35-2046, 35-2047, and 35-2048) were collected from the discharge channel beneath the outfall east of the septic system leach field. One water sample (Location ID No. 35-2228) was collected from the septic tank. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 200 to 250 cpm, which are within background levels.

Supplemental sampling was performed on December 7, 1995, to resample one location (Location ID No. 35-2057) because the original sample material was lost at the analytical laboratory. Two soil samples were collected at the 8- to 10-ft and 10- to 11-ft intervals from one hand-auger hole (Location ID No. 35-2277), which replaces Location ID Nos. 35-2057-A2 and 35-2057-A3). Beta/gamma radiation measurements obtained during field screening of the samples ranged from 100 to 120 cpm, which are within background levels.

During the drilling of one borehole (Location ID No. 35-2061) 0.5 ppm of organic vapor were detected at a depth of 2.5 ft. During drilling of one hand-auger hole (Location ID No. 35-2057) low-level organic vapor was detected; the highest recorded value was 1.2 ppm. During collection of the water sample (Location ID No. 35-2228) 6.0 ppm of organic vapor were detected when the septic tank lid was opened. Organic vapor was detected at the

TABLE 5.11.4-1

SUMMARY OF SAMPLES TAKEN AT PRS No. 35-009(d)

Location ID	Sample ID	Depth (ft)	Matrix	VOC Mobile Lab	VOC Fixed Lab	SVOC Mobile Lab	SVOC Fixed Lab	INORG Mobile Lab	INORG Fixed Lab	Rad Van	Rad Fixed Lab
35-2046	AAA6541	0-0.5	mixed soil	NR	NR	16713	NR	16757	NR	16769	16721
35-2047	AAA6542	0-0.5	mixed soil	NR	NR	16713	NR	16757	NR	16769	16721
35-2048	AAA6543	0-0.5	mixed soil	NR	NR	16713	NR	16757	16748	16769	16721
35-2057	AAA6564	5-8	Qbt3	16759	16718	0	16718	16768	16776	16756	16754
35-2057	AAA6565	8-10	Qbt3	NR	NR	16759	NR	16768	NR	16756	16754
35-2057	AAA6566	10-15.2	Qbt3	NR	NR	16759	NR	16768	NR	16756	16754
35-2058	AAA6567	5-8	Qbt3	16744	NR	16744	NR	16760	NR	16758	16755
35-2058	AAA6568	8-10	Qbt3	16744	NR	16744	16750	16760	NR	16758	16755
35-2058	AAA6569	10-18.2	Qbt3	16744	NR	16744	NR	16760	NR	16758	16755
35-2058	AAA6570	10-18.2	Qbt3	16744	NR	16744	NR	16760	NR	16758	16755
35-2059	AAA6504	1-2	mixed soil	16713	16713	16713	NR	16757	NR	16769	16721
35-2059	AAA6517	7.5-8.5	mixed soil	16713	16713	16713	NR	16757	16748	16769	16721
35-2059	AAA6518	14-15	Qbt3	16713	16713	16713	NR	16757	NR	16769	16721
35-2059	AAA6519	17.5-18.5	Qbt3	16713	16713	16713	NR	16757	NR	16769	16721
35-2060	AAA6520	4-5	mixed soil	16713	16715	16713	16715	16757	NR	16769	16721
35-2060	AAA6534	7.5-8.5	mixed soil	16713	16713	16713	NR	16757	NR	16769	16721
35-2060	AAA6535	14-15	Qbt3	16713	16713	16713	NR	16757	NR	16769	16721
35-2060	AAA6536	17-18	Qbt3	16713	16713	16713	NR	16757	NR	16769	16721
35-2061	AAA6547	0.5-2.5	mixed soil	16713	16715	16713	NR	16757	NR	16769	16721
35-2061	AAA6548	7.5-8.5	mixed soil	16713	16713	16713	NR	16757	NR	16769	16721
35-2061	AAA6549	14-15	Qbt3	16713	16713	16713	NR	16757	NR	16769	16721
35-2061	AAA6550	14-15	Qbt3	16713	16713	16713	NR	16757	NR	16769	16721
35-2061	AAA6551	17-18	Qbt3	16713	16713	16713	NR	16757	NR	16769	16721
35-2062	AAA6552	1-2.5	mixed soil	16713	16713	16713	NR	16757	NR	16769	16721
35-2062	AAA6553	9-10	mixed soil	16713	16713	16713	16715	16757	NR	16769	16721
35-2062	AAA6554	14-15	Qbt3	16713	16713	16713	NR	16757	NR	16769	16721
35-2062	AAA6555	19-20	Qbt3	16713	16713	16713	NR	16757	16748	16769	16721
35-2277	0435-95-0191	8-10	mixed soil	NR	1701	NR	NR	NR	NR	NR	NR
35-2277	0435-95-0192	10-11	mixed soil	NR	1701	NR	NR	NR	NR	NR	NR

surface of the water sample and was recorded at 1.0 ppm. During the collection of samples from one borehole (Location ID No. 35-2060) 4.0 ppm of organic vapor were detected at the 5- to 7.5-ft interval, and 3.0 ppm were detected at the 10- to 15-ft interval.

Table 5.11.4-1 summarizes all sampling for PRS No. 35-009(d); Figure 5.11.4-1 shows the sample locations.

5.11.5 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.

Twenty-seven samples from nine locations, including two field duplicates, 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. Four soil samples from four locations were 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, lithium, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, sodium, strontium, 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 sample matrix in the upper intervals generally consisted of sand, clay, cobbles or a mixture of these materials, and tuff. In deeper intervals, the sample matrix was predominantly tuff. The mixed-soil UTL values were used for background comparison for the 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. In Table 5.11.5-1, the values in the boxes indicate inorganic chemicals that were detected in soil at concentrations greater than or equal to their respective UTLs. These inorganic chemicals are also shown in Figure 5.11.5-1. The highest observed concentrations above background at each location are summarized below.

- Aluminum was detected in one sample at a concentration of 12,200 mg/kg, which is above the Qbt3 UTL of 3,700 mg/kg.
- Antimony was detected in one sample at a concentration of 5 mg/kg, which is above the XRF UTL of 1.45 mg/kg.
- Barium was detected in one sample at a concentration of 47.8 mg/kg, which is above the Qbt3 UTL of 28 mg/kg. Barium was also detected in one sample at a concentration of 901 mg/kg, which is above the XRF UTL of 561 mg/kg.
- Calcium was detected in one sample at 2,180 mg/kg, which is above the Qbt3 UTL of 1,520 mg/kg.
- Chromium was detected in one sample at a concentration of 10.6 mg/kg, which is above the Qbt3 UTL of 2.1 mg/kg.
- Copper was detected in one sample at a concentration of 27 mg/kg, which is above the XRF UTL of 16.7 mg/kg.
- Magnesium was detected in one sample at 2,020 mg/kg, which is above the Qbt3 UTL of 628 mg/kg.

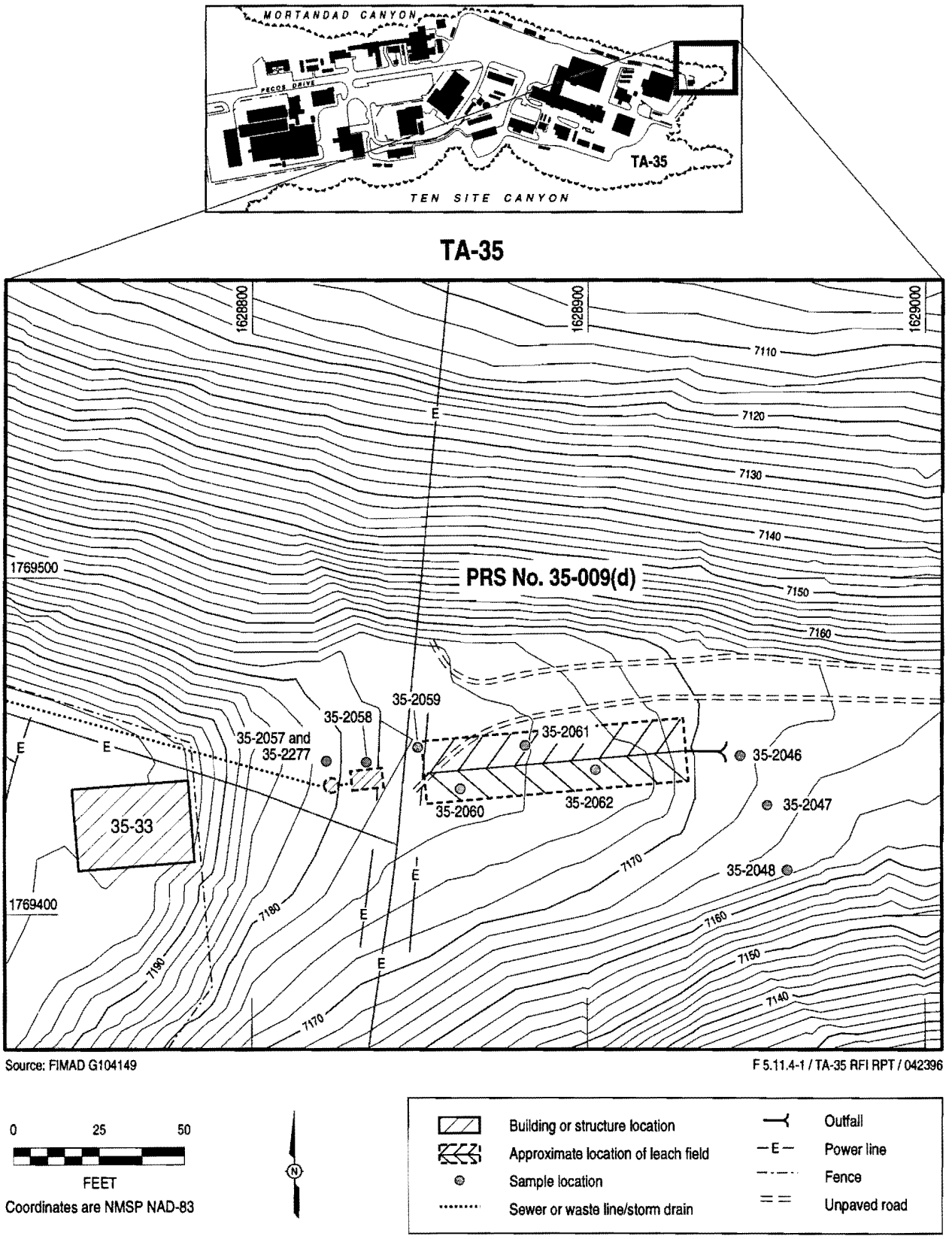


Figure 5.11.4-1. Locations of samples at PRS No. 35-009(d).

TABLE 5.11.5-1

INORGANIC CONSTITUENTS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTL FOR PRS No. 35-009(d)

Location ID	Sample ID	Depth (ft)	Ag	Al	Ba	Ca	Cd	Cr	Cu	Hg	K	Li	Mg
SAL	N/A	N/A	383	77000	5300	N.A.	38	210	2800	23	N.A.	1500	N.A.
Mixed soil UTL	N/A	N/A	N.A.	38700	315	6120	2.7	19.3	30.7	0.1	3410	N.A.	4610
Qbt3 UTL	N/A	N/A	1.9	3700	28	1520	N.A.	2.1	2	N.A.	735	N.A.	628
XRF UTL	N/A	N/A	N/A	N/A	561	10900	N.A.	45	16.7	N.A.	38700	N/A	N/A
35-2046	AAA6541	0-.5	NA	NA	121	4300	<3	<12	10	<5	33100	NA	NA
35-2047	AAA6542	0-.5	NA	NA	73	4300	<3	<12	<8	<5	31900	NA	NA
35-2048	AAA6543	0-.5	<.65	2270	<19.7	1390	<.65	<1.6	<2.6	<5	<381	<2.8	<466
35-2057	AAA6564	5-8	<1.1 UJ	12200	47.8	2180	1.5	10.6	<4.8	<5	<928	9.6	2020
35-2057	AAA6565	8-10	NA	NA	196	4500	<3	20	<8	<5	30600	NA	NA
35-2057	AAA6566	10-15.2	NA	NA	164	3100	<3	<12	<8	<5	31200	NA	NA
35-2058	AAA6567	5-8	NA	NA	116	2200	<3	15	<8	<5	34200	NA	NA
35-2058	AAA6568	8-10	NA	NA	70	2200	<3	<12	<8	<5	33700	NA	NA
35-2058	AAA6569	10-18.2	NA	NA	196	3900	<3	27	9	<5	31000	NA	NA
35-2059	AAA6504	1-2	NA	NA	130	2600	<3	<12	<8	<5	33400	NA	NA
35-2059	AAA6517	7.5-8.5	<.64	1570	<14.1	<554	<.64	3	<2.6	<5	<287	<3.4	<449
35-2059	AAA6518	14-15	NA	NA	92	2500	<3	<12	<8	<5	32800	NA	NA
35-2059	AAA6519	17.5-18.5	NA	NA	151	3300	<3	<12	10	<5	30400	NA	NA
35-2060	AAA6520	4-5	NA	NA	901	9400	<3	31	27	<5	31200	NA	NA
35-2060	AAA6534	7.5-8.5	NA	NA	222	3300	<3	<12	<8	<5	33000	NA	NA
35-2060	AAA6535	14-15	NA	NA	100	2100	<3	<12	<8	<5	35300	NA	NA
35-2060	AAA6536	17-18	NA	NA	128	2700	<3	<12	<8	<5	32900	NA	NA
35-2061	AAA6547	0.5-2.5	NA	NA	104	2800	<3	<12	<8	<5	33900	NA	NA
35-2061	AAA6548	7.5-8.5	NA	NA	227	2700	<3	<12	9	<5	35500	NA	NA
35-2061	AAA6549	14-15	NA	NA	123	1900	<3	<12	<8	<5	34300	NA	NA
35-2061	AAA6551	17-18	NA	NA	109	1900	<3	<12	<8	<5	34300	NA	NA
35-2062	AAA6552	1-2.5	NA	NA	125	3100	<3	<12	<8	<5	34800	NA	NA
35-2062	AAA6553	9-10	NA	NA	175	2600	<3	<12	<8	<5	34400	NA	NA
35-2062	AAA6554	14-15	NA	NA	126	2000	<3	<12	<8	<5	34600	NA	NA
35-2062	AAA6555	19-20	<.63	1600	<11.7	<492	<.63	<1	<1.1	<5	<359	<3.5	<391

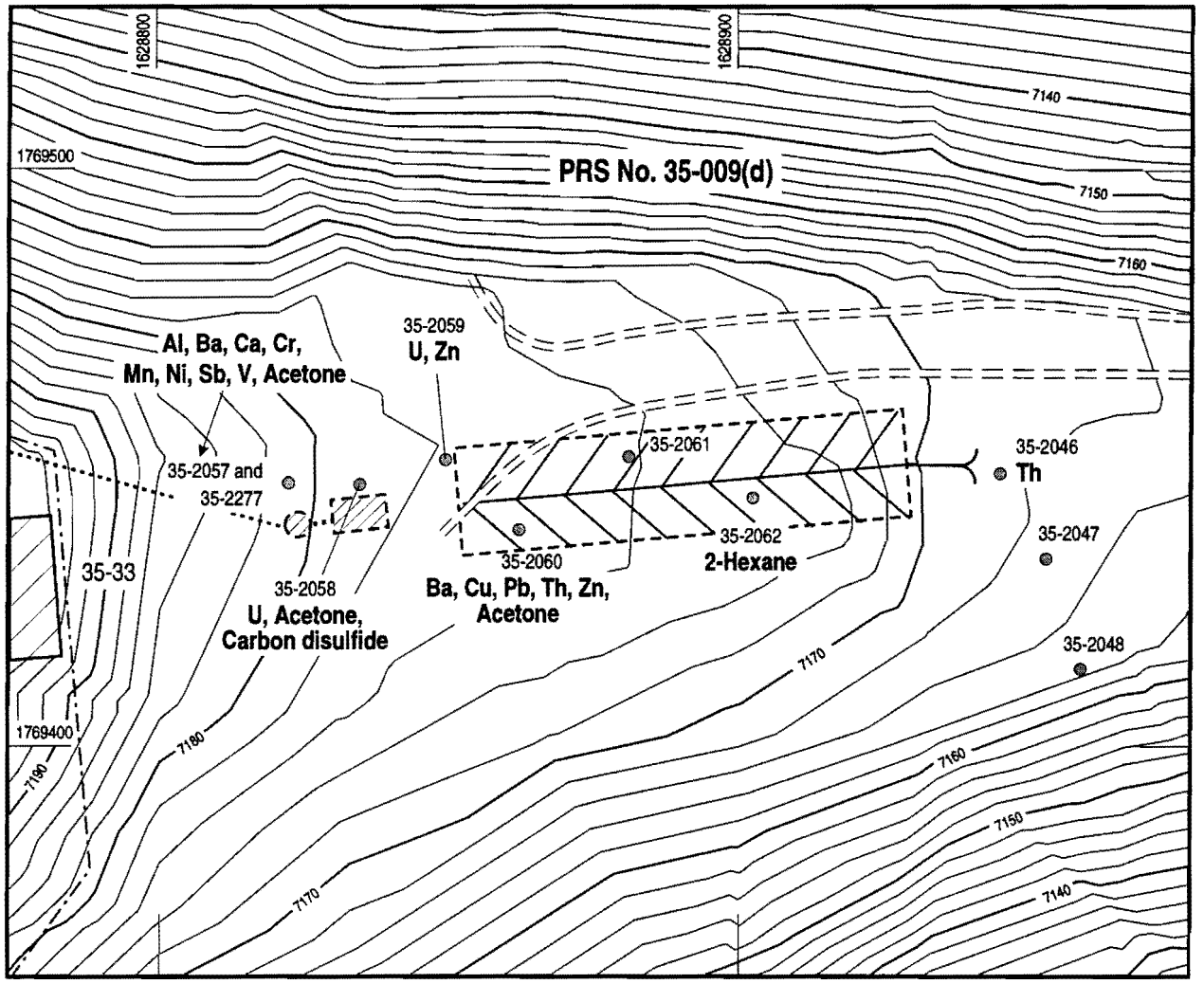
*mg/kg

TABLE 5.11.5-1 (continued)

INORGANIC CONSTITUENTS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTL FOR PRS No. 35-009(d)

Location ID	Sample ID	Depth (ft)	Mo	Ni	Pb	Sb	Se	Sr	Th	Ti	U	V	Zn
SAL	N/A	N/A	380	1500	400	31	380	46000	N.A.	N.A.	230	540	23000
Mixed soil UTL	N/A	N/A	N.A.	15.2	23.3	1	1.7	N.A.	22.6	N.A.	5.45	41.9	50.8
Qbt3 UTL	N/A	N/A	N.A.	2.6	16.2	0.4	N.A.	N.A.	16.3	N.A.	4.37	4.01	55.5
XRF UTL	N/A	N/A	N/A	22.5	28.4	1.45	N.A.	N/A	22.1	N.A.	5.33	N.A.	76.6
35-2046	AAA6541	0-.5	NA	<13	15	<4	<4	NA	24	668	<8	NA	52
35-2047	AAA6542	0-.5	NA	<13	17	<4	<4	NA	15	760	<8	NA	74
35-2048	AAA6543	0-.5	<6.3	<2	5.8	<1.1	<.44	<4.9	21	681	<8	<2.7	43
35-2057	AAA6564	5-8	<.62	8.7	10	<4.2	<.6	20.1 J	22	1660	<8	16.4 J	55
35-2057	AAA6565	8-10	NA	<13	16	5	<4	NA	17	975	<8	NA	50
35-2057	AAA6566	10-15.2	NA	<13	14	<4	<4	NA	15	802	<8	NA	37
35-2058	AAA6567	5-8	NA	<13	10	<4	<4	NA	16	563	<8	NA	33
35-2058	AAA6568	8-10	NA	<13	12	<4	<4	NA	15	703	<8	NA	76
35-2058	AAA6569	10-18.2	NA	17	24	<4	<4	NA	20	1180	9	NA	69
35-2059	AAA6504	1-2	NA	<13	17	<4	<4	NA	21	780	<8	NA	48
35-2059	AAA6517	7.5-8.5	<6.2	<1.9	5.4	<1.1	<.42	<2.4	12	1000	<8	<5.2	80
35-2059	AAA6518	14-15	NA	<13	14	<4	<4	NA	22	915	10	NA	56
35-2059	AAA6519	17.5-18.5	NA	<13	23	<4	<4	NA	21	1070	<8	NA	55
35-2060	AAA6520	4-5	NA	<13	40	<4	<4	NA	12	2340	<8	NA	129
35-2060	AAA6534	7.5-8.5	NA	<13	18	<4	<4	NA	24	818	<8	NA	91
35-2060	AAA6535	14-15	NA	<13	19	<4	<4	NA	23	710	<8	NA	44
35-2060	AAA6536	17-18	NA	<13	22	<4	<4	NA	21	806	<8	NA	63
35-2061	AAA6547	0.5-2.5	NA	<13	19	<4	<4	NA	16	790	<8	NA	41
35-2061	AAA6548	7.5-8.5	NA	<13	18	<4	<4	NA	21	777	9	NA	73
35-2061	AAA6549	14-15	NA	<13	17	<4	<4	NA	19	613	<8	NA	52
35-2061	AAA6551	17-18	NA	<13	16	<4	<4	NA	14	555	<8	NA	49
35-2062	AAA6552	1-2.5	NA	<13	20	<4	<4	NA	21	778	<8	NA	44
35-2062	AAA6553	9-10	NA	<13	19	<4	<4	NA	16	683	<8	NA	57
35-2062	AAA6554	14-15	NA	<13	16	<4	<4	NA	15	583	<8	NA	50
35-2062	AAA6555	19-20	<6.1	<1.9	3.6	<1	<.42	<2.4	13	600	<8	<3.6	48

*mg/kg



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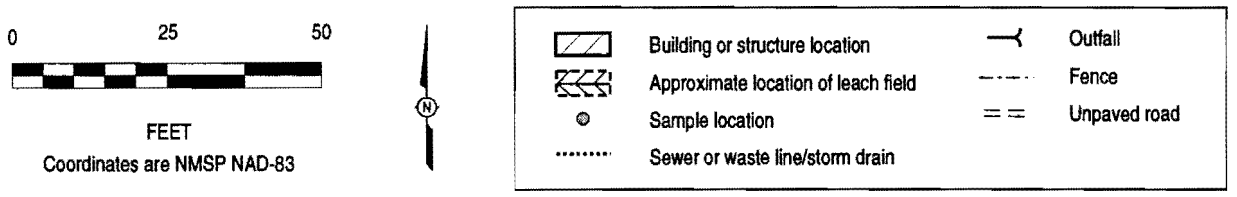


Figure 5.11.5-1. Locations of detected organic chemicals and analytes that exceed UTLs at PRS No. 35-009(d).

- Nickel was detected in one sample at a concentration of 8.7 mg/kg, which is above the Qbt3 UTL of 2.6 mg/kg.
- Thorium was detected in three samples at two locations at maximum concentrations of 24 mg/kg, which are above the XRF UTL of 22.1 mg/kg.
- Lead was detected in one sample at a concentration of 40 mg/kg, which is above the XRF UTL of 28.4 mg/kg.
- Uranium was detected in three samples at three locations at concentrations of 9, 10, and 9 mg/kg, which are above the XRF UTL of 5.33 mg/kg.
- Vanadium was detected in one sample at a concentration of 16.4 mg/kg, which is above the Qbt3 UTL of 4.01 mg/kg.
- Zinc was detected in three samples at two locations at maximum concentrations of 80 and 129 mg/kg, which are above the XRF UTL of 76.6 mg/kg.

5.11.6 Evaluation of Organic Constituents

The organic chemicals analyzed for at this PRS included VOCs and SVOCs. Twenty-six soil samples from nine locations, including two field duplicates, were analyzed for SVOCs in the mobile laboratory facility. Four soil samples from four locations were also analyzed for SVOCs in a fixed-site laboratory. Twenty-two soil samples from six locations, including two field duplicates, were analyzed for VOCs in the mobile laboratory facility. Eighteen soil samples from seven locations, including one field duplicate, were also analyzed for VOCs in a fixed-site laboratory. Organic chemicals detected in soil are shown in Table 5.11.6-1 and Figure 5.11.5-1 and are summarized below.

- Acetone was detected in six samples from four locations at estimated concentrations of 0.7, 0.27, 0.24, 0.38, 0.069, and 0.18 mg/kg. The estimated concentrations at Location ID Nos. 35-2060 and 35-2062 have a likely high bias.
- Carbon disulfide was detected in two samples from one location at estimated concentrations of 0.0053 and 0.0059 mg/kg.
- 2-Hexanone was detected in one sample at an estimated concentration of 0.029 mg/kg.

TABLE 5.11.6-1

PRS No. 35-009(d) SOIL CONCENTRATIONS* FOR DETECTED ORGANIC CONSTITUENTS

Location ID	Sample ID	Depth (ft)	Acetone		Carbon disulfide		2-Hexanone
SAL	N/A	N/A	2000		16		N.A.
CRQL	N/A	N/A	0.02		0.005		0.02
35-2057	AAA6564	5-8	0.7	J	ND		ND
35-2058	AAA6567	5-8	0.27	J	ND		ND
35-2058	AAA6568	8-10	0.24	J	0.0059	J	ND
35-2058	AAA6569	10-18.2	0.38	J	0.0053	J	ND
35-2060	AAA6520	4-5	0.069	J+	ND		ND
35-2061	AAA6547	0.5-2.5	0.18	J+	ND		ND
35-2062	AAA6553	9-10	ND		ND		0.029 S, J

*mg/kg

5.11.7 Human Health Assessment

5.11.7.1 Screening Assessment

Ten inorganic chemicals and three 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.

No sample results for any chemical exceeded SAL values at this PRS. The MCE result for noncarcinogens was 0.73. Because only one chemical for which a SAL is based on carcinogenic effects was detected above background or EQL values (chromium), an MCE calculation for carcinogens was unnecessary. The MCE value for noncarcinogens indicates that additive effects among chemicals present above background levels do not represent a potential human health risk.

All the COPCs identified in Sections 5.11.5 and 5.11.6 except 2-hexanone have soil SALs for comparison. 2-Hexanone, like *n*-hexane (another 6-carbon solvent) has been associated with the development of peripheral neuropathies in exposed populations. The SAL for *n*-hexane is 290 mg/kg. Although a SAL is not available for 2-hexanone, a measure of its relative toxicity to *n*-hexane may be inferred by the fact that the threshold limit value (TLV) developed for 2-hexanone by the American Conference of Governmental Industrial Hygienists is 10 times lower than the TLV for *n*-hexane. Because 2-hexanone was measured in only one sample at an estimated concentration of 0.029 mg/kg, which is four orders of magnitude below the SAL for n-hexane, it is concluded that additional evaluation of 2-hexanone is unwarranted.

The only inorganic chemical 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. Therefore, further evaluation of titanium is not proposed.

Calcium, magnesium, and thorium (chemicals for which SAL values are unavailable) were also detected above UTL values in one or more samples. Calcium and magnesium are both essential elements and are among those metals identified by EPA (1989, 8021) as subject to elimination as COPCs on the basis of professional judgment. Because intake of these metals in food and water is commonly far greater than could be reasonable associated with the observed concentrations in site soil, these COPCs are not evaluated further in this assessment. Thorium was measured above its UTL value in 3 of 25 samples at concentrations approximately 8% higher than its UTL value. Because of its low frequency of detection and because the measured values are only slightly elevated relative to the UTL value, further evaluation of thorium is not proposed.

5.11.7.2 Risk Assessment

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

5.11.8 Ecological Assessment

The general landscape condition around this PRS is moderately developed and disturbed, and a high potential exists for receptors to come in contact with some of the chemicals above background levels associated with the site (barium, copper, lead, thorium, and zinc) (Table 5.11.5-1). Therefore, this PRS will be included as a potential contaminant source in the ecological risk assessment. An ecological risk assessment will be conducted when that approach has been approved by the regulators. Threatened and endangered species and/or sensitive habitat listed in Chapter 2.0 of this RFI report will be evaluated in the ecological risk assessment.

5.11.9 Extent of Contamination

The extent of contamination at this PRS has been defined for inorganic chemicals, VOCs, and SVOCs near the septic tank, leach field, and outfall. The number of individual samples and sample locations for each analyte suite are discussed in Sections 5.11.5 and 5.11.6.

The locations of samples where COPCs were identified in the background comparison are shown in Figure 5.11.5-1. The samples collected at this PRS were biased by location to areas where contamination released with septic liquids would be expected to occur.

All COPCs identified in the background comparison were identified in the boreholes at the septic tank or leach field. No analytes were measured above UTL or EQL values in the three surface samples collected from the outfall drainage. Because no evidence of contamination was measured in the outfall and concentrations at the source do not indicate a human health risk, it is concluded that the extent of contamination relative to human health risk has been defined.

The data collected at this PRS will be incorporated with data from other PRSs in this vicinity for a future evaluation of ecological risk in an ecological exposure unit, as discussed in Section 5.11.8.

5.11.10 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. 35-009(d) was to determine the presence or absence of contamination associated with the sanitary septic system that served TA-35-27. No COPCs were identified in the human health screening assessment.

Samples for specific analytes were collected from boreholes adjacent to the septic tank and within the leach field and associated outfall drainage. These are the locations where contaminants present in the sanitary waste stream would be most likely to occur in site soils today. Because these sample locations were biased to identify areas where high levels of contamination might exist, it is concluded that the extent of contamination has been determined for the purposes of human health risk characterization. In addition, this site is the subject of a voluntary corrective action (LANL 1886, 52894) in which the septic tank will be filled in place, as a good management practice, to prevent any future release of contaminants from the septic tank.

Based on NFA criterion number 4, a Class III permit modification is requested to remove PRS No. 35-009(d) 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. The site data will be retained for an area-wide ecological assessment, as described in Section 5.11.8.

5.12 PRS No. 35-014(a)

PRS No. 35-014(a) is the area surrounding building TA-35-2 where soils may be potentially contaminated by radionuclides released to the atmosphere from a laboratory exhaust stack located on the south side of TA-35-2.

RCRA chemicals were not of potential concern at this PRS (see Sections 3.3.2 and 7.12 of the work plan [LANL 1992, 7666]). Therefore, no inorganic or organic chemicals were analyzed for.

PRS Nos. 35-014(a) are recommended for NFA based on NFA criterion number 1 (LANL 1995, 53863).

Radiological sample results are not presented or 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 5.12.4.3.

5.12.1 History

PRS No. 35-014(a) is discussed in detail in Section 3.3.2 of the work plan (LANL 1992, 7666).

Potential contamination associated with this PRS is believed to have originated from the exhaust stack that served a tritium glove box facility located in the basement of TA-35-2. Reports indicate that several thousand curies of tritium were emitted from this stack to the atmosphere between 1954 and 1979.

The contaminants that were potentially present include gross-alpha, -beta, and -gamma radiation and tritium.

5.12.2 Description

PRS No. 35-014(a) is located on Ten Site Mesa and includes most of the south-central portion of the east end of TA-35. The site is highly industrialized and consists of concrete walkways, asphalt roads and storage areas, landscaped grassy areas, employee picnic areas, and experimental fruit trees between laboratory buildings southwest of TA-35-2. The area is relatively flat, but it slopes gently southward toward the southern edge of Ten Site Mesa. Surface water flows mostly southward toward Ten Site Canyon, although some surface water on the north side of TA-35-2 flows northward toward Mortandad Canyon.

5.12.3 Previous Investigations

No previous investigations have been performed at this site. However, monitoring of TA-35 stack emissions has been recorded since the 1950s. Table 3-23 in Section 3.3.2.3 of the work plan summarizes quantities of normal airborne releases of radionuclides from TA-35-2 between 1967 and 1971 (LANL 1992, 7666). Also, two peach trees located on the south side of TA-35-2 just beneath the stack are sampled annually as part of the Laboratory's environmental surveillance program. Analyses of peach and leaf samples have indicated slightly elevated concentrations of tritium, ^{90}Sr, total uranium, ^{239,240}Pu, and ^{238}Pu. These investigations are discussed in Section 3.3.2.4 of the work plan.

5.12.4 Field Investigation

The objective of the Phase I RFI was to characterize the nature of potential contamination associated with radioactive emissions from the exhaust stack.

The conceptual model for the RFI predicted that the grass-covered and soil areas surrounding TA-35-2 are likely locations for contaminants to accumulate. Most of the area surrounding the exhaust stack is covered with asphalt, and contaminants that may fall onto the asphalt or onto the building roofs would probably be washed by precipitation to rain gutters and storm drains. Therefore, the areas to be sampled included the grassy area around TA-35-2, the soil beneath the rain gutters and storm drains, and the soil areas that receive runoff from the roof of TA-35-2.

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 Hazco 1256 OVA, a Ludlum Model 39 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. Organic vapors and alpha radiation were detected, as noted below.

5.12.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed in October 1993 in association with TA-35 site-wide radiation surveillance. Personnel from Laboratory group ESH-1 conduct environmental monitoring of the area continually.

An engineering survey was performed on November 4, 1993. The survey included a review of aerial photographs, a field site inspection, the establishment of the radiation grid survey points, and staking the appropriate sample locations. During the survey it was noted that much of the surface storm water from the PRS drains to a discharge channel on the south side of the mesa that empties into Ten Site Canyon.

The radiation grid survey was performed on November 12, 1993. A total of 19 radiation measurements were obtained from grid locations north, west, and south of the west wing of TA-35-2 near the exhaust stack. The radiation grid locations included Location ID Nos. 35-6001 through 35-6019, which were spaced at approximately 30-ft intervals. The radiation grid survey was performed using a Bicron Survey 2000 detector, although all subsequent radiation grid surveys performed after November 12, 1993, were performed using the Eberline ESP-1 beta/gamma meter. Beta/gamma radiation measurements made with the Bicron ranged from 50 to 120 cpm, and the average was 91 cpm, which is within background levels. Location ID No. 35-6017, which is on the concrete sidewalk outside the west door of TA-35-2, was used as a reference location for QA/QC of all radiation grid surveys at TA-35. Later measurements obtained at the reference location were consistently higher using the Eberline instrument when compared with the Bicron. Between December 1993 and August 1994, 20 measurements were obtained at the reference location. The average of these reference measurements is 210 cpm, which is 2.1 times greater than the average measurement obtained using the Bicron. Therefore, to provide consistency in the TA-35 radiation grid measurements, the radiation measurements obtained from the Bicron instrument have been multiplied by an adjustment factor of 2.1. Therefore, the highest values after multiplying by the adjustment factor was 252 cpm, the lowest value was 105 cpm, and the average was 191 cpm, which is within background levels.

5.12.4.2 Deviations from the Sampling and Analysis Plan

The original SAP is described in Section 7.12 of the work plan (LANL 1992, 7666). However, the SAP was modified based on information gathered during the engineering surveys. The changes to the SAP, which are summarized below, are documented in the December 20, 1993, memorandum to the Operable Unit 1129 file (Walterscheid 1993, 40803).

The original SAP required that one sample for each planned analysis be collected in the area of the hand-auger hole that had the highest observed radioactivity as determined by field screening. If no radioactivity was found, the sample would be collected from random locations in the recovered boring interval. However, the modified SAP allowed for collecting the sample material from a homogenized 1-ft interval of retrieved core material, as is done for standard drilling and sampling practices.

The original SAP required that the depth of the hand-auger hole be determined by field screening and that the hole to be drilled until field screening indicated that no contamination was present. However, the modified SAP required that all hand-auger holes be completed to a depth of 3 ft. The original SAP also stated that two additional 1-ft samples would be collected to confirm that no contamination exists. The modified SAP removed the requirement for those two additional samples because confirmation would not be necessary if all hand-auger holes would be drilled only to the standardized 3-ft depth.

As a result of the engineering surveys, one original sample (Location ID No. 35-2080) was relocated from the grassy area on the north side of TA-35-2 to a surface storm-water discharge point at the south side of Ten Site Mesa. This sample location was established to sample surface sediment and potential contaminants that would naturally accumulate from the PRS.

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

5.12.4.3 Sampling Activities

Phase I sampling was performed from November 16, 1993, through November 19, 1993. A total of 11 locations were sampled, and 31 soil samples were collected (not including duplicate QA/QC samples). All samples were collected from soil or grass-covered sites near TA-35-2. Four hand-auger holes (Location ID Nos. 35-2070, 35-2071, 35-2073, and 35-2074) were located below the roof storm-water drain discharge areas around TA-35-2. The sample collection intervals are shown in Table 5.12.4-1. Five samples (Location ID Nos. 35-2074, 35-2075, 35-2076, 35-2077, and 35-2220) were collected in the landscaped grassy area around TA-35-2. Two samples (Location ID Nos. 35-2078 and 35-2079) were collected in undisturbed soil areas several hundred feet southwest and south of TA-35-2, respectively. As previously mentioned, one sample (Location ID No. 35-2080) was located in surface water drainage where sediments and potential contaminants could have accumulated.

Organic vapors were detected at Location ID No. 35-2075 at the 1-ft depth (0.1 ppm); at Location ID No. 35-2078 at the 2-ft depth (0.1 ppm); and at Location ID No. 35-2079 at the 2-ft depth (0.2 ppm). Beta/gamma radiation measurements obtained during field screening of the samples ranged from 70 to 300 cpm, which are below background levels.

On November 18, 1993, one hand-auger hole (Location ID No. 35-2077) encountered alpha radiation readings of 2,500 cpm in the samples recovered from the 1- to 2-ft interval. Sampling activities were suspended pursuant to directives from ESH-1 personnel. Therefore, only one sample (from the 0- to 1-ft interval) was collected from Location ID No. 35-2077. The sample from the 1- to 2-ft interval was left in place near the hand-auger hole. On November 19, 1993, field screening of the samples showed that no alpha radiation was present. The samples were returned to the hand-auger hole, and the hole was abandoned. It was later determined that the source of the alpha radiation readings was a pinhole in the probe covering and not actual radioactive contamination. Another hand-auger hole (Location ID No. 35-2220) was drilled adjacent to Location ID No. 35-2077, and the samples collected from Location ID No. 35-2220 replaced the sampling planned for Location ID No. 35-2077.

Table 5.12.4-1 summarizes all sampling for PRS No. 35-014(a); Figure 5.12.4-1 shows the sample locations.

5.12.5 Background Comparisons

RCRA chemicals were not of potential concern at this PRS (see Sections 3.3.2 and 7.12 of the work plan [LANL 1992, 7666]). Therefore, no inorganic chemicals were analyzed for.

5.12.6 Evaluation of Organic Constituents

RCRA chemicals were not of potential concern at this PRS (see Sections 3.3.2 and 7.12 of the work plan [LANL 1992, 7666]). Therefore, no organic chemicals were analyzed for.

5.12.7 Human Health Assessment

5.12.7.1 Screening Assessment

RCRA chemicals were not of potential concern at this PRS (see Sections 3.3.2 and 7.12 of the work plan [LANL 1992, 7666]). Therefore, no data for RCRA chemicals were collected.

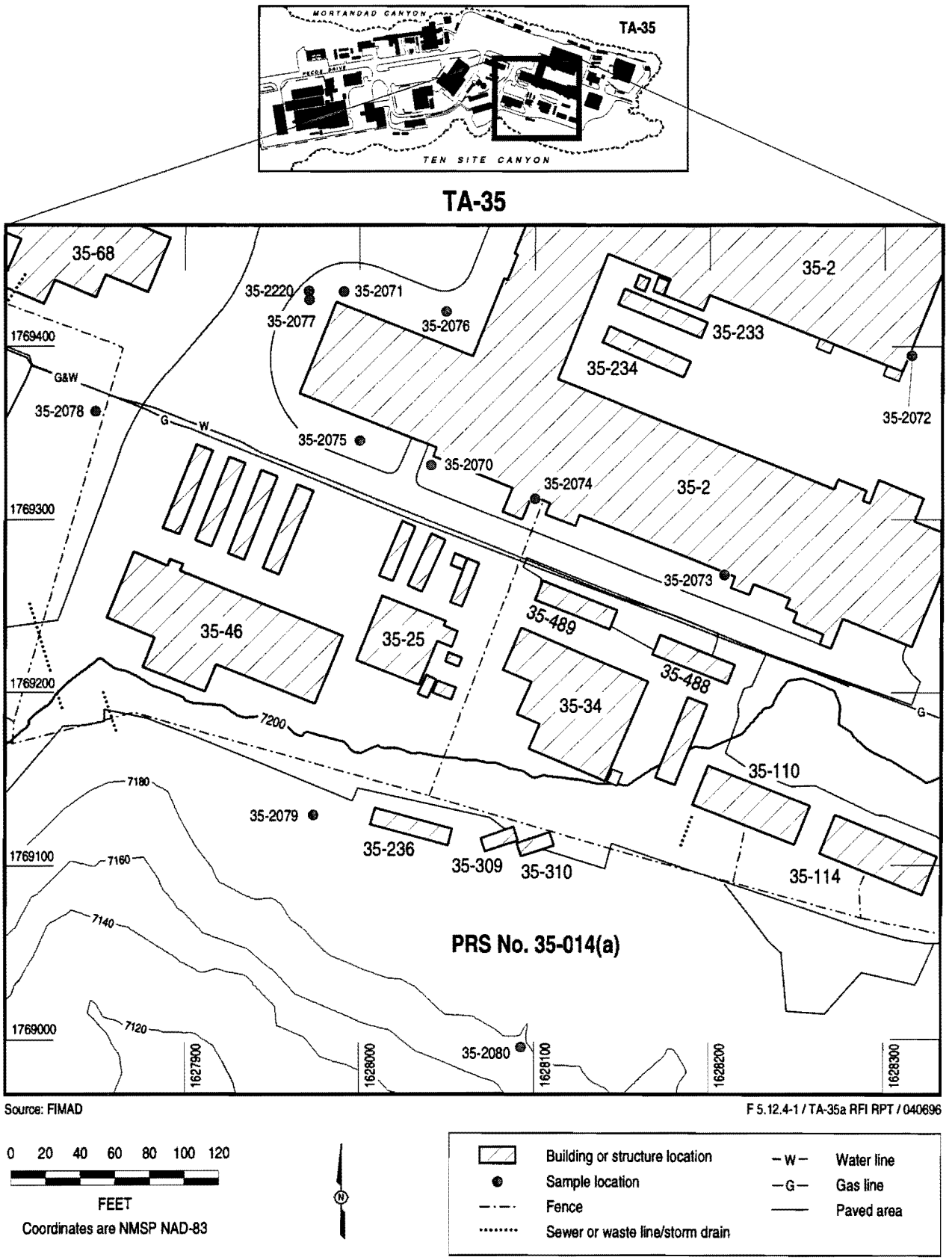
5.12.7.2 Risk Assessment

RCRA chemicals were not of potential concern at this PRS (see Sections 3.3.2 and 7.12 of the work plan [LANL 1992, 7666]). Therefore, no data for RCRA chemicals were collected.

TABLE 5.12.4-1

SUMMARY OF SAMPLES TAKEN AT PRS No. 35-014(a)

Location ID	Sample ID	Depth (ft)	Matrix	Rad Van	Rad Fixed Lab
35-2070	AAA3797	0-1	mixed soil	16387	16386
35-2070	AAA3798	1-2	mixed soil	16387	16386
35-2070	AAA3799	2-3	mixed soil	16387	16386
35-2071	AAA3822	0-1	mixed soil	16387	16386
35-2071	AAA3800	0-1	mixed soil	16387	16386
35-2071	AAA3817	1-2	mixed soil	16387	16386
35-2071	AAA3818	2-3	mixed soil	16387	16386
35-2073	AAA6353	0-1	mixed soil	16385	16355
35-2073	AAA6354	1-2	mixed soil	16385	16355
35-2073	AAA6355	2-3	mixed soil	16385	16355
35-2074	AAA6356	0-1	mixed soil	16385	16355
35-2074	AAA6357	1-2	mixed soil	16385	16355
35-2074	AAA6358	2-3	mixed soil	16385	16355
35-2075	AAA6359	0-1	mixed soil	16385	16355
35-2075	AAA6360	1-2	mixed soil	16385	16355
35-2075	AAA6361	2-3	Qbt3	16385	16355
35-2076	AAA6341	0-1	mixed soil	16393	16391
35-2076	AAA6342	1-2	mixed soil	16393	16391
35-2076	AAA6343	2-3	mixed soil	16393	16391
35-2077	AAA6344	0-1	mixed soil	16393	16391
35-2078	AAA6347	0-1	mixed soil	16393	16391
35-2078	AAA6348	1-2	mixed soil	16393	16391
35-2078	AAA6349	2-3	mixed soil	16393	16391
35-2079	AAA3826	0-1	mixed soil	16393	16391
35-2079	AAA3827	1-2	mixed soil	16393	16391
35-2079	AAA3828	2-3	Qbt3	16393	16391
35-2080	AAA4445	0-1	mixed soil	16393	16391
35-2080	AAA4446	1-2	Qbt3	16393	16391
35-2080	AAA4447	2-3	Qbt3	16393	16391
35-2220	AAA6369	0-1	mixed soil	16390	16389
35-2220	AAA6365	1-2	Qbt3	16390	16389
35-2220	AAA6370	1-2	Qbt3	16390	16389
35-2220	AAA6371	2-3	QAbt3	16390	16389



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0 20 40 60 80 100 120

FEET

Coordinates are NMSP NAD-83

	Building or structure location	—W—	Water line
●	Sample location	—G—	Gas line
—·—·	Fence	——	Paved area
·····	Sewer or waste line/storm drain		

Figure 5.12.4-1. Locations of samples at PRS No. 35-014(a).

5.12.8 Ecological Assessment

No inorganic or organic chemicals were of concern or measured at this PRS; therefore, these constituents are eliminated as contaminant sources for ecological risk. No further ecological evaluation of this site is required.

5.12.9 Extent of Contamination

Thirty-three soil samples from eleven locations were analyzed for tritium, uranium isotopes, and plutonium isotopes in a fixed-site laboratory. These samples were also submitted to the radiological van for gamma spectroscopic analysis of ^{241}Am, ^{140}Ba, ^{144}Ce, ^{60}Co, ^{137}Cs, ^{152}Eu, ^{22}Na, ^{237}Np, and ^{106}Ru. Two of these samples were also sent for confirmatory gamma spectroscopy in a fixed-site laboratory.

An addendum to this RFI report, presenting the results of the radionuclide sampling, will be submitted at a later date. This PRS has been defined as the site of soils potentially contaminated by radionuclides emitted from stacks on TA-35-2. Therefore, the SAP described in the work plan (LANL 1992, 7666) specifies analysis of only radionuclides in the soil samples collected at this PRS.

5.12.10 Conclusions and Recommendations

The objectives of the Phase I RFI at PRS No.35-014(a) were to determine if radionuclides had been released to the environment, and, if so, to collect sufficient data to support transport model calculations. Inorganic and organic chemicals were not analyzed for in the soil samples collected at this PRS. Sample results for radionuclides will be discussed in an addendum to this RFI report.

PRS No. 35-014(a) has never received solid or hazardous wastes as defined in the HSWA Module of the Laboratory's RCRA permit. Therefore, based on NFA criterion number 1, a Class III permit modification is requested to remove this site from the HSWA Module of the Laboratory's RCRA operating permit. This PRS may be investigated as an area of concern based on potential radiological contamination.

5.13 PRS No. 35-014(b)

PRS No. 35-014(b) is the site where a leaking barrel of dielectric-oil-containing PCBs was found east of building TA-35-2.

No COPCs were identified during the screening assessment. Aroclor 1254 was the only organic chemical detected above its EQL value.

PRS No. 35-014(b) is recommended for NFA based on NFA criterion number 4 (LANL 1995, 53863).

Radiological sample results are not presented or 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 5.13.4.3.

5.13.1 History

PRS No. 35-014(b) is discussed in detail in Sections 3.3.2 and 7.12 of the work plan (LANL 1992, 7666).

In 1985 a 55-gal. barrel that contained dielectric oil was found to be leaking (Scholl Fritz 1985, 892). The barrel was labeled "DIALA AX, S03287, Shell Oil." It was removed, and the site was cleaned up by Laboratory group HSE-7, but it is not known if all the contamination was cleaned up.

The contaminants that were potentially present include gross-alpha, -beta, and -gamma radiation; SVOCs; PCBs; and tritium.

5.13.2 Description

PRS No. 35-014(b) is located on Ten Site Mesa in a highly industrialized area at TA-35 at the southeast corner of the north wing of building TA-35-2. The site is currently covered with asphalt, and reports suggest that the site was paved at the time of the oil spill. The area is relatively flat but slopes gently toward the southeast. Surface runoff from the site flows down the asphalt, along the patrol road south of building TA-35-29, and eventually to the small tributary canyon of Ten Site Canyon at the east end of TA-35. No indication of the oil spill was noted during the investigation; however, the site may have been repaved with new asphalt after the spill.

5.13.3 Previous Investigations

On February 12, 1985, a sample was collected at the site of the oil spill and sent to a contract laboratory for PCB analysis (Scholl Fritz 1985, 892). The sample was reported to contain 50.4 mg/g of PCBs, and HSE-7 was notified of the analytical results.

5.13.4 Field Investigation

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

The conceptual model for the RFI took into account the known dielectric oil spill from the leaking barrel. Any remaining spill material left after cleanup of the site was expected to be located in the surface soil in the immediate vicinity of the spill site. Therefore, a judgmental sampling approach was used, and the sampling activities were biased toward the site of the oil spill. The location of the barrel described in the Scholl Fritz memorandum (1985, 892) could not be determined during the Phase I RFI. However, several imprints of storage containers, and some associated surface staining on the asphalt were observed. Because no particular imprint could be linked to the drum known to have contained PCBs, the field team decided to place the sampling location adjacent to TA-35-2 at the lowest point near the surface imprints. The rationale behind this sample location is that if a sizable spill were to have occurred, liquid would run over the asphalt and collect in the nearby depression.

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

Field screening during site surveys and sample collection activities was performed using a Hazco 1256 OVA, a Ludlum Model 39 alpha meter, and an Eberline ESP-1 beta/gamma meter. Using this instrumentation, background radiation measurements at TA-35 ranged 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.

5.13.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed in October 1993 in association with TA-35 site-wide radiation surveillance. Personnel from Laboratory group ESH-1 conduct environmental monitoring of the area continually.

An engineering survey was conducted on November 4, 1993. Personnel at TA-35 were interviewed, and the actual location of the leaking barrel was established.

5.13.4.2 Deviations from the Sampling and Analysis Plan

The original SAP is described in Section 7.12 of the work plan (LANL 1992, 7666). However, the SAP was modified based on information gathered during the engineering survey. The changes to the SAP, which are summarized below, are documented in a December 20, 1993, memorandum to the Operable Unit 1129 file (Walterscheid 1993, 40803).

The engineering survey revealed that the planned sample location was not shown correctly in the work plan. Therefore, the sample location was changed to the correct location. Additionally, Location ID No. 35-2080 that was originally planned for this PRS was replaced by Location ID No. 35-2072. The original SAP did not require SVOC analysis of the samples; however, SVOC analysis was added because this PRS is the site of an oil spill.

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

5.13.4.3 Sampling Activities

During the Phase I RFI, several imprints associated with portable containers and surface staining (which indicates oil) were observed on the asphalt surface. Location ID NO. 35-2072 was located at a low point by the wall of TA-35-2 near the observed imprints based on the assumption that a large volume of liquid leaking from a storage container would be likely to collect at that point (Perona 1996, 53925). The exact location of the particular barrel described in the Scholl Fritz memorandum (1985, 892) was not identifiable.

Phase I sampling was conducted on November 16, 1993. One location was sampled and three soil samples were collected (not including duplicate QA/QC samples). One hand-auger hole was drilled to a depth of 3 ft (Location ID No. 35-2072). The sample collection intervals are shown in Table 5.13.4-1. The highest beta/gamma radiation measurement obtained during field screening of the samples was 230 cpm, which is within background levels.

Table 5.13.4-1 summarizes all sampling for PRS No. 35-014(b); Figure 5.13.4-1 shows the sample locations.

5.13.5 Background Comparisons

Because inorganic chemicals were not analyzed for at PRS No. 35-014(b), no UTL comparisons were performed.

5.13.6 Evaluation of Organic Constituents

The organic chemicals analyzed for at this PRS include SVOCs and PCBs. Four soil samples collected from one location were analyzed. Before sample collection, 1 ft of fill material immediately below the asphalt cover was removed because of residual contamination associated with the asphalt.

The fixed-site laboratory analysis for PCBs included the following Aroclors: 1016, 1221, 1232, 1242, 1248, 1254, and 1260. The organic chemicals that were detected in soil with concentrations above EQL values are shown in Table 5.13.6-1 and on Figure 5.13.6-1 and are discussed below.

- Aroclor 1254 at concentrations of 0.05, 0.054, and 0.06 mg/kg was detected in the surface to 1-ft, 1- to 2-ft, and 2- to 3-ft intervals, respectively.

TABLE 5.13.4-1

SUMMARY OF SAMPLES TAKEN AT PRS No. 35-014(b)

Location ID	Sample ID	Depth (ft)	Matrix	SVOC Mobile Lab	PCB Fixed Lab	Rad Van	Rad Fixed Lab
35-2072	AAA3819	0-1	mixed soil	16301	16301	16387	16386
35-2072	AAA3820	1-2	mixed soil	16301	16301	16387	16386
35-2072	AAA3821	2-3	mixed soil	16301	16301	16387	16386
35-2072	AAA3823	2-3	mixed soil	16301	16301	16585	NR

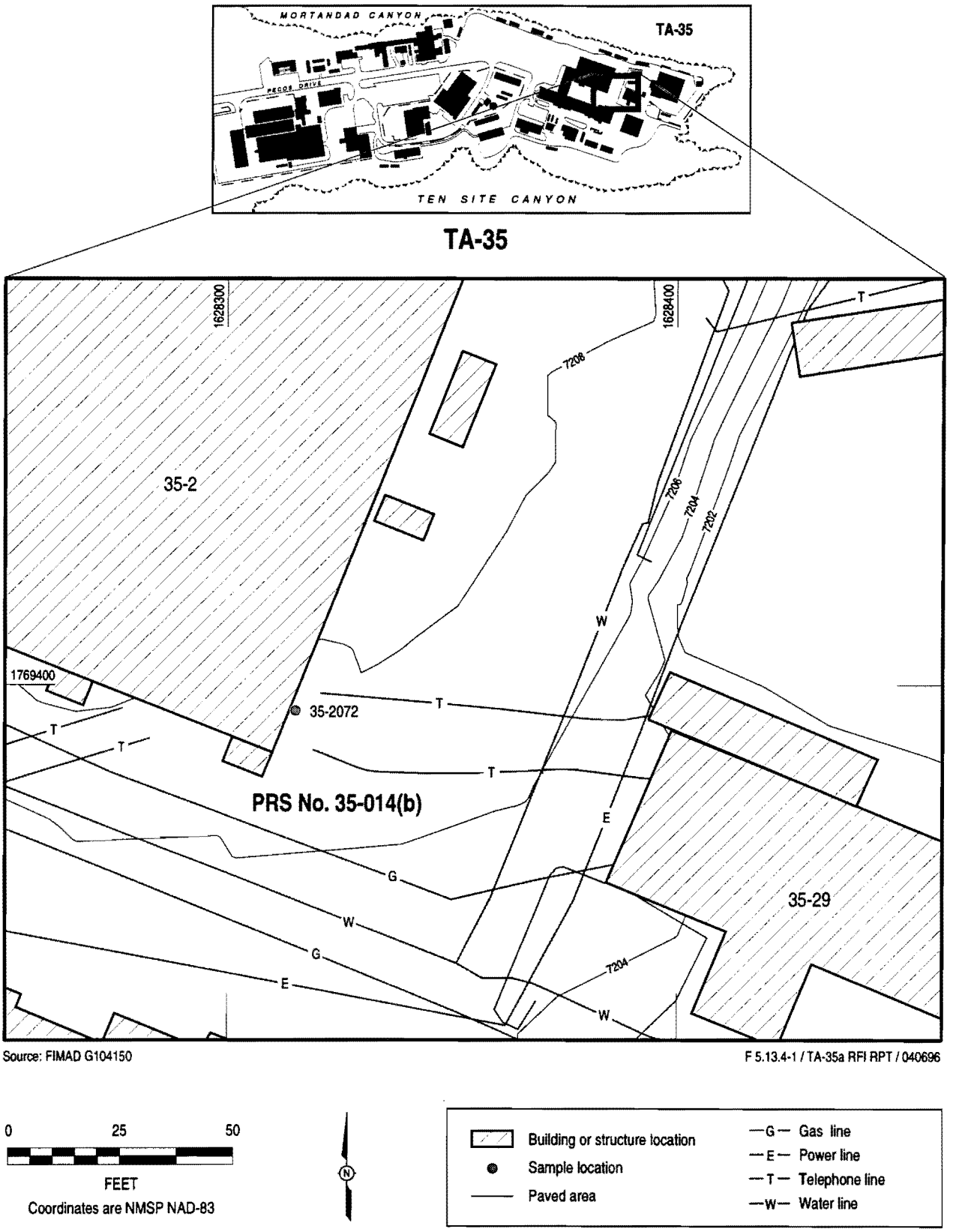


Figure 5.13.4-1. Location of sample at PRS No. 35-014(b).

TABLE 5.13.6-1

PRS No. 35-014(b) SOIL CONCENTRATIONS* FOR DETECTED ORGANIC CONSTITUENTS

Location ID	Sample ID	Depth (ft)	Aroclor 1254	Mixed Aroclors
SAL	N/A	N/A	1.4	1
CRQL	N/A	N/A	.033	.033
35-2072	AAA3819	0-1	0.05	0.05
35-2072	AAA3820	1-2	0.054	0.054
35-2072	AAA3821	2-3	0.06	0.06

*mg/kg

EQLs for PCBs ranged from 0.036 to 0.074 mg/kg, which are well below the thresholds discussed in the SAL comparison in the following section. However, soil samples at all three depth intervals showed large, unresolved saturated hydrocarbon peaks in the chromatograms. EQLs for SVOC analytes were reported by the laboratory to be elevated by greater than a factor of 10. Therefore, EQLs are greater than SAL values for several analytes, particularly PAHs. For example, the EQLs for benzo(a)pyrene, a PAH that is a potent carcinogen, are as high as 11 mg/kg, whereas the SAL for benzo(a)pyrene is 0.06 mg/kg. Hydrocarbon contamination that was not resolved by the analytical laboratory was observed in all the samples (see Table B-8 in Appendix B of this RFI report), although the source of these hydrocarbons cannot be confidently ascribed to any particular source such as the barrel described by Scholl Fritz. Additionally, the absence of SVOC contamination cannot be determined because of the elevated EQLs caused by the presence of the hydrocarbon contamination.

Although PAHs were not quantitated at levels as low as screening concentrations, contributions of PAHs from PRS No. 35-014(b), if any, are in all likelihood insignificant relative to PAH leaching to surface soil from the widespread asphalt at TA-35. Other issues relating to gross hydrocarbon contamination in the area, including possible impact on surface water quality, are discussed in Section 5.4, where relatively large releases have been documented at PRS Nos. 35-003(j and k), 35-014(d), and 35-015(b).

5.13.7 Human Health Assessment

5.13.7.1 Screening Assessment

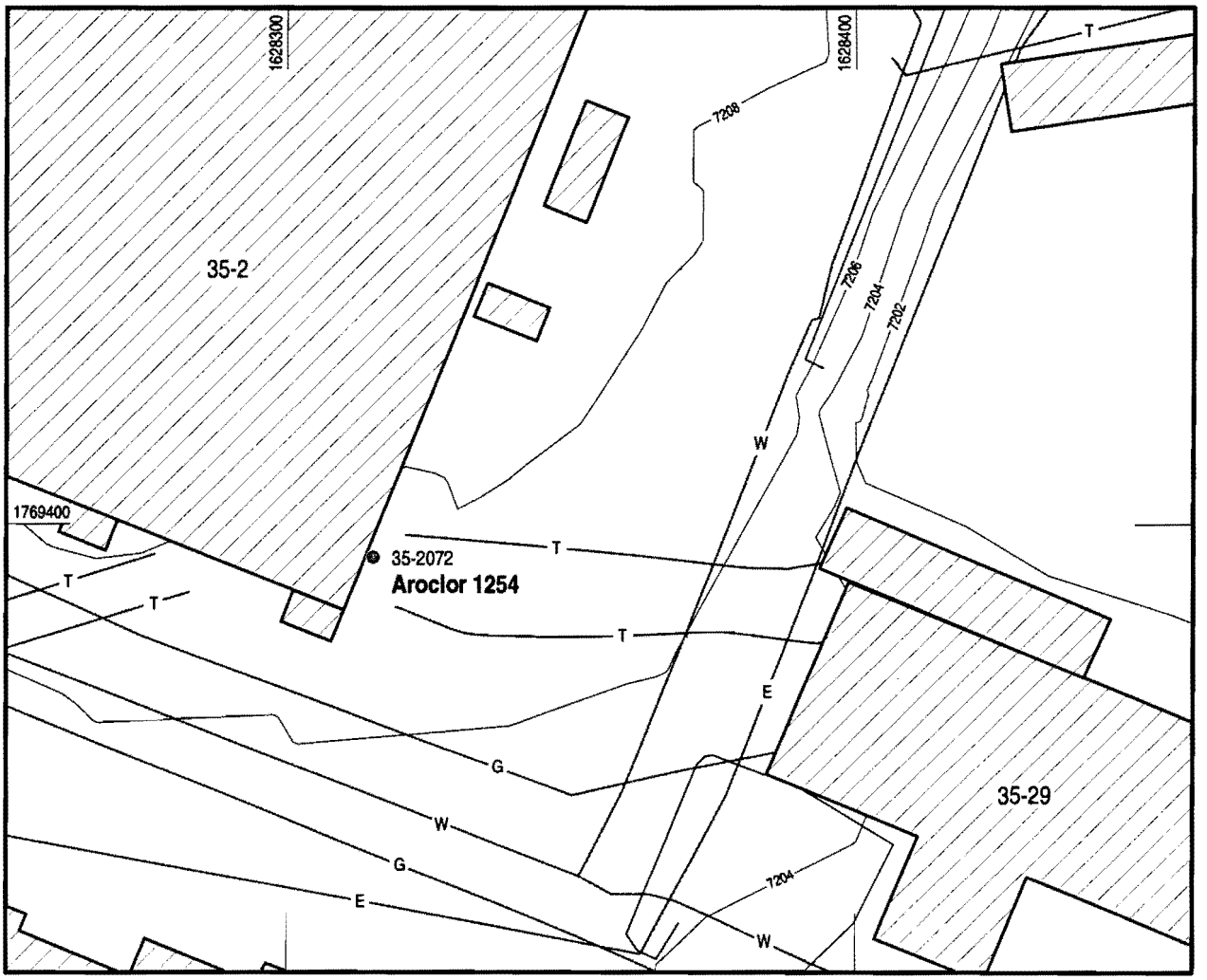
Aroclor 1254 was identified above its EQL value at all three sample intervals. The data are presented in Table 5.13.6-1 as "Mixed Aroclors" because Aroclor 1254 is evaluated on the basis of noncarcinogenic health effects; whereas, total PCBs, which are equivalent to the sum of all individual Aroclors detected, are evaluated as carcinogens. Aroclor 1254 was not detected above either the noncarcinogenic SAL of 1.4 mg/kg or the carcinogenic SAL of 1 mg/kg. Because Aroclor 1254 was the only chemical detected, an MCE calculation was not performed.

5.13.7.2 Risk Assessment

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

5.13.8 Ecological Assessment

The general landscape condition around this PRS is highly developed and disturbed, and a low potential exists for receptors to come in contact with PCBs (Table 2.4-1) because the site is paved over. Therefore, no further ecological evaluation of this site is required.



Source: FIMAD G104150

F 5.13.6-1 / TA-35a RFI RPT / 040796

0 25 50
FEET
Coordinates are NMSP NAD-83

Building or structure location
Sample location
Paved area
—G— Gas line
—E— Power line
—T— Telephone line
—W— Water line

Figure 5.13.6-1. Location of organic chemicals that were detected at PRS No. 35-014(b).

5.13.9 Extent of Contamination

The extent of contamination at this PRS has not been precisely determined. The samples collected at this PRS contained PCBs at levels below 10% of the SALs for total PCBs and individual Aroclors. Because this sample location would be expected to contain significant levels of contamination if a large release were to have occurred, it is concluded that a large PCB spill has not occurred at this PRS. It is possible that small or slow releases of oil may have moved through the asphalt directly below a leaking container rather than running over the asphalt. However, any contamination associated with such a release is likely to be highly localized and limited in extent. Conclusions drawn from these observations are provided in the following section.

5.13.10 Conclusions and Recommendations

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

The objective of the Phase I RFI at PRS No. 35-014(b) was to determine the presence or absence of contamination associated with the leaking barrel. A single hand-auger hole was drilled at a low point by the wall where leaking liquid would likely collect. SVOCs and PCBs were measured in the samples; only Aroclor 1254 was detected above EQL values. Aroclor 1254 was not present above its SAL value in any sample.

Although the nature and extent of contamination have been only partially determined, additional sampling at this location is not recommended. The area associated with this PRS is approximately 100 ft^2, and samples collected in an area where contamination from a sizable spill would accumulate did not reveal PCB contamination at even one-tenth the screening value. Even if additional localized PCB contamination from a small leak were to be identified, such a small area of contamination would be highly unlikely to pose a significant human health risk because it would represent only a tiny fraction of an exposure area.

Although the extent of hydrocarbon contamination at this PRS has not been determined (as described in Section 5.13.6), it is likely to be much less extensive than at PRS Nos. 35-003(j and k), 35-014(d), and 35-015(b), which are located approximately 30 ft east of this PRS, because only small, portable containers were stored at this PRS. Therefore, the expense of collecting additional SVOC data at this small PRS is deemed to be unwarranted.

Based on NFA criterion number 4, a Class III permit modification is requested to remove this site from the HSWA Module of the Laboratory's RCRA operating permit. The size, location, and operational history of the PRS and the available sample data indicate that this site is not likely to pose a significant human health or ecological risk under continuing industrial land use now or in the foreseeable future.

5.14 PRS Nos. 35-014(e_2) and 35-016(i)

PRS No. 35-014(e_2) is the site of an oil spill that originated from overflows of a waste-oil impoundment. PRS No. 35-016(i) is an active storm-water outfall that handles storm-water runoff from the area east of the impoundment. The two PRSs are included in the same decision set because they are in such close proximity that contamination from overflows from the impoundment that went over the mesa edge would intermingle with contaminants in the outfall area. Therefore, these PRSs cannot be evaluated independently.

No COPCs were identified in the risk-based screening assessment. Chromium, nickel, lead, manganese, antimony, uranium, and zinc were measured above background levels. Mixed Aroclors and TPH were the only organic chemicals detected above EQL values.

PRS Nos. 35-014(e_2) and 35-016(i) are recommended for NFA based on NFA criteria number 3 and number 4 (LANL 1995, 53863).

Radiological sample results are not presented or 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 5.14.4.3.

5.14.1 History

PRS Nos. 35-014(e_2) and 35-016(i) are discussed in detail in Section 3.3.2 of the work plan and Section 7.25 of the June 1994 addendum to the work plan (LANL 1992, 7666; Pratt 1994, 43475).

The contamination source for PRS No. 35-014(e_2) was oil spills from a gunite-lined, surface waste-oil impoundment (designated as PRS No. 35-005[a]) that was used to store waste dielectric oil. The impoundment was constructed in 1985 to replace an impoundment that had previously existed at the same location. The impoundment was built to collect oil spills from the oil-handling facilities adjacent to building TA-35-85; liquid wastes (such as solvents and oils) from drains that serviced oil-handling equipment (such as Marx tanks) in TA-35-85; and precipitation runoff. When the impoundment was operative, the oil was periodically pumped out of the impoundment and recycled. The impoundment was drained in 1988 and decommissioned in 1989. It was later replaced by a bermed steel tank that is currently inactive.

PRS No. 35-016(i) is a storm-water outfall that originates from storm-water drains south of TA-35-85. The outfall was probably installed around 1977 when TA-35-85 was constructed. The discharge area below the outfall also receives surface runoff from the eastern part of PRS No. 35-014(e_2) and may have provided a pathway for oil spills associated with the former waste-oil impoundment.

The contaminants that were potentially present include gross-alpha, -beta, and -gamma radiation; VOCs; SVOCs; metals; and PCBs.

5.14.2 Description

These PRSs are located about 150 ft northeast of TA-35-85 at the northern edge of Ten Site Mesa. PRS No. 35-014(e_2) is an area approximately 30 ft by 50 ft between an existing inactive oil storage tank and the edge of the mesa. The surface materials are composed of backfill soil that is several feet thick. A small soil berm about 1 ft high extends in an arc around the outlet valve from the containment structure for the existing oil tank. A small amount of oil-stained soil is present near the outlet valve, but no obvious oil staining is apparent in the area. The topography of the site is relatively flat with a gentle slope northward toward the edge of the mesa. The edge of the mesa is very steep (the estimated slope is greater than 80%) and is covered with bushes and trees.

The outfall associated with PRS No. 35-016(i) is an 18-in.-diameter corrugated metal pipe (CMP) located about 30 ft northeast of the existing oil storage tank. The source of the outfall is surface storm-water collection drains that are located along Pecos Drive south of TA-35-85. The backfill soil material at the edge of the mesa below the outfall have eroded to form a small erosional channel down the side of the mesa where bedrock tuff is exposed to about 3 ft below the outfall. The erosional channel also collects surface runoff from the area, including a portion of PRS No. 35-014(e_2). The surface runoff has caused erosion of backfill material around the CMP outfall. Surface runoff and discharge from the outfall are intermittent and sourced by natural precipitation events. Vegetation on the side of the mesa below the outfall appears to be normal and healthy.

5.14.3 Previous Investigations

Previous investigations were performed at PRS No. 35-005(a), which was the source of contamination for PRS No. 35-014(e_2). Investigations were performed after decommissioning and removal of the impoundment. After the impoundment was removed, the soil beneath the impoundment was found to contain VOCs. Therefore, the soil was excavated and removed to a depth of 1 to 2 ft. To verify the cleanup, soil samples were collected at the surface and from 5-ft intervals from a borehole that was drilled to a depth of 45 ft. All samples were within background levels for gross-alpha, -beta, and -gamma radiation and below detection limits for VOCs and SVOCs. However, the analytical data for VOCs and SVOCs were suspect because surrogate recovery results were outside EPA limits and EPA-allowable holding times were missed. In addition, the SVOC data were compromised because of interference from dielectric waste oil resulting in elevated EQLs. The data could not be located for inclusion on this RFI report except for the following summary. The subsurface samples did not contain TPH, but the two surface samples contained 97 ± 19 ppm TPH, and 314 ± 62 ppm TPH (Fresquez 1991, 823).

In 1985, soil samples were collected from oil-stained areas around the impoundment and analyzed for PCBs. The samples did not contain PCB concentrations greater than the detection limit of 1 ppm (LANL 1990, 7511).

5.14.4 Field Investigation

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

The conceptual model for the RFI took into account the known dielectric oil spill from the impoundment. The spill material was expected to infiltrate surface soils and be mobilized by surface runoff to the edge of the mesa. The conceptual model did not predict that hazardous constituents were released to the environment from the storm-water outfall associated with PRS No. 35-016(i). A judgmental sampling approach was used, and the sampling activities were biased toward areas where residual contamination was expected. Samples were collected from the discharge area below the outfall. At PRS No. 35-014(e_2) samples were collected from six shallow auger holes that were located on a grid basis.

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 Hazco 1256 OVA, a Ludlum Model 39 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 these sites, and no alpha radiation or organic vapors were detected.

5.14.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed on September 8, 1994. Beta/gamma radiation measurements ranged from 157 to 226 cpm, and the average was 197 cpm, which is within background levels.

Engineering surveys were performed on March 10, 1994, and from September 8, 1994, through September 12, 1994. The surveys consisted of a review of archival information, oblique photographs, aerial photographs, and engineering drawings of TA-35 as well as field site inspections. The work plan describes PRS No. 35-016(i) as being an 18-in. CMP that drains the TA-35 parking area. However, during the engineering survey performed on September 8, 1994, no evidence was found to indicate that the CMP is the outfall that drains the parking area. The CMP is buried about 4 ft below the surface and protrudes about 3 ft from the backfill material at the edge of the mesa. The CMP was found to extend about 30 ft southward from the discharge point and then bend southwesterly toward TA-35-85. Potential sources of the outfall were investigated inside TA-35-85. The probable source for the outfall was determined to be storm-water drains along Pecos Drive south of TA-35-85.

The former location of the impoundment associated with PRS No. 35-014(e_2) was identified through review of historical site aerial photographs. The backfill soil material observed in the historical photographs at the edge of the mesa adjacent to the former impoundment also appears to be present in recent aerial photographs taken after the impoundment was removed. Therefore, the sample locations for this PRS were located in the backfill material at the edge of the mesa. The six hand-auger holes were located on a grid at approximately 20-ft intervals.

A radiation grid survey was performed on September 9, 1994. The radiation grid locations included Location ID Nos. 35-7637 through 35-7660, which were spaced at approximately 10-ft intervals. Beta/gamma radiation measurements ranged from 182 to 304 cpm, and the average was 228 cpm, which is within background levels.

5.14.4.2 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).

5.14.4.3 Sampling Activities

Phase I sampling was performed on March 25, 1995, and March 27, 1995. A total of eight locations were sampled, and 22 samples were collected: 1 surface soil sample and 21 subsurface soil samples (not including duplicate QA/QC samples).

At PRS No. 35-014(e_2) six hand-auger holes were drilled to a depth of 3 ft (Location ID Nos. 35-2144 through 35-2149). The sample collection intervals are shown in Table 5.14.4-1. Backfill soil material was sampled from each of the hand-auger holes. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 186 to 282 cpm, which are within background levels.

At PRS No. 35-016(i) one surface sample was collected (Location ID No. 35-2165); one hand-auger hole was drilled to a depth of 3 ft (Location ID No. 35-2166). Three samples were collected from the hand-auger hole, one from each 1-ft interval. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 196 to 253 cpm, which are within background levels.

Table 5.14.4-1 summarizes all sampling for PRS Nos. 35-014(e_2) and 35-016(i); Figure 5.14.4-1 shows the sample locations.

TABLE 5.14.4-1

SUMMARY OF SAMPLES TAKEN AT PRS Nos. 35-014(e_2) AND 35-016(i)

Location ID	Sample ID	Depth (ft)	Matrix	VOC Mobile Lab	VOC Fixed Lab	PAH Mobile Lab	SVOC Fixed Lab	PCB Mobile Lab	PCB Fixed Lab	INORG Mobile Lab	Rad Van
35-2144	AAC1309	0-1	mixed soil	NR	NR	NR	NR	21673	NR	NR	NR
35-2144	AAC1310	1-2	mixed soil	NR	NR	NR	NR	21673	NR	NR	NR
35-2144	AAC1311	2-3	mixed soil	21673	21673	21673	NR	21673	NR	NR	NR
35-2145	AAC1312	0-1	mixed soil	NR	NR	NR	NR	21673	NR	NR	NR
35-2145	AAC1185	1-2	mixed soil	NR	NR	NR	NR	21673	NR	NR	NR
35-2145	AAC1186	2-3	mixed soil	NR	NR	NR	NR	21673	NR	NR	NR
35-2146	AAC1187	0-1	mixed soil	21673	NR	21673	21673	21673	21673	NR	NR
35-2146	AAC1188	1-2	mixed soil	NR	NR	NR	NR	21673	NR	NR	NR
35-2146	AAC3353	2-3	mixed soil	NR	NR	NR	NR	21673	NR	NR	NR
35-2147	AAC3354	0-1	mixed soil	NR	NR	NR	NR	21673	NR	NR	NR
35-2147	AAC3355	1-2	mixed soil	NR	NR	NR	NR	21673	NR	NR	NR
35-2147	AAC3356	2-3	mixed soil	NR	NR	NR	NR	21673	NR	NR	NR
35-2148	AAC3357	0-1	mixed soil	NR	NR	NR	NR	21673	NR	NR	NR
35-2148	AAC3358	1-2	mixed soil	21673	NR	21673	NR	21673	NR	NR	NR
35-2148	AAC3359	2-3	mixed soil	NR	NR	NR	NR	21673	NR	NR	NR
35-2149	AAC3360	0-1	mixed soil	NR	NR	NR	NR	21673	NR	NR	NR
35-2149	AAC3361	1-2	mixed soil	NR	NR	NR	NR	21673	NR	NR	NR
35-2149	AAC3362	2-3	mixed soil	NR	NR	NR	NR	21673	NR	NR	NR
35-2165	AAC1295	0-0.5	mixed soil	21665	NR	21665	NR	21665	NR	21666	21664
35-2166	AAC1296	0-1	Qbt3	21673	NR	21673	NR	21673	NR	21675	NR
35-2166	AAC1300	1-2	Qbt3	21673	NR	NR	NR	NR	NR	21675	NR
35-2166	AAC1297	1-2	Qbt3	21673	NR	21673	NR	21673	NR	21675	NR
35-2166	AAC1298	2-3	Qbt3	21673	NR	21673	NR	21673	NR	21675	NR

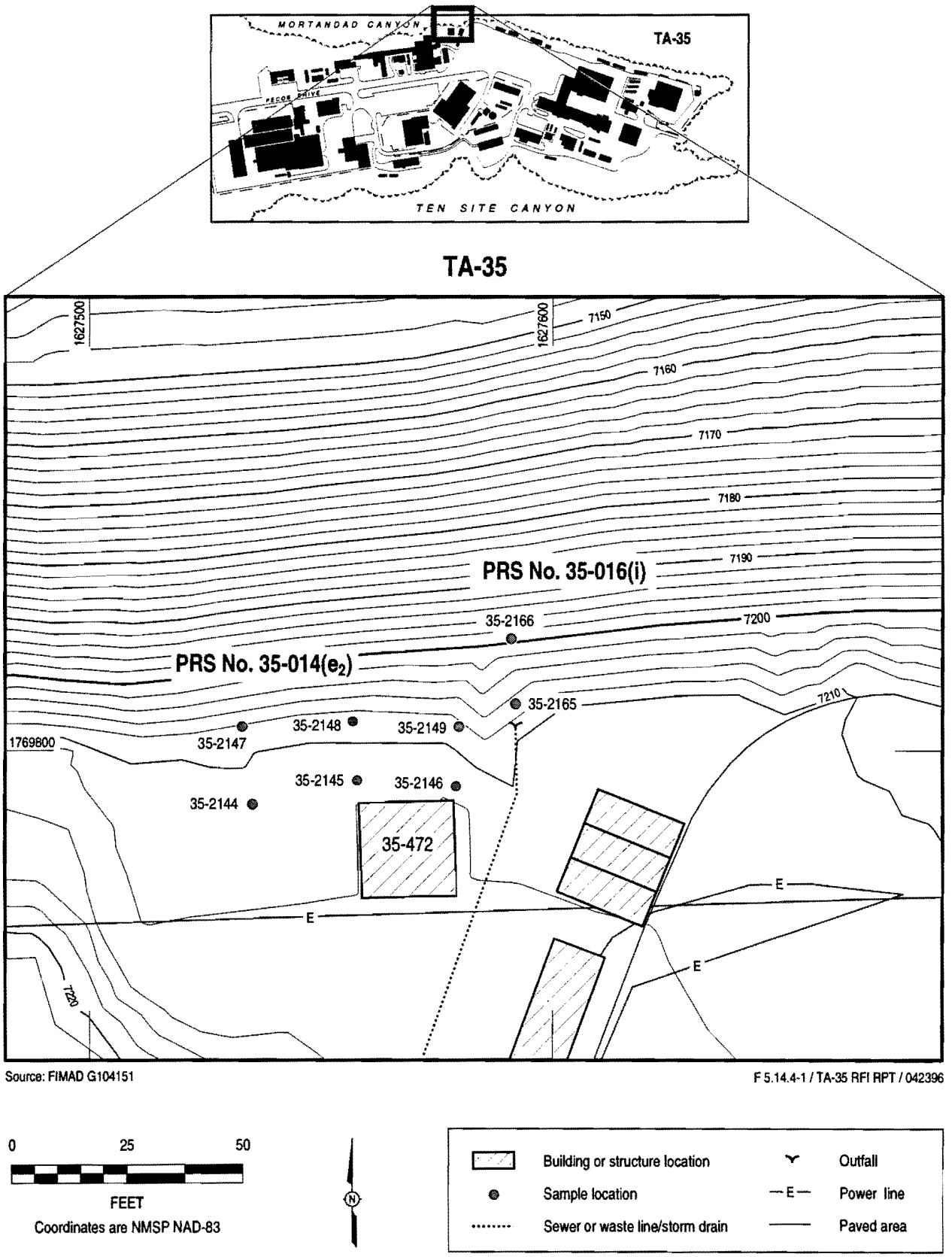


Figure 5.14.4-1. Locations of samples at PRS Nos. 35-014(e_2) and 35-016(i).

5.14.5 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 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.

Four soil samples from the two locations associated with PRS No. 35-016(i) 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.

The highest detected value for each analyte was used for the background comparison. The sample matrix varied and included combinations of sand, clay, and humus. In Table 5.14.5-1, the values in the boxes indicate inorganic chemicals that were detected in soil at concentrations greater than or equal to their respective UTLs. The highest observed concentrations above background levels at each location are summarized below.

- Antimony was detected in one sample at a concentration of 4.19 mg/kg, which is above the XRF UTL of 1.45 mg/kg; three samples were below the detection limit of 4 mg/kg.
- Chromium was detected in one sample at maximum concentration of 53.3 mg/kg, which is above the XRF UTL of 45.1 mg/kg.
- Nickel was detected in one sample at a concentration of 34.6 mg/kg, which is above the XRF UTL of 22.5 mg/kg.
- Lead was detected in one sample at a concentration of 69.6 mg/kg, which is above the XRF UTL of 28.4 mg/kg.
- Manganese was detected in one sample at a concentration of 709 mg/kg, which is above the XRF UTL of 681 mg/kg.

TABLE 5.14.5-1

INORGANIC CONSTITUENTS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTL FOR PRS Nos. 35-014(e_2) AND 35-016(i)

Location ID	Sample ID	Depth (ft)	Cd	Cr	Hg	Mn	Ni	Pb	Sb	Se	Ti	U	Zn
SAL	N/A	N/A	38	210	23	N.A.	1500	400	31	380	N.A.	230	23000
Mixed soil UTL	N/A	N/A	2.7	19.3	0.1	4610	15.2	23.3	1	N.A.	N.A.	5.45	50.8
Qbt3 UTL	N/A	N/A	N.A.	2.1	N.A.	628	2.6	16.2	.04	N.A.	N.A.	4.37	55.5
XRF UTL	N/A	N/A	N.A.	45.1	N.A.	681	22.5	28.4	1.45	N.A.	N.A.	5.33	76.6
35-2165	AAC1295	0-.5	<3	18	<5	709	34.6	69.6	<4	<4	1624	<8	362
35-2166	AAC1296	0-1	<3	32	<5	373	<13	21	<4	<4	595	<8	60.6
35-2166	AAC1297	1-2	<3	53.3	<5	354	20.2	21	<4	<4	511	<8	52.7
35-2166	AAC1298	2-3	<3	14	<5	397	<13	17	4.19	<4	667	10.8	54.7

*mg/kg

- Uranium was detected in one sample at a concentration of 10.8 mg/kg, which is above the XRF UTL of 5.33 mg/kg; three samples were below the detection limit of 8 mg/kg.
- Zinc was detected in one sample at a concentration of 362 mg/kg, which is above the XRF UTL of 76.6 mg/kg.

Figure 5.14.5-1 shows the location of analytes that exceeded the background UTLs and were carried forward to the screening assessment.

5.14.6 Evaluation of Organic Constituents

The organic chemicals analyzed for at these PRSs include PAH compounds, VOCs, and PCBs. Twenty-two samples from eight locations were analyzed in the mobile laboratory facility for PCBs. Seven samples from five locations were analyzed in the mobile laboratory facility for SVOCs; eight samples from five locations were analyzed in the mobile laboratory facility for VOCs. One sample was also analyzed in a fixed-site laboratory for VOCs, SVOCs, and PCBs.

As discussed in Section 4.2.4 in Chapter 4.0 of this RFI report, the presence of SVOCs was screened by analyzing PAH compounds at the mobile laboratory facility. 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."

Organic chemicals detected in soil at concentrations above EQL values are shown in Table 5.14.6-1 and Figure 5.14.5-1 and are summarized below.

- Aroclor 1260 (evaluated as mixed Aroclor) was detected in 12 samples at estimated concentrations ranging from 0.052 to 0.645 mg/kg.
- TPH (in the C_{10} to C_{20} range) as detected in one sample at an estimated concentration of 11 mg/kg.

5.14.7 Human Health Assessment

5.14.7.1 Screening Assessment

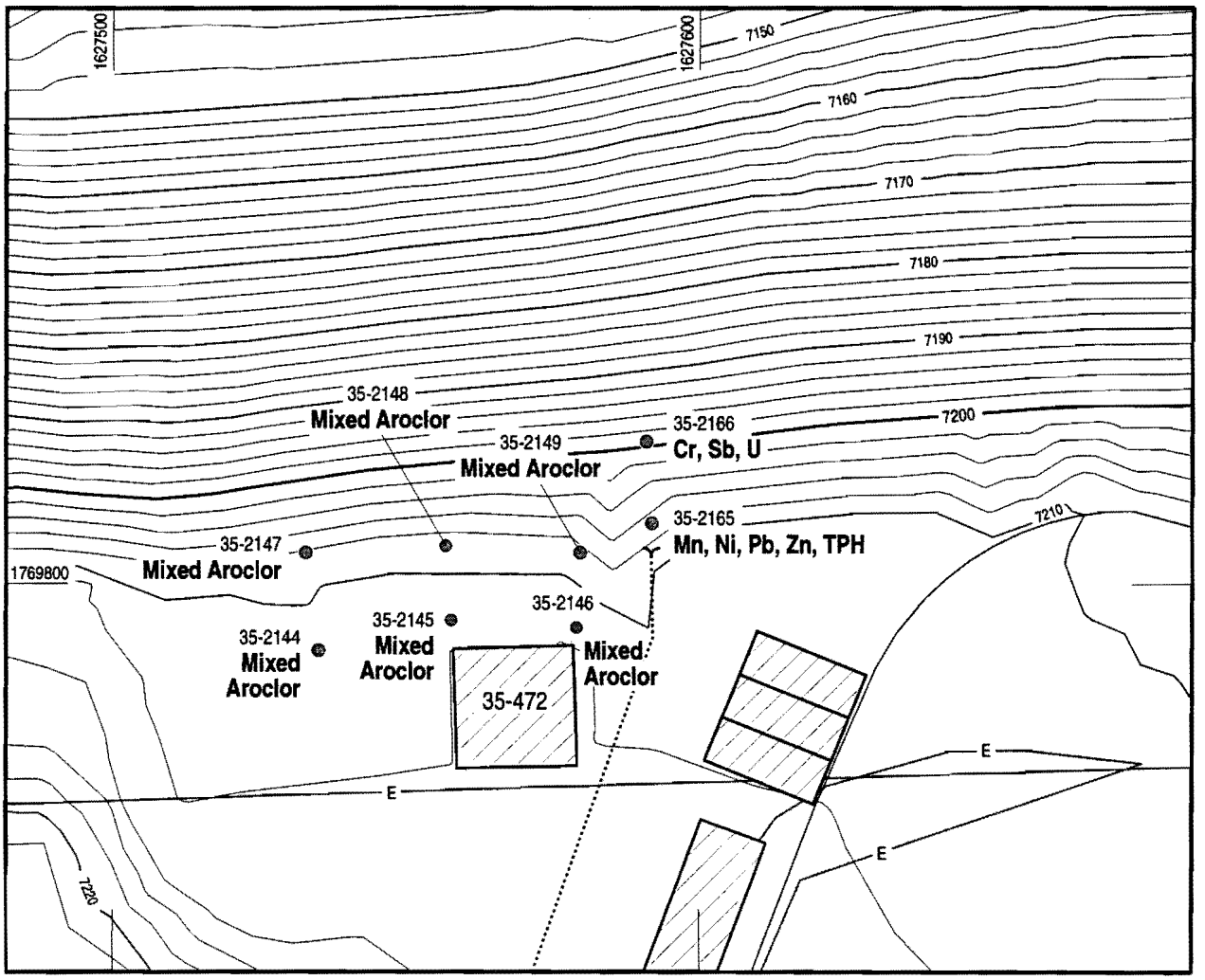
Seven inorganic chemicals and two organic chemicals were carried forward to the screening assessment from the background and EQL comparisons. As described in Section 3.4.1 in Chapter 3.0 of this RFI report, analytes are divided into two classes (noncarcinogens and chemical carcinogens) for the screening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

No sample results for any chemical exceeded SAL values at these PRSs. The MCE result for noncarcinogens was 0.39 and for carcinogens was 0.90. Therefore, no COPCs are identified on the basis of possible additive effects.

An analyte for which a SAL is unavailable is TPH. Because TPH may contain a variety of saturated and unsaturated hydrocarbons, human health screening is performed on characteristic chemicals that may be present in TPH and for which toxicity values have been published. These characteristic chemicals, including benzene, substituted benzenes, and PAHs, were analyzed for as part of the VOC and PAH suites.

5.14.7.2 Risk Assessment

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



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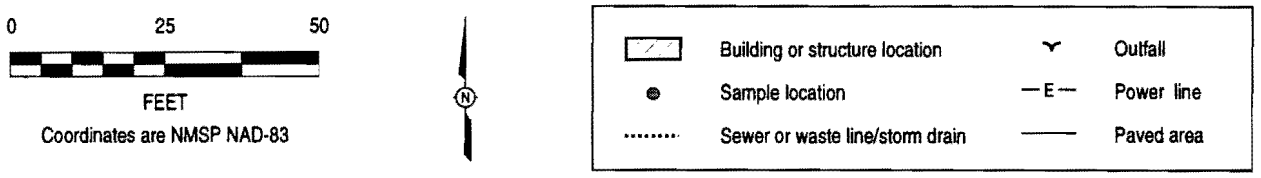


Figure 5.14.5-1. Locations of detected organic chemicals and analytes that exceed UTLs at PRS Nos. 35-014(e_2) and 35-016(i).

TABLE 5.14.6-1

PRS Nos. 35-014 (e_2) AND 35-016 (i)
SOIL CONCENTRATIONS* FOR DETECTED ORGANIC CONSTITUENTS

Location ID	Sample ID	Depth (ft)	Mixed Aroclors	TPH
SAL	N/A	N/A	1	N.A.
CRQL	N/A	N/A	1	5
35-2144	AAC1309	0-1	0.144 S,J	NR
35-2144	AAC1310	1-2	0.068 S,J	NR
35-2145	AAC1312	0-1	0.052 S,J	NR
35-2146	AAC1187	0-1	0.0568	NR
35-2146	AAC1188	1-2	0.198 S,J	NR
35-2147	AAC3354	0-1	0.5 S,J	NR
35-2147	AAC3355	1-2	0.645 S,J	NR
35-2147	AAC3356	2-3	0.347 S,J	NR
35-2148	AAC3357	0-1	0.432 S,J	NR
35-2148	AAC3358	1-2	0.338 S,J	NR
35-2148	AAC3359	2-3	0.207 S,J	NR
35-2149	AAC3360	0-1	0.161 S,J	NR
35-2165	AAC1295	0-0.5	ND	11 S,J

*mg/kg

5.14.8 Ecological Assessment

The general landscape condition around these PRSs is moderately developed and disturbed, and a high potential exists for receptors to come in contact with chemicals above background levels and detected organic chemicals associated with the site (lead, manganese, nickel, zinc, Aroclors, and TPH) (Table 5.14.5-1 and Table 5.14.6-1). Therefore, this PRS will be included as a potential contaminant source in the ecological risk assessment. An ecological risk assessment will be conducted when that approach has been approved by the regulators. Threatened and endangered species and/or sensitive habitat listed in Chapter 2.0 of this RFI report will be evaluated in the ecological risk assessment.

5.14.9 Extent of Contamination

The extent of chemicals above background levels and above detection limits at these PRSs has not been determined for inorganic chemicals and TPH. The number of individual samples and sample locations for each analyte suite are discussed in Section 5.14.4 and shown on Table 5.14.4-1. The inorganic analyte suite consisted of four samples collected at two locations. Twenty-two samples were analyzed for PCBs, and seven were analyzed for PAHs. Eight samples were analyzed for VOCs, and none were measured above EQLs. In addition, gross VOC contamination in the site has been ruled out by field screening for VOCs using hand-held instruments during sample collection. VOCs are generally not persistent contaminants in soil media.

No PCBs were measured above SAL values in any of the 22 biased samples. Therefore, the extent of possible contamination associated with PCBs has been well defined relative to human health screening values.

Chemicals above background levels identified in the background comparison are shown in Figure 5.14.5-1. The samples collected at these PRSs were biased by location to areas where contamination released from the impoundment would be expected to occur. These areas include hand-auger holes near the oil spills from the

impoundment on the mesa top and in the path of the outfall. As described in Section 5.14.7.1, the concentrations of contaminants observed at these biased sample locations do not indicate a potential human health threat, although TPH and elevated metal concentrations were observed. However, TPH and metals may be found at higher concentrations on the mesa edge or the slope below. The extent of TPH and metal contamination at this site will be determined under a separate investigation, as stated below.

On June 21, 1993, the New Mexico Environment Department (NMED) denied closure of TSL-85 (also known as PRS Nos. 35-005[a] and 35-014[e_2]) and required that the area of the impoundment be resampled as part of the TA-35 RFI (NMED 1996, 53924). Previous samples collected at the site (see Section 5.14.3) were rejected by NMED because surrogate recovery results for VOC and SVOC analysis were outside EPA limits and missed EPA-allowable holding times. This amended closure plan states that

> To achieve closure the Laboratory will remove standing liquids, wastes, and waste residues from the surface impoundment, the inactive underground storage tank, and their associated structures, and removal of any underlying and/or surrounding soil contaminated with hazardous constituents. The Laboratory will also remove any contaminated media from the Mortandad Canyon spill pathway and other associated areas impacted by any releases from the unit as defined in 40CFR264.501, Subpart S. A risk assessment shall be performed based upon analytical data from the site . . .

The amended closure plan also states that to achieve the closure, 6 additional samples must be collected in the area below the impoundment, 12 samples must be collected below the location of the former underground storage tank and associated piping, and 11 soil samples must be collected along the Mortandad Canyon spill path. In summary, the closure plan requires that the extent of contamination be determined and that contamination be removed as part of the closure effort.

5.14.10 Conclusions and Recommendations

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

The objective of the Phase I RFI at PRS Nos. 35-014(e_2) and PRS 35-016(i) was to determine the presence or absence of contamination associated with the impoundment and outfall. No COPCs were identified in the human health screening assessment.

Although the extent of metals and TPH present above background levels has not been determined, a potential human health risk has not been identified on the basis of the existing sample data. In addition, the site is scheduled to be closed under the amended closure plan (NMED 1996, 53924).

Based on NFA criterion number 3 and criterion number 4, a Class III permit modification is requested to remove PRS Nos. 35-014(e_2) and 35-016(i) from the HSWA Module of the Laboratory's RCRA operating permit. These PRSs are to be closed under a different authority (Closure Plan Approval, EPA Identification Number: NM0890010515). Also, the sample data indicate that this site is not likely to pose a significant human health risk now or in the foreseeable future. The site data will be retained for an area-wide ecological assessment, as described in Section 5.14.8.

5.15 PRS No. 35-014(f)

Results of the Phase I RFI, the SAP, and the cleanup plan for PRS No. 35-014(f) will be presented in a VCA plan, which will be submitted by June 1996.

5.16 PRS No. 35-016(f)

PRS No. 35-016(f) is an active storm-water outfall at the edge of Ten Site Mesa north of building TA-35-85.

No COPCs were identified during the screening assessment. Nickel, thorium, and zinc were measured above background levels.

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

Radiological sample results are not presented or 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 5.16.4.3.

5.16.1 History

PRS No. 35-016(f) is discussed in detail in Section 3.3.2 of the work plan and Section 7.25 of the June 1994 addendum to the work plan (LANL 1992, 7666; Pratt 1994, 43475).

The western laser corridor of TA-35-85 was constructed around 1985 to house laser experiments. The storm-water drain system and the outfall were probably installed at that time to drain the area south of the laser corridor and east of building TA-35-189. Roof drains from the laser corridor and the southern extension of TA-35-85 discharge to the storm sewer system. Any potential contamination at this PRS may have originated from the roofs of TA-35-85 and TA-35-189 and from the parking and driveway areas east of TA-35-189.

The contaminants that were potentially present include gross-alpha, -beta, and -gamma radiation; VOCs; SVOCs; metals; and PCBs.

5.16.2 Description

The outfall is located at the edge of Ten Site Mesa about 30 ft north of TA-35-85; it discharges to the north side of the mesa. The outfall is an 18-in.-diameter CMP that originates from several storm-water collection grates south of the west corridor of TA-35-85 and east of TA-35-189. The storm-water collection grates are located in bare soil and in asphalt paved areas and collect both surface storm-water flow and discharge from roof drains from TA-35-35 and TA-35-189.

The mesa edge is composed primarily of backfill material that has eroded into a small discharge channel below the outfall. Discharge from the outfall is intermittent and sourced by natural precipitation events. The topography below the outfall is a steep mesa side (the estimated slope is greater than 70%). Vegetation below the outfall appears normal and healthy.

5.16.3 Previous Investigations

No previous investigations have been performed at this site.

5.16.4 Field Investigation

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

The conceptual model for the RFI took into account the potential for hazardous material spills in the source area of the storm-water outfall. Any spill material was expected to be mobilized by surface runoff through the storm drain system to the adjacent mesa edge. The conceptual model did not predict that hazardous constituents were released to the environment. A judgmental sampling approach was used, and the sampling activities were biased toward the area below the storm-water outfall discharge where residual contamination was expected.

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 were performed using a Hazco 1256 OVA, a Ludlum Model 39 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.

5.16.4.1 Environmental and Engineering Surveys

The H&S radiation survey was performed on September 8, 1994. A beta/gamma radiation measurement of 292 cpm was obtained from the discharge channel below the outfall, and a measurement of 182 cpm was obtained from inside the CMP at the outfall, which are within background levels.

Engineering surveys were performed on September 8, 1994, September 12, 1994, and March 10, 1995. Surveys consisted of a review of archival information, oblique photographs, aerial photographs, and engineering drawings of TA-35 as well as a field inspection. The source of the outfall was determined, the drainage system associated with the outfall was documented, and the sample locations were established.

A radiation grid survey was performed on September 12, 1994. The 15 radiation grid locations included Location ID Nos. 35-7661 through 35-7675, which were spaced at approximately 5-ft intervals. Beta/gamma radiation measurements ranged from 198 to 275 cpm, and the average was 250 cpm, which is within background levels.

5.16.4.2 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).

5.16.4.3 Sampling Activities

Phase I sampling was performed on March 14, 1995. Two locations were sampled, and four samples were collected (not including duplicate QA/QC samples). One surface soil sample (Location ID No. 35-2154) was collected directly below the outfall. Three subsurface soil samples were collected from a 3-ft-deep hand-auger hole (Location ID No. 35-2155) located in the drainage channel about 10 ft below the outfall. The sample collection intervals are shown in Table 5.16.4-1. Beta/gamma radiation measurements obtained during field screening of the samples ranged from 255 to 361 cpm, which are within background levels.

Table 5.16.4-1 summarizes all sampling for PRS No. 35-016(f); Figure 5.16.4-1 shows the sample locations.

TABLE 5.16.4-1

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

Location ID	Sample ID	Depth (ft)	Matrix	VOC Mobile Lab	VOC Fixed Lab	PAH Mobile Lab	SVOC Fixed Lab	PCB Mobile Lab	PCB Fixed Lab	INORG Mobile Lab	INORG Fixed Lab	Rad Van	Rad Fixed Lab
35-2154	AAC1207	0-0.5	mixed soil	21598	21576	21598	NR	21598	NR	21600	NR	21597	NR
35-2155	AAC1208	0-1	mixed soil	21598	NR	21598	NR	21598	NR	21600	21579	21597	NR
35-2155	AAC1209	1-2	mixed soil	21598	NR	21598	21576	21598	21576	21600	NR	21597	NR
35-2155	AAC1211	2-3	Qbt3	NR	NR	NR	NR	NR	NR	21600	NR	NR	NR
35-2155	AAC1210	2-3	Qbt3	21598	NR	21598	NR	21598	NR	21600	NR	21597	NR
35-2284	0435-95-0205	0-1	mixed soil	NR	NR	NR	1678	NR	NR	NR	NR	NR	NR

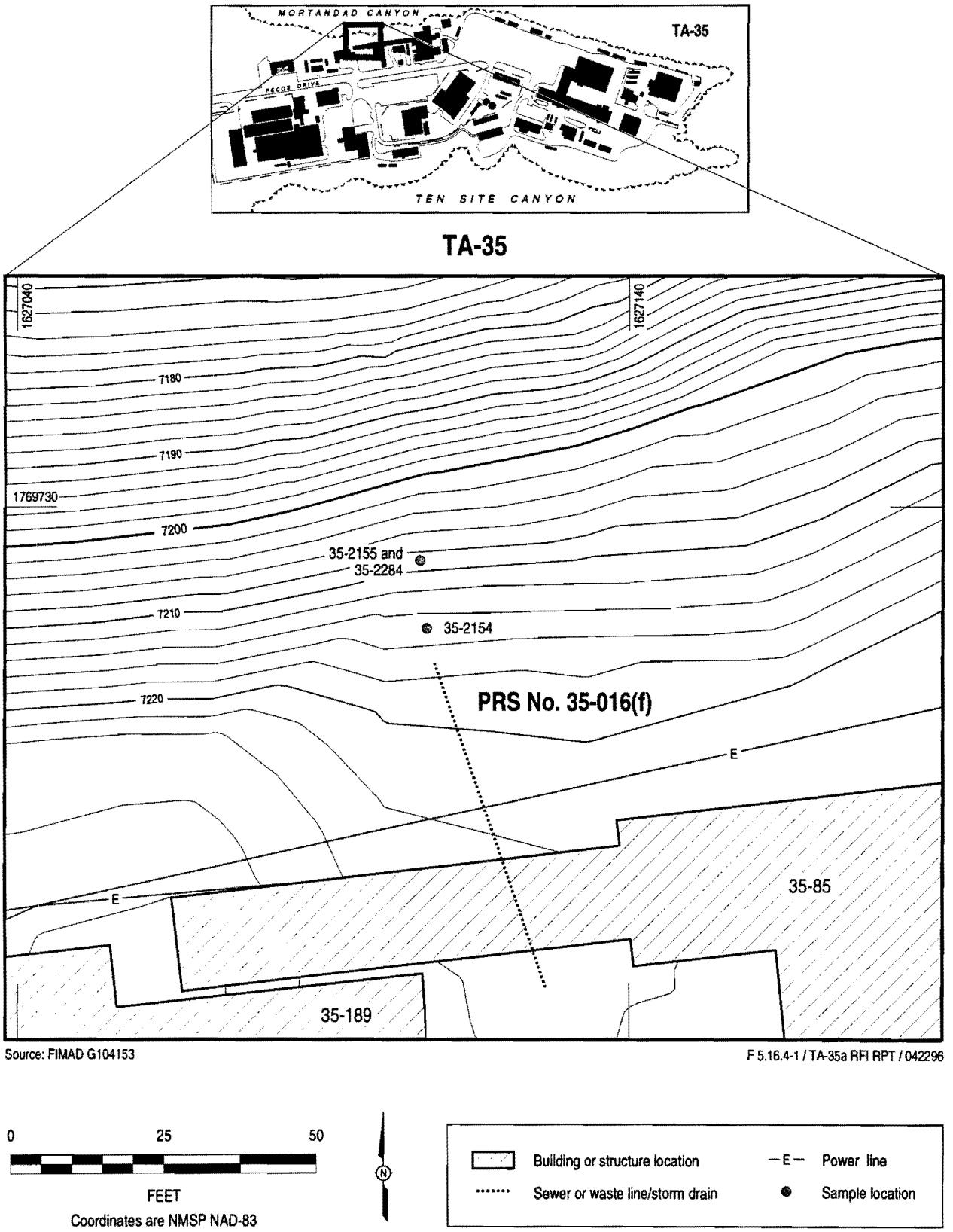


Figure 5.16.4-1. Locations of samples at PRS No. 35-016(f).

5.16.5 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 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 soil samples from two locations, including one field duplicate, 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. The sample collected at the 0 to 1-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, cobalt, copper, iron, lead, lithium, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, sodium, strontium, 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).

The highest detected value for each analyte was used for the background comparison. The sample matrices consisted of a mixture of sand and clay. In Table 5.16.5-1, the values in the boxes indicate inorganic chemicals that were detected in soil at concentrations greater than or equal to their respective UTLs. The highest observed concentrations above background levels at each location are shown in Figure 5.16.5-1 and are summarized below.

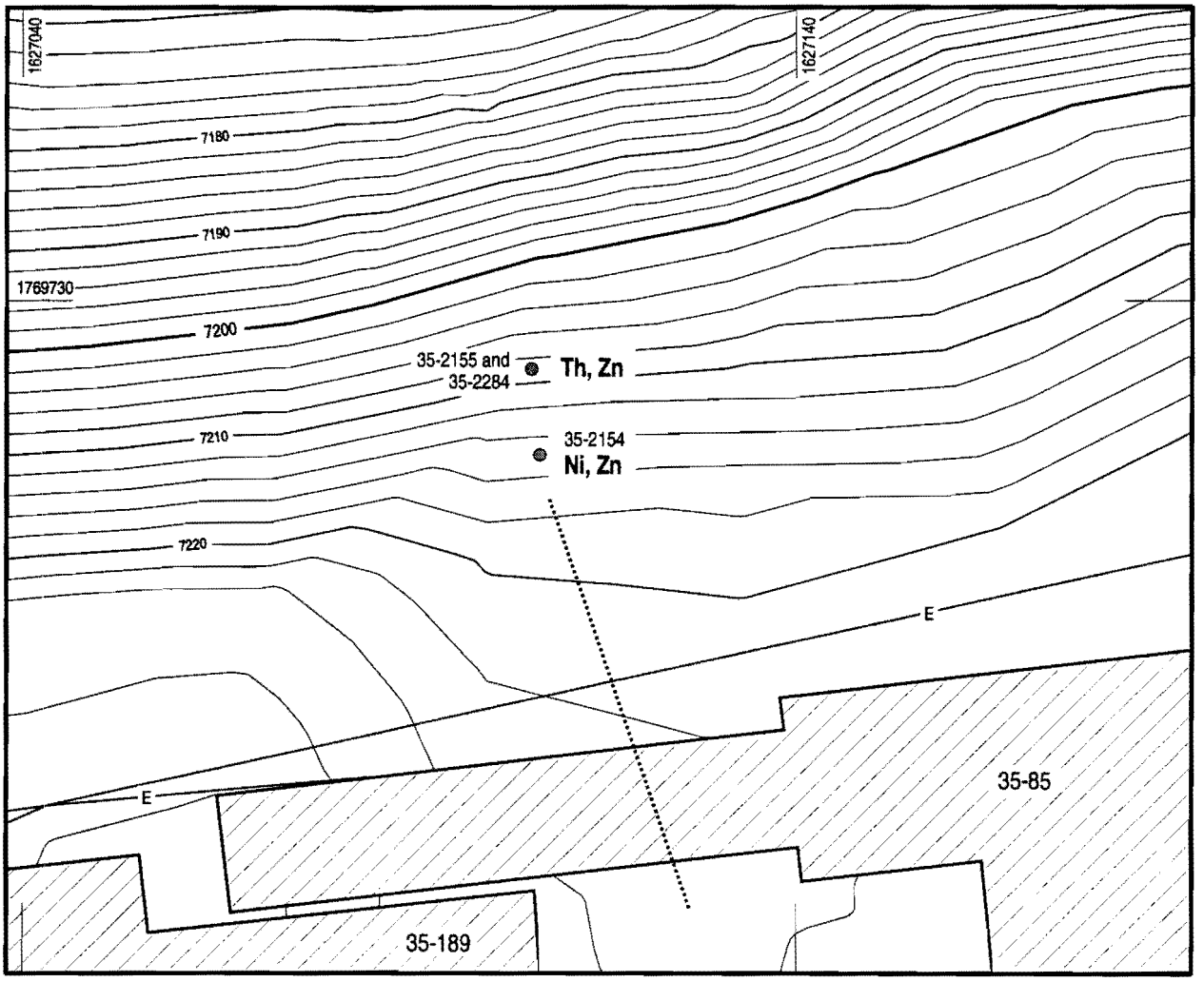
- Nickel was detected in one sample at a concentration of 26.9 mg/kg, which is above the UTL of 22.5 mg/kg.
- Thorium was detected in one sample at a concentration of 24.9 mg/kg, which is above the XRF UTL of 22.1 mg/kg.
- Zinc was detected in one sample at a concentration of 104 mg/kg, which is above the XRF UTL of 76.6. Zinc was also detected at 57.6 mg/kg, which is above the mixed-soil UTL of 50.8 mg/kg.

TABLE 5.16.5-1

INORGANIC CONSTITUENTS WITH CONCENTRATIONS* GREATER THAN BACKGROUND UTL FOR PRS No. 35-016(f)

Location ID	Sample ID	Depth (ft)	Ag	Cd	Hg	Ni	Sb	Se	Th	Ti	Tl	U	Zn
SAL	N/A	N/A	383	38	23	1500	31	380	N.A.	N.A.	N.A.	230	23000
Mixed soil UTL	N/A	N/A	N.A.	2.7	0.1	15.2	1	1.7	22.6	N.A.	1	5.45	50.8
Qbt3 UTL	N/A	N/A	1.9	N.A.	N.A.	2.6	0.4	N.A.	16.3	N.A.	N.A.	4.37	55.5
XRF UTL	N/A	N/A	N/A	N.A.	N.A.	22.5	1.45	N.A.	22.1	N.A.	N.A.	5.33	76.6
35-2154	AAC1207	0-.5	NA	<3	6.4	26.9	<4	<4	18	1766	NA	<8	104
35-2155	AAC1208	0-1	<.29	<.1	<.12	<3.4	<.51	<1.1	15	1036	<1.2	<8	57.6
35-2155	AAC1209	1-2	NA	<3	<5	<13	<4	<4	13	1178	NA	<8	55.5
35-2155	AAC1210	2-3	NA	<3	<5	15.5	<4	<4	24.9	698	NA	<8	34.5

*mg/kg



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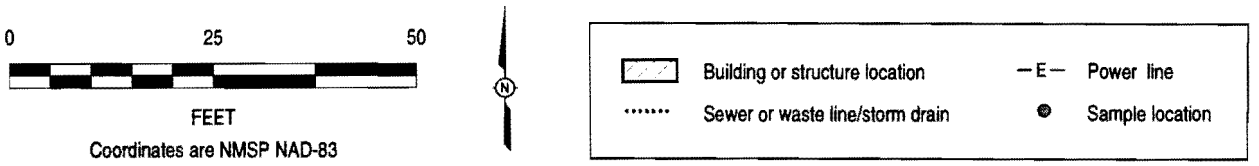

Figure 5.16.5-1. Locations of analytes that exceed UTLs at PRS No. 35-016(f).

5.16.6 Evaluation of Organic Constituents

Four soil samples collected from two locations were analyzed for VOCs, PAHs, and PCBs by the mobile laboratory facility. The laboratory analysis for PCBs included the following Aroclors: 1016, 1221, 1232, 1242, 1248, 1254, and 1260. At a fixed-site laboratory facility, one sample was analyzed for SVOCs, one sample was analyzed for VOCs, and one sample was analyzed for PCBs. No organic compounds were detected in any sample.

5.16.7 Human Health Assessment

5.16.7.1 Screening Assessment

Three inorganic chemicals were carried forward from the background comparison to the screening assessment. 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 0.3. Because no chemical carcinogens were identified as COPCs in Sections 5.16.5 and 5.16.6, an MCE calculation for chemical carcinogens was not performed.

No COPCs are identified in the human health screening assessment. All the COPCs identified in the background comparison in Section 5.16.5 except thorium (Table 5.16.5-1) have soil SALs for comparison. Thorium was measured above its XRF UTL value in only one of four samples, at a concentration approximately 10% higher than the UTL value. Therefore, additional evaluation of thorium is not proposed. The only analyte for which neither a UTL or 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. Therefore, further evaluation of titanium is not proposed.

5.16.7.2 Risk Assessment

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

5.16.8 Ecological Assessment

The general landscape condition around this PRS is moderately developed and disturbed, and a high potential exists for receptors to come in contact with chemicals above background levels associated with the site (nickel and zinc) (Table 5.16.5-1). Therefore, this PRS will be included as a potential contaminant source in the ecological risk assessment. An ecological risk assessment will be conducted when that approach has been approved by the regulators. Threatened and endangered species and/or sensitive habitat listed in Chapter 2.0 of this RFI report will be evaluated in the ecological risk assessment.

5.16.9 Extent of Contamination

Three inorganic chemicals were identified above UTL values at this PRS, as shown in Figure 5.16.5-1. The samples were located based on the assumption that some contaminants released with outfall water would remain near the discharge point. It is also likely, however, that contamination released into the outfall has been carried down the outfall drainage with discharge water and deposited in sediments on canyon wall benches or carried to the main channel in Mortandad Canyon.

The samples were collected directly below the outfall drainage in a location where particle settlement was likely to occur. Contaminant concentrations in discharge water were not sufficiently high to result in identification of risk-based COPCs in soils at the sample locations. The likelihood of observing higher soil concentrations at a more distant location is low because pollutant concentrations generally decrease with distance from a release site. However, even if sediment depositional patterns were to result in higher contaminant concentrations at a specific location away from the outfall, it is unlikely that these concentrations would present unacceptable human health risks because of the low exposure frequency associated with areas such as drainages on canyon walls.

Although the extent of contamination cannot be defined with certainty based on existing samples, the low levels observed in these biased samples do not warrant further attempts to bound extent. Therefore, additional sampling in the outfall drainage is not proposed.

5.16.10 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(f) was to determine the presence or absence of contamination associated the outfall. No COPCs were identified in the human health screening assessment.

The extent of contamination cannot be conclusively determined based on sample data, but the weight of evidence suggests that environmental contamination at concentrations of human health concern has not occurred.

Based on NFA criterion number 4, PRS No. 35-016(f) will not be added to the HSWA Module of the Laboratory's RCRA operating permit and it is proposed for removal from the ER Project list of PRSs. The sample data indicate that this site is not likely to pose a significant human health risk now or in the foreseeable future. The site data will be retained for an area-wide ecological assessment, as described in Section 5.16.8.

5.17 PRS No. 35-016(g)

Results of the Phase I RFI and the SAP for further investigation at PRS No. 35-016(g) will be presented in a subsequent RFI report, which will be submitted on June 5, 1996.

5.18 PRS No. 35-016(h)

Results of the Phase I RFI and the SAP for further investigation at PRS No. 35-016(h) will be presented in a subsequent RFI report, which will be submitted on June 5, 1996.

5.19 PRS Nos. 35-008 and 35-014(e1)

Results of the Phase I RFI, the SAP, and the cleanup plan for PRS Nos. 35-008 and 35-014(e_1) will be presented in a VCA plan, which will be submitted by January 1997.

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Appendix A

Analytical Data

APPENDIX A. ANALYTICAL DATA

This appendix contains analytical data that are not available in the Facility for Information Management, Analysis, and Display (FIMAD) or that are not presented in the tables in Chapter 5.0 of this Resource Conservation and Recovery Act facility investigation (RFI) report. All other analytical data are available at FIMAD. If FIMAD is not accessible, data will be provided upon request.

Analytical data that are not presently available in FIMAD include some analyses performed in the mobile laboratory facility. Because all detected organic analytes are reported in the tables in Chapter 5.0 of this RFI report, the results for volatile organic compound, semivolatile organic compound, and polychlorinated biphenyl measurements made in the mobile laboratory facility are not presented in this appendix.

The results of the x-ray fluorescence (XRF) analyses performed in the mobile laboratory facility are not all available at FIMAD. All XRF analytes present above the background upper tolerance limit value are reported in the tables in Chapter 5.0 of this RFI report. The complete XRF data set is presented in this appendix.

TABLE A-1

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-003(h)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2027	AAA6605	2–3	Arsenic	<4
35-2027	AAA6605	2–3	Barium	387
35-2027	AAA6605	2–3	Calcium	5600
35-2027	AAA6605	2–3	Cadmium	<3
35-2027	AAA6605	2–3	Chromium	16
35-2027	AAA6605	2–3	Copper	<8
35-2027	AAA6605	2–3	Iron	17300
35-2027	AAA6605	2–3	Mercury	<5
35-2027	AAA6605	2–3	Potassium	30300
35-2027	AAA6605	2–3	Manganese	409
35-2027	AAA6605	2–3	Nickel	22
35-2027	AAA6605	2–3	Lead	21
35-2027	AAA6605	2–3	Antimony	<4
35-2027	AAA6605	2–3	Selenium	<4
35-2027	AAA6605	2–3	Thorium	<8
35-2027	AAA6605	2–3	Titanium	2010
35-2027	AAA6605	2–3	Uranium	<8
35-2027	AAA6605	2–3	Zinc	61
35-2027	AAA6606	9–10	Arsenic	<4
35-2027	AAA6606	9–10	Barium	531
35-2027	AAA6606	9–10	Calcium	7500
35-2027	AAA6606	9–10	Cadmium	<3
35-2027	AAA6606	9–10	Chromium	29
35-2027	AAA6606	9–10	Copper	13
35-2027	AAA6606	9–10	Iron	21100
35-2027	AAA6606	9–10	Mercury	<5
35-2027	AAA6606	9–10	Potassium	26000
35-2027	AAA6606	9–10	Manganese	440
35-2027	AAA6606	9–10	Nickel	16
35-2027	AAA6606	9–10	Lead	34
35-2027	AAA6606	9–10	Antimony	<4
35-2027	AAA6606	9–10	Selenium	<4
35-2027	AAA6606	9–10	Thorium	14
35-2027	AAA6606	9–10	Titanium	2920
35-2027	AAA6606	9–10	Uranium	<8
35-2027	AAA6606	9–10	Zinc	53
35-2027	AAA6607	9–10	Arsenic	5
35-2027	AAA6607	9–10	Barium	509
35-2027	AAA6607	9–10	Calcium	7400
35-2027	AAA6607	9–10	Cadmium	<3
35-2027	AAA6607	9–10	Chromium	13
35-2027	AAA6607	9–10	Copper	<8
35-2027	AAA6607	9–10	Iron	21100
35-2027	AAA6607	9–10	Mercury	<5
35-2027	AAA6607	9–10	Potassium	26400
35-2027	AAA6607	9–10	Manganese	442
35-2027	AAA6607	9–10	Nickel	<13
35-2027	AAA6607	9–10	Lead	30
35-2027	AAA6607	9–10	Antimony	5

TABLE A-1 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-003(h)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2027	AAA6607	9–10	Selenium	<4
35-2027	AAA6607	9–10	Thorium	15
35-2027	AAA6607	9–10	Titanium	2980
35-2027	AAA6607	9–10	Uranium	<8
35-2027	AAA6607	9–10	Zinc	57
35-2027	AAA6608	20–21	Arsenic	<4
35-2027	AAA6608	20–21	Barium	181
35-2027	AAA6608	20–21	Calcium	4200
35-2027	AAA6608	20–21	Cadmium	<3
35-2027	AAA6608	20–21	Chromium	<12
35-2027	AAA6608	20–21	Copper	<8
35-2027	AAA6608	20–21	Iron	13700
35-2027	AAA6608	20–21	Mercury	<5
35-2027	AAA6608	20–21	Potassium	32100
35-2027	AAA6608	20–21	Manganese	416
35-2027	AAA6608	20–21	Nickel	<13
35-2027	AAA6608	20–21	Lead	23
35-2027	AAA6608	20–21	Antimony	<4
35-2027	AAA6608	20–21	Selenium	<4
35-2027	AAA6608	20–21	Thorium	21
35-2027	AAA6608	20–21	Titanium	1060
35-2027	AAA6608	20–21	Uranium	<8
35-2027	AAA6608	20–21	Zinc	60
35-2027	AAA6609	28.5–29.5	Arsenic	<4
35-2027	AAA6609	28.5–29.5	Barium	76
35-2027	AAA6609	28.5–29.5	Calcium	1700
35-2027	AAA6609	28.5–29.5	Cadmium	<3
35-2027	AAA6609	28.5–29.5	Chromium	<12
35-2027	AAA6609	28.5–29.5	Copper	<8
35-2027	AAA6609	28.5–29.5	Iron	11000
35-2027	AAA6609	28.5–29.5	Mercury	<5
35-2027	AAA6609	28.5–29.5	Potassium	35000
35-2027	AAA6609	28.5–29.5	Manganese	477
35-2027	AAA6609	28.5–29.5	Nickel	<13
35-2027	AAA6609	28.5–29.5	Lead	20
35-2027	AAA6609	28.5–29.5	Antimony	<4
35-2027	AAA6609	28.5–29.5	Selenium	<4
35-2027	AAA6609	28.5–29.5	Thorium	24
35-2027	AAA6609	28.5–29.5	Titanium	668
35-2027	AAA6609	28.5–29.5	Uranium	<8
35-2027	AAA6609	28.5–29.5	Zinc	41
35-2027	AAA6605	2–3	Arsenic	<4
35-2027	AAA6605	2–3	Barium	387
35-2027	AAA6605	2–3	Calcium	5600
35-2027	AAA6605	2–3	Cadmium	<3
35-2027	AAA6605	2–3	Chromium	16
35-2027	AAA6605	2–3	Copper	<8
35-2027	AAA6605	2–3	Iron	17300
35-2027	AAA6605	2–3	Mercury	<5

TABLE A-1 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-003(h)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2027	AAA6605	2–3	Potassium	30300
35-2027	AAA6605	2–3	Manganese	409
35-2027	AAA6605	2–3	Nickel	22
35-2027	AAA6605	2–3	Lead	21
35-2027	AAA6605	2–3	Antimony	<4
35-2027	AAA6605	2–3	Selenium	<4
35-2027	AAA6605	2–3	Thorium	<8
35-2027	AAA6605	2–3	Titanium	2010
35-2027	AAA6605	2–3	Uranium	<8
35-2027	AAA6605	2–3	Zinc	61
35-2027	AAA6606	9–10	Arsenic	<4
35-2027	AAA6606	9–10	Barium	531
35-2027	AAA6606	9–10	Calcium	7500
35-2027	AAA6606	9–10	Cadmium	<3
35-2027	AAA6606	9–10	Chromium	29
35-2027	AAA6606	9–10	Copper	13
35-2027	AAA6606	9–10	Iron	21100
35-2027	AAA6606	9–10	Mercury	<5
35-2027	AAA6606	9–10	Potassium	26000
35-2027	AAA6606	9–10	Manganese	440
35-2027	AAA6606	9–10	Nickel	16
35-2027	AAA6606	9–10	Lead	34
35-2027	AAA6606	9–10	Antimony	<4
35-2027	AAA6606	9–10	Selenium	<4
35-2027	AAA6606	9–10	Thorium	14
35-2027	AAA6606	9–10	Titanium	2920
35-2027	AAA6606	9–10	Uranium	<8
35-2027	AAA6606	9–10	Zinc	53
35-2027	AAA6607	9–10	Arsenic	5
35-2027	AAA6607	9–10	Barium	509
35-2027	AAA6607	9–10	Calcium	7400
35-2027	AAA6607	9–10	Cadmium	<3
35-2027	AAA6607	9–10	Chromium	13
35-2027	AAA6607	9–10	Copper	<8
35-2027	AAA6607	9–10	Iron	21100
35-2027	AAA6607	9–10	Mercury	<5
35-2027	AAA6607	9–10	Potassium	26400
35-2027	AAA6607	9–10	Manganese	442
35-2027	AAA6607	9–10	Nickel	<13
35-2027	AAA6607	9–10	Lead	30
35-2027	AAA6607	9–10	Antimony	5
35-2027	AAA6607	9–10	Selenium	<4
35-2027	AAA6607	9–10	Thorium	15
35-2027	AAA6607	9–10	Titanium	2980
35-2027	AAA6607	9–10	Uranium	<8
35-2027	AAA6607	9–10	Zinc	57
35-2027	AAA6608	20–21	Arsenic	<4
35-2027	AAA6608	20–21	Barium	181
35-2027	AAA6608	20–21	Calcium	4200

TABLE A-1 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-003(h)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2027	AAA6608	20–21	Cadmium	<3
35-2027	AAA6608	20–21	Chromium	<12
35-2027	AAA6608	20–21	Copper	<8
35-2027	AAA6608	20–21	Iron	13700
35-2027	AAA6608	20–21	Mercury	<5
35-2027	AAA6608	20–21	Potassium	32100
35-2027	AAA6608	20–21	Manganese	416
35-2027	AAA6608	20–21	Nickel	<13
35-2027	AAA6608	20–21	Lead	23
35-2027	AAA6608	20–21	Antimony	<4
35-2027	AAA6608	20–21	Selenium	<4
35-2027	AAA6608	20–21	Thorium	21
35-2027	AAA6608	20–21	Titanium	1060
35-2027	AAA6608	20–21	Uranium	<8
35-2027	AAA6608	20–21	Zinc	60
35-2027	AAA6609	28.5–29.5	Arsenic	<4
35-2027	AAA6609	28.5–29.5	Barium	76
35-2027	AAA6609	28.5–29.5	Calcium	1700
35-2027	AAA6609	28.5–29.5	Cadmium	<3
35-2027	AAA6609	28.5–29.5	Chromium	<12
35-2027	AAA6609	28.5–29.5	Copper	<8
35-2027	AAA6609	28.5–29.5	Iron	11000
35-2027	AAA6609	28.5–29.5	Mercury	<5
35-2027	AAA6609	28.5–29.5	Potassium	35000
35-2027	AAA6609	28.5–29.5	Manganese	477
35-2027	AAA6609	28.5–29.5	Nickel	<13
35-2027	AAA6609	28.5–29.5	Lead	20
35-2027	AAA6609	28.5–29.5	Antimony	<4
35-2027	AAA6609	28.5–29.5	Selenium	<4
35-2027	AAA6609	28.5–29.5	Thorium	24
35-2027	AAA6609	28.5–29.5	Titanium	668
35-2027	AAA6609	28.5–29.5	Uranium	<8
35-2027	AAA6609	28.5–29.5	Zinc	41

TABLE A-2

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-004(b)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2120	AAC1285	0–1	Arsenic	<4
35-2120	AAC1285	0–1	Barium	375
35-2120	AAC1285	0–1	Calcium	5770
35-2120	AAC1285	0–1	Cadmium	<3
35-2120	AAC1285	0–1	Chromium	<12
35-2120	AAC1285	0–1	Copper	17
35-2120	AAC1285	0–1	Iron	18500
35-2120	AAC1285	0–1	Mercury	<5
35-2120	AAC1285	0–1	Potassium	26900
35-2120	AAC1285	0–1	Manganese	306
35-2120	AAC1285	0–1	Nickel	<13
35-2120	AAC1285	0–1	Lead	29
35-2120	AAC1285	0–1	Antimony	<4
35-2120	AAC1285	0–1	Selenium	<4
35-2120	AAC1285	0–1	Thorium	14.6
35-2120	AAC1285	0–1	Titanium	2217
35-2120	AAC1285	0–1	Uranium	<8
35-2120	AAC1285	0–1	Zinc	58.3
35-2120	AAC1286	1–2	Arsenic	<4
35-2120	AAC1286	1–2	Barium	293
35-2120	AAC1286	1–2	Calcium	4740
35-2120	AAC1286	1–2	Cadmium	<3
35-2120	AAC1286	1–2	Chromium	<12
35-2120	AAC1286	1–2	Copper	8.35
35-2120	AAC1286	1–2	Iron	17700
35-2120	AAC1286	1–2	Mercury	<5
35-2120	AAC1286	1–2	Potassium	27200
35-2120	AAC1286	1–2	Manganese	301
35-2120	AAC1286	1–2	Nickel	<13
35-2120	AAC1286	1–2	Lead	19.1
35-2120	AAC1286	1–2	Antimony	<4
35-2120	AAC1286	1–2	Selenium	<4
35-2120	AAC1286	1–2	Thorium	8.5
35-2120	AAC1286	1–2	Titanium	2027
35-2120	AAC1286	1–2	Uranium	<8
35-2120	AAC1286	1–2	Zinc	54.8
35-2120	AAC1287	2–3	Arsenic	9.67
35-2120	AAC1287	2–3	Barium	367
35-2120	AAC1287	2–3	Calcium	7600
35-2120	AAC1287	2–3	Cadmium	<3
35-2120	AAC1287	2–3	Chromium	<12
35-2120	AAC1287	2–3	Copper	30.1
35-2120	AAC1287	2–3	Iron	18200
35-2120	AAC1287	2–3	Mercury	<5
35-2120	AAC1287	2–3	Potassium	27500
35-2120	AAC1287	2–3	Manganese	351
35-2120	AAC1287	2–3	Nickel	<13
35-2120	AAC1287	2–3	Lead	25.5
35-2120	AAC1287	2–3	Antimony	<4

TABLE A-2 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-004(b)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2120	AAC1287	2–3	Selenium	<4
35-2120	AAC1287	2–3	Thorium	16.4
35-2120	AAC1287	2–3	Titanium	2206
35-2120	AAC1287	2–3	Uranium	<8
35-2120	AAC1287	2–3	Zinc	44.1
35-2121	AAC1288	0–1	Arsenic	5.52
35-2121	AAC1288	0–1	Barium	663
35-2121	AAC1288	0–1	Calcium	6790
35-2121	AAC1288	0–1	Cadmium	<3
35-2121	AAC1288	0–1	Chromium	15.4
35-2121	AAC1288	0–1	Copper	20.3
35-2121	AAC1288	0–1	Iron	22200
35-2121	AAC1288	0–1	Mercury	<5
35-2121	AAC1288	0–1	Potassium	21900
35-2121	AAC1288	0–1	Manganese	448
35-2121	AAC1288	0–1	Nickel	<13
35-2121	AAC1288	0–1	Lead	27.8
35-2121	AAC1288	0–1	Antimony	<4
35-2121	AAC1288	0–1	Selenium	<4
35-2121	AAC1288	0–1	Thorium	10
35-2121	AAC1288	0–1	Titanium	4226
35-2121	AAC1288	0–1	Uranium	<8
35-2121	AAC1288	0–1	Zinc	62
35-2121	AAC1289	1–2	Arsenic	<4
35-2121	AAC1289	1–2	Barium	400
35-2121	AAC1289	1–2	Calcium	5260
35-2121	AAC1289	1–2	Cadmium	<3
35-2121	AAC1289	1–2	Chromium	<12
35-2121	AAC1289	1–2	Copper	11.3
35-2121	AAC1289	1–2	Iron	19600
35-2121	AAC1289	1–2	Mercury	<5
35-2121	AAC1289	1–2	Potassium	26800
35-2121	AAC1289	1–2	Manganese	348
35-2121	AAC1289	1–2	Nickel	<13
35-2121	AAC1289	1–2	Lead	21.4
35-2121	AAC1289	1–2	Antimony	<4
35-2121	AAC1289	1–2	Selenium	<4
35-2121	AAC1289	1–2	Thorium	13.1
35-2121	AAC1289	1–2	Titanium	2540
35-2121	AAC1289	1–2	Uranium	<8
35-2121	AAC1289	1–2	Zinc	51.9
35-2121	AAC1290	2–3	Arsenic	6.37
35-2121	AAC1290	2–3	Barium	342
35-2121	AAC1290	2–3	Calcium	4830
35-2121	AAC1290	2–3	Cadmium	<3
35-2121	AAC1290	2–3	Chromium	13.3
35-2121	AAC1290	2–3	Copper	10.4
35-2121	AAC1290	2–3	Iron	18000
35-2121	AAC1290	2–3	Mercury	<5

TABLE A-2 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-004(b)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2121	AAC1290	2–3	Potassium	28700
35-2121	AAC1290	2–3	Manganese	324
35-2121	AAC1290	2–3	Nickel	<13
35-2121	AAC1290	2–3	Lead	27.7
35-2121	AAC1290	2–3	Antimony	<4
35-2121	AAC1290	2–3	Selenium	<4
35-2121	AAC1290	2–3	Thorium	14.6
35-2121	AAC1290	2–3	Titanium	1934
35-2121	AAC1290	2–3	Uranium	<8
35-2121	AAC1290	2–3	Zinc	45.6

TABLE A-3

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-016(e)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2152	AAC1291	0–.5	Arsenic	<4
35-2152	AAC1291	0–.5	Barium	305
35-2152	AAC1291	0–.5	Calcium	3730
35-2152	AAC1291	0–.5	Cadmium	<3
35-2152	AAC1291	0–.5	Chromium	<12
35-2152	AAC1291	0–.5	Copper	8.99
35-2152	AAC1291	0–.5	Iron	15700
35-2152	AAC1291	0–.5	Mercury	<5
35-2152	AAC1291	0–.5	Potassium	30000
35-2152	AAC1291	0–.5	Manganese	347
35-2152	AAC1291	0–.5	Nickel	<13
35-2152	AAC1291	0–.5	Lead	20.6
35-2152	AAC1291	0–.5	Antimony	<4
35-2152	AAC1291	0–.5	Selenium	<4
35-2152	AAC1291	0–.5	Thorium	<8
35-2152	AAC1291	0–.5	Titanium	1916
35-2152	AAC1291	0–.5	Uranium	<8
35-2152	AAC1291	0–.5	Zinc	60.3
35-2153	AAC1292	0–1	Arsenic	9.56
35-2153	AAC1292	0–1	Barium	323
35-2153	AAC1292	0–1	Calcium	4670
35-2153	AAC1292	0–1	Cadmium	<3
35-2153	AAC1292	0–1	Chromium	39.5
35-2153	AAC1292	0–1	Copper	19.1
35-2153	AAC1292	0–1	Iron	19500
35-2153	AAC1292	0–1	Mercury	<5
35-2153	AAC1292	0–1	Potassium	30700
35-2153	AAC1292	0–1	Manganese	447
35-2153	AAC1292	0–1	Nickel	27.2
35-2153	AAC1292	0–1	Lead	29.7
35-2153	AAC1292	0–1	Antimony	<4
35-2153	AAC1292	0–1	Selenium	<4
35-2153	AAC1292	0–1	Thorium	23.8
35-2153	AAC1292	0–1	Titanium	2132
35-2153	AAC1292	0–1	Uranium	<8
35-2153	AAC1292	0–1	Zinc	62.5
35-2153	AAC1293	1–2	Arsenic	<4
35-2153	AAC1293	1–2	Barium	290
35-2153	AAC1293	1–2	Calcium	4770
35-2153	AAC1293	1–2	Cadmium	<3
35-2153	AAC1293	1–2	Chromium	47.7
35-2153	AAC1293	1–2	Copper	<8
35-2153	AAC1293	1–2	Iron	17500
35-2153	AAC1293	1–2	Mercury	<5
35-2153	AAC1293	1–2	Potassium	27800
35-2153	AAC1293	1–2	Manganese	370
35-2153	AAC1293	1–2	Nickel	<13
35-2153	AAC1293	1–2	Lead	20.2
35-2153	AAC1293	1–2	Antimony	<4

TABLE A-3 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-016(e)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2153	AAC1293	1–2	Selenium	<4
35-2153	AAC1293	1–2	Thorium	12.6
35-2153	AAC1293	1–2	Titanium	1837
35-2153	AAC1293	1–2	Uranium	<8
35-2153	AAC1293	1–2	Zinc	53
35-2153	AAC1294	2–3	Arsenic	<4
35-2153	AAC1294	2–3	Barium	310
35-2153	AAC1294	2–3	Calcium	5400
35-2153	AAC1294	2–3	Cadmium	<3
35-2153	AAC1294	2–3	Chromium	71.8
35-2153	AAC1294	2–3	Copper	<8
35-2153	AAC1294	2–3	Iron	17600
35-2153	AAC1294	2–3	Mercury	<5
35-2153	AAC1294	2–3	Potassium	28100
35-2153	AAC1294	2–3	Manganese	365
35-2153	AAC1294	2–3	Nickel	13.7
35-2153	AAC1294	2–3	Lead	18
35-2153	AAC1294	2–3	Antimony	<4
35-2153	AAC1294	2–3	Selenium	<4
35-2153	AAC1294	2–3	Thorium	12.7
35-2153	AAC1294	2–3	Titanium	1809
35-2153	AAC1294	2–3	Uranium	<8
35-2153	AAC1294	2–3	Zinc	55.5

TABLE A-4

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(a)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2033	AAA6418	12–13	Antimony	<4
35-2033	AAA6418	12–13	Arsenic	<4
35-2033	AAA6418	12–13	Barium	232
35-2033	AAA6418	12–13	Cadmium	<3
35-2033	AAA6418	12–13	Calcium	2200
35-2033	AAA6418	12–13	Chromium	<12
35-2033	AAA6418	12–13	Copper	<8
35-2033	AAA6418	12–13	Iron	9900
35-2033	AAA6418	12–13	Lead	12
35-2033	AAA6418	12–13	Manganese	378
35-2033	AAA6418	12–13	Mercury	<5
35-2033	AAA6418	12–13	Nickel	<13
35-2033	AAA6418	12–13	Potassium	32000
35-2033	AAA6418	12–13	Selenium	<4
35-2033	AAA6418	12–13	Thorium	10
35-2033	AAA6418	12–13	Titanium	613
35-2033	AAA6418	12–13	Uranium	<8
35-2033	AAA6418	12–13	Zinc	47
35-2033	AAA6419	16–17	Antimony	<4
35-2033	AAA6419	16–17	Arsenic	<4
35-2033	AAA6419	16–17	Barium	135
35-2033	AAA6419	16–17	Cadmium	<3
35-2033	AAA6419	16–17	Calcium	2100
35-2033	AAA6419	16–17	Chromium	<12
35-2033	AAA6419	16–17	Copper	<8
35-2033	AAA6419	16–17	Iron	9400
35-2033	AAA6419	16–17	Lead	9
35-2033	AAA6419	16–17	Manganese	317
35-2033	AAA6419	16–17	Mercury	<5
35-2033	AAA6419	16–17	Nickel	<13
35-2033	AAA6419	16–17	Potassium	34300
35-2033	AAA6419	16–17	Selenium	<4
35-2033	AAA6419	16–17	Thorium	<8
35-2033	AAA6419	16–17	Titanium	629
35-2033	AAA6419	16–17	Uranium	<8
35-2033	AAA6419	16–17	Zinc	31
35-2033	AAA6417	7–8	Antimony	<4
35-2033	AAA6417	7–8	Arsenic	<4
35-2033	AAA6417	7–8	Barium	223
35-2033	AAA6417	7–8	Cadmium	<3
35-2033	AAA6417	7–8	Calcium	5100
35-2033	AAA6417	7–8	Chromium	<12
35-2033	AAA6417	7–8	Copper	<8
35-2033	AAA6417	7–8	Iron	10700
35-2033	AAA6417	7–8	Lead	14
35-2033	AAA6417	7–8	Manganese	302
35-2033	AAA6417	7–8	Mercury	<5
35-2033	AAA6417	7–8	Nickel	<13
35-2033	AAA6417	7–8	Potassium	32300

TABLE A-4 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(a)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2033	AAA6417	7–8	Selenium	<4
35-2033	AAA6417	7–8	Thorium	16
35-2033	AAA6417	7–8	Titanium	661
35-2033	AAA6417	7–8	Uranium	<8
35-2033	AAA6417	7–8	Zinc	35
35-2034	AAA6421	13.5–14.5	Antimony	<4
35-2034	AAA6421	13.5–14.5	Arsenic	<4
35-2034	AAA6421	13.5–14.5	Barium	143
35-2034	AAA6421	13.5–14.5	Cadmium	<3
35-2034	AAA6421	13.5–14.5	Calcium	2500
35-2034	AAA6421	13.5–14.5	Chromium	<12
35-2034	AAA6421	13.5–14.5	Copper	<8
35-2034	AAA6421	13.5–14.5	Iron	9800
35-2034	AAA6421	13.5–14.5	Lead	13
35-2034	AAA6421	13.5–14.5	Manganese	335
35-2034	AAA6421	13.5–14.5	Mercury	<5
35-2034	AAA6421	13.5–14.5	Nickel	<13
35-2034	AAA6421	13.5–14.5	Potassium	32600
35-2034	AAA6421	13.5–14.5	Selenium	<4
35-2034	AAA6421	13.5–14.5	Thorium	14
35-2034	AAA6421	13.5–14.5	Titanium	654
35-2034	AAA6421	13.5–14.5	Uranium	<8
35-2034	AAA6421	13.5–14.5	Zinc	38
35-2034	AAA6422	19–20	Antimony	<4
35-2034	AAA6422	19–20	Arsenic	<4
35-2034	AAA6422	19–20	Barium	133
35-2034	AAA6422	19–20	Cadmium	<3
35-2034	AAA6422	19–20	Calcium	1600
35-2034	AAA6422	19–20	Chromium	<12
35-2034	AAA6422	19–20	Copper	<8
35-2034	AAA6422	19–20	Iron	8100
35-2034	AAA6422	19–20	Lead	13
35-2034	AAA6422	19–20	Manganese	302
35-2034	AAA6422	19–20	Mercury	<5
35-2034	AAA6422	19–20	Nickel	<13
35-2034	AAA6422	19–20	Potassium	33300
35-2034	AAA6422	19–20	Selenium	<4
35-2034	AAA6422	19–20	Thorium	13
35-2034	AAA6422	19–20	Titanium	531
35-2034	AAA6422	19–20	Uranium	<8
35-2034	AAA6422	19–20	Zinc	28
35-2034	AAA6420	5.5–6.5	Antimony	<4
35-2034	AAA6420	5.5–6.5	Arsenic	<4
35-2034	AAA6420	5.5–6.5	Barium	153
35-2034	AAA6420	5.5–6.5	Cadmium	<3
35-2034	AAA6420	5.5–6.5	Calcium	1800
35-2034	AAA6420	5.5–6.5	Chromium	<12
35-2034	AAA6420	5.5–6.5	Copper	<8
35-2034	AAA6420	5.5–6.5	Iron	8300

TABLE A-4 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(a)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2034	AAA6420	5.5–6.5	Lead	14
35-2034	AAA6420	5.5–6.5	Manganese	264
35-2034	AAA6420	5.5–6.5	Mercury	<5
35-2034	AAA6420	5.5–6.5	Nickel	<13
35-2034	AAA6420	5.5–6.5	Potassium	32700
35-2034	AAA6420	5.5–6.5	Selenium	<4
35-2034	AAA6420	5.5–6.5	Thorium	19
35-2034	AAA6420	5.5–6.5	Titanium	554
35-2034	AAA6420	5.5–6.5	Uranium	<8
35-2034	AAA6420	5.5–6.5	Zinc	41
35-2223	AAA6453	0–.5	Antimony	<4
35-2223	AAA6453	0–.5	Arsenic	<4
35-2223	AAA6453	0–.5	Barium	176
35-2223	AAA6453	0–.5	Cadmium	<3
35-2223	AAA6453	0–.5	Calcium	2700
35-2223	AAA6453	0–.5	Chromium	<12
35-2223	AAA6453	0–.5	Copper	15
35-2223	AAA6453	0–.5	Iron	10500
35-2223	AAA6453	0–.5	Lead	16
35-2223	AAA6453	0–.5	Manganese	334
35-2223	AAA6453	0–.5	Mercury	<5
35-2223	AAA6453	0–.5	Nickel	<13
35-2223	AAA6453	0–.5	Potassium	32100
35-2223	AAA6453	0–.5	Selenium	<4
35-2223	AAA6453	0–.5	Thorium	13
35-2223	AAA6453	0–.5	Titanium	793
35-2223	AAA6453	0–.5	Uranium	<8
35-2223	AAA6453	0–.5	Zinc	47
35-2224	AAA6454	0–.5	Antimony	<4
35-2224	AAA6454	0–.5	Arsenic	<4
35-2224	AAA6454	0–.5	Barium	204
35-2224	AAA6454	0–.5	Cadmium	<3
35-2224	AAA6454	0–.5	Calcium	3600
35-2224	AAA6454	0–.5	Chromium	17
35-2224	AAA6454	0–.5	Copper	160
35-2224	AAA6454	0–.5	Iron	11800
35-2224	AAA6454	0–.5	Lead	27
35-2224	AAA6454	0–.5	Manganese	215
35-2224	AAA6454	0–.5	Mercury	<5
35-2224	AAA6454	0–.5	Nickel	<13
35-2224	AAA6454	0–.5	Potassium	31900
35-2224	AAA6454	0–.5	Selenium	<4
35-2224	AAA6454	0–.5	Thorium	16
35-2224	AAA6454	0–.5	Titanium	1020
35-2224	AAA6454	0–.5	Uranium	14
35-2224	AAA6454	0–.5	Zinc	123

TABLE A-5

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(b)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2041	AAA6461	4–5	Arsenic	<4
35-2041	AAA6461	4–5	Barium	134
35-2041	AAA6461	4–5	Calcium	1800
35-2041	AAA6461	4–5	Cadmium	<3
35-2041	AAA6461	4–5	Chromium	<12
35-2041	AAA6461	4–5	Copper	<8
35-2041	AAA6461	4–5	Iron	8500
35-2041	AAA6461	4–5	Mercury	<5
35-2041	AAA6461	4–5	Potassium	33900
35-2041	AAA6461	4–5	Manganese	279
35-2041	AAA6461	4–5	Nickel	<13
35-2041	AAA6461	4–5	Lead	18
35-2041	AAA6461	4–5	Antimony	<4
35-2041	AAA6461	4–5	Selenium	<4
35-2041	AAA6461	4–5	Thorium	17
35-2041	AAA6461	4–5	Titanium	547
35-2041	AAA6461	4–5	Uranium	<8
35-2041	AAA6461	4–5	Zinc	37
35-2041	AAA6462	9–10	Arsenic	<4
35-2041	AAA6462	9–10	Barium	124
35-2041	AAA6462	9–10	Calcium	1600
35-2041	AAA6462	9–10	Cadmium	<3
35-2041	AAA6462	9–10	Chromium	<12
35-2041	AAA6462	9–10	Copper	<8
35-2041	AAA6462	9–10	Iron	8500
35-2041	AAA6462	9–10	Mercury	<5
35-2041	AAA6462	9–10	Potassium	33600
35-2041	AAA6462	9–10	Manganese	263
35-2041	AAA6462	9–10	Nickel	<13
35-2041	AAA6462	9–10	Lead	14
35-2041	AAA6462	9–10	Antimony	<4
35-2041	AAA6462	9–10	Selenium	<4
35-2041	AAA6462	9–10	Thorium	19
35-2041	AAA6462	9–10	Titanium	530
35-2041	AAA6462	9–10	Uranium	<8
35-2041	AAA6462	9–10	Zinc	44
35-2041	AAA6463	14–15	Arsenic	<4
35-2041	AAA6463	14–15	Barium	128
35-2041	AAA6463	14–15	Calcium	1900
35-2041	AAA6463	14–15	Cadmium	<3
35-2041	AAA6463	14–15	Chromium	<12
35-2041	AAA6463	14–15	Copper	<8
35-2041	AAA6463	14–15	Iron	10000
35-2041	AAA6463	14–15	Mercury	<5
35-2041	AAA6463	14–15	Potassium	32600
35-2041	AAA6463	14–15	Manganese	240
35-2041	AAA6463	14–15	Nickel	<13
35-2041	AAA6463	14–15	Lead	11

TABLE A-5 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(b)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2041	AAA6463	14–15	Antimony	<4
35-2041	AAA6463	14–15	Selenium	<4
35-2041	AAA6463	14–15	Thorium	11
35-2041	AAA6463	14–15	Titanium	590
35-2041	AAA6463	14–15	Uranium	<8
35-2041	AAA6463	14–15	Zinc	38
35-2042	AAA6464	4–5	Arsenic	<4
35-2042	AAA6464	4–5	Barium	22
35-2042	AAA6464	4–5	Calcium	2200
35-2042	AAA6464	4–5	Cadmium	<3
35-2042	AAA6464	4–5	Chromium	<12
35-2042	AAA6464	4–5	Copper	<8
35-2042	AAA6464	4–5	Iron	9700
35-2042	AAA6464	4–5	Mercury	<5
35-2042	AAA6464	4–5	Potassium	31200
35-2042	AAA6464	4–5	Manganese	634
35-2042	AAA6464	4–5	Nickel	<13
35-2042	AAA6464	4–5	Lead	46
35-2042	AAA6464	4–5	Antimony	<4
35-2042	AAA6464	4–5	Selenium	<4
35-2042	AAA6464	4–5	Thorium	39
35-2042	AAA6464	4–5	Titanium	276
35-2042	AAA6464	4–5	Uranium	19
35-2042	AAA6464	4–5	Zinc	119
35-2042	AAA6465	6–7	Arsenic	<4
35-2042	AAA6465	6–7	Barium	158
35-2042	AAA6465	6–7	Calcium	2400
35-2042	AAA6465	6–7	Cadmium	<3
35-2042	AAA6465	6–7	Chromium	<12
35-2042	AAA6465	6–7	Copper	10
35-2042	AAA6465	6–7	Iron	10200
35-2042	AAA6465	6–7	Mercury	<5
35-2042	AAA6465	6–7	Potassium	33100
35-2042	AAA6465	6–7	Manganese	345
35-2042	AAA6465	6–7	Nickel	<13
35-2042	AAA6465	6–7	Lead	14
35-2042	AAA6465	6–7	Antimony	<4
35-2042	AAA6465	6–7	Selenium	<4
35-2042	AAA6465	6–7	Thorium	15
35-2042	AAA6465	6–7	Titanium	639
35-2042	AAA6465	6–7	Uranium	12
35-2042	AAA6465	6–7	Zinc	39
35-2042	AAA6466	14–15	Arsenic	<4
35-2042	AAA6466	14–15	Barium	116
35-2042	AAA6466	14–15	Calcium	2500
35-2042	AAA6466	14–15	Cadmium	<3
35-2042	AAA6466	14–15	Chromium	<12
35-2042	AAA6466	14–15	Copper	<8
35-2042	AAA6466	14–15	Iron	12100

TABLE A-5 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(b)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2042	AAA6466	14–15	Mercury	<5
35-2042	AAA6466	14–15	Potassium	33200
35-2042	AAA6466	14–15	Manganese	316
35-2042	AAA6466	14–15	Nickel	<13
35-2042	AAA6466	14–15	Lead	13
35-2042	AAA6466	14–15	Antimony	<4
35-2042	AAA6466	14–15	Selenium	<4
35-2042	AAA6466	14–15	Thorium	17
35-2042	AAA6466	14–15	Titanium	682
35-2042	AAA6466	14–15	Uranium	<8
35-2042	AAA6466	14–15	Zinc	46
35-2042	AAA6467	19–20	Arsenic	<4
35-2042	AAA6467	19–20	Barium	123
35-2042	AAA6467	19–20	Calcium	2000
35-2042	AAA6467	19–20	Cadmium	<3
35-2042	AAA6467	19–20	Chromium	<12
35-2042	AAA6467	19–20	Copper	<8
35-2042	AAA6467	19–20	Iron	11000
35-2042	AAA6467	19–20	Mercury	<5
35-2042	AAA6467	19–20	Potassium	33200
35-2042	AAA6467	19–20	Manganese	353
35-2042	AAA6467	19–20	Nickel	<13
35-2042	AAA6467	19–20	Lead	16
35-2042	AAA6467	19–20	Antimony	<4
35-2042	AAA6467	19–20	Selenium	<4
35-2042	AAA6467	19–20	Thorium	16
35-2042	AAA6467	19–20	Titanium	640
35-2042	AAA6467	19–20	Uranium	9
35-2042	AAA6467	19–20	Zinc	44
35-2041	AAA6474	19–20	Arsenic	<4
35-2041	AAA6474	19–20	Barium	176
35-2041	AAA6474	19–20	Calcium	2600
35-2041	AAA6474	19–20	Cadmium	<3
35-2041	AAA6474	19–20	Chromium	<12
35-2041	AAA6474	19–20	Copper	<8
35-2041	AAA6474	19–20	Iron	14900
35-2041	AAA6474	19–20	Mercury	<5
35-2041	AAA6474	19–20	Potassium	31400
35-2041	AAA6474	19–20	Manganese	360
35-2041	AAA6474	19–20	Nickel	<13
35-2041	AAA6474	19–20	Lead	18
35-2041	AAA6474	19–20	Antimony	<4
35-2041	AAA6474	19–20	Selenium	<4
35-2041	AAA6474	19–20	Thorium	19
35-2041	AAA6474	19–20	Titanium	905
35-2041	AAA6474	19–20	Uranium	<8
35-2041	AAA6474	19–20	Zinc	53
35-2039	AAA6410	11–12	Antimony	<4
35-2039	AAA6410	11–12	Arsenic	<4

TABLE A-5 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(b)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2039	AAA6410	11–12	Barium	132
35-2039	AAA6410	11–12	Cadmium	<3
35-2039	AAA6410	11–12	Calcium	1900
35-2039	AAA6410	11–12	Chromium	<12
35-2039	AAA6410	11–12	Copper	<8
35-2039	AAA6410	11–12	Iron	9400
35-2039	AAA6410	11–12	Lead	14
35-2039	AAA6410	11–12	Manganese	396
35-2039	AAA6410	11–12	Mercury	<5
35-2039	AAA6410	11–12	Nickel	<13
35-2039	AAA6410	11–12	Potassium	33400
35-2039	AAA6410	11–12	Selenium	<4
35-2039	AAA6410	11–12	Thorium	16
35-2039	AAA6410	11–12	Titanium	610
35-2039	AAA6410	11–12	Uranium	<8
35-2039	AAA6410	11–12	Zinc	38
35-2039	AAA6411	19–20	Antimony	<4
35-2039	AAA6411	19–20	Arsenic	<4
35-2039	AAA6411	19–20	Barium	100
35-2039	AAA6411	19–20	Cadmium	<3
35-2039	AAA6411	19–20	Calcium	1700
35-2039	AAA6411	19–20	Chromium	<12
35-2039	AAA6411	19–20	Copper	<8
35-2039	AAA6411	19–20	Iron	9200
35-2039	AAA6411	19–20	Lead	15
35-2039	AAA6411	19–20	Manganese	386
35-2039	AAA6411	19–20	Mercury	<5
35-2039	AAA6411	19–20	Nickel	<13
35-2039	AAA6411	19–20	Potassium	34800
35-2039	AAA6411	19–20	Selenium	<4
35-2039	AAA6411	19–20	Thorium	14
35-2039	AAA6411	19–20	Titanium	546
35-2039	AAA6411	19–20	Uranium	<8
35-2039	AAA6411	19–20	Zinc	37
35-2039	AAA6409	5–6	Antimony	5
35-2039	AAA6409	5–6	Arsenic	<4
35-2039	AAA6409	5–6	Barium	140
35-2039	AAA6409	5–6	Cadmium	<3
35-2039	AAA6409	5–6	Calcium	1700
35-2039	AAA6409	5–6	Chromium	<12
35-2039	AAA6409	5–6	Copper	<8
35-2039	AAA6409	5–6	Iron	9100
35-2039	AAA6409	5–6	Lead	12
35-2039	AAA6409	5–6	Manganese	255
35-2039	AAA6409	5–6	Mercury	<5
35-2039	AAA6409	5–6	Nickel	<13
35-2039	AAA6409	5–6	Potassium	32500
35-2039	AAA6409	5–6	Selenium	<4
35-2039	AAA6409	5–6	Thorium	11

TABLE A-5 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(b)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2039	AAA6409	5–6	Titanium	574
35-2039	AAA6409	5–6	Uranium	<8
35-2039	AAA6409	5–6	Zinc	24
35-2040	AAA6413	14–15	Antimony	<4
35-2040	AAA6413	14–15	Arsenic	<4
35-2040	AAA6413	14–15	Barium	109
35-2040	AAA6413	14–15	Cadmium	<3
35-2040	AAA6413	14–15	Calcium	1600
35-2040	AAA6413	14–15	Chromium	<12
35-2040	AAA6413	14–15	Copper	<8
35-2040	AAA6413	14–15	Iron	8800
35-2040	AAA6413	14–15	Lead	13
35-2040	AAA6413	14–15	Manganese	335
35-2040	AAA6413	14–15	Mercury	<5
35-2040	AAA6413	14–15	Nickel	<13
35-2040	AAA6413	14–15	Potassium	33700
35-2040	AAA6413	14–15	Selenium	<4
35-2040	AAA6413	14–15	Thorium	12
35-2040	AAA6413	14–15	Titanium	538
35-2040	AAA6413	14–15	Uranium	<8
35-2040	AAA6413	14–15	Zinc	39
35-2040	AAA6414	19–20	Antimony	<4
35-2040	AAA6414	19–20	Arsenic	<4
35-2040	AAA6414	19–20	Barium	120
35-2040	AAA6414	19–20	Cadmium	<3
35-2040	AAA6414	19–20	Calcium	1800
35-2040	AAA6414	19–20	Chromium	<12
35-2040	AAA6414	19–20	Copper	<8
35-2040	AAA6414	19–20	Iron	9200
35-2040	AAA6414	19–20	Lead	18
35-2040	AAA6414	19–20	Manganese	342
35-2040	AAA6414	19–20	Mercury	<5
35-2040	AAA6414	19–20	Nickel	<13
35-2040	AAA6414	19–20	Potassium	35700
35-2040	AAA6414	19–20	Selenium	<4
35-2040	AAA6414	19–20	Thorium	17
35-2040	AAA6414	19–20	Titanium	578
35-2040	AAA6414	19–20	Uranium	<8
35-2040	AAA6414	19–20	Zinc	42
35-2040	AAA6412	6.5–7.5	Antimony	<4
35-2040	AAA6412	6.5–7.5	Arsenic	<4
35-2040	AAA6412	6.5–7.5	Barium	179
35-2040	AAA6412	6.5–7.5	Cadmium	<3
35-2040	AAA6412	6.5–7.5	Calcium	3300
35-2040	AAA6412	6.5–7.5	Chromium	<12
35-2040	AAA6412	6.5–7.5	Copper	<8
35-2040	AAA6412	6.5–7.5	Iron	11300
35-2040	AAA6412	6.5–7.5	Lead	16
35-2040	AAA6412	6.5–7.5	Manganese	396

TABLE A-5 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(b)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2040	AAA6412	6.5–7.5	Mercury	<5
35-2040	AAA6412	6.5–7.5	Nickel	<13
35-2040	AAA6412	6.5–7.5	Potassium	33500
35-2040	AAA6412	6.5–7.5	Selenium	<4
35-2040	AAA6412	6.5–7.5	Thorium	12
35-2040	AAA6412	6.5–7.5	Titanium	793
35-2040	AAA6412	6.5–7.5	Uranium	<8
35-2040	AAA6412	6.5–7.5	Zinc	56
35-2041	AAA6462	9–10	Antimony	<4
35-2041	AAA6462	9–10	Arsenic	<4
35-2041	AAA6462	9–10	Barium	123
35-2041	AAA6462	9–10	Cadmium	<3
35-2041	AAA6462	9–10	Calcium	1600
35-2041	AAA6462	9–10	Chromium	<12
35-2041	AAA6462	9–10	Copper	<8
35-2041	AAA6462	9–10	Iron	9300
35-2041	AAA6462	9–10	Lead	14
35-2041	AAA6462	9–10	Manganese	306
35-2041	AAA6462	9–10	Mercury	<5
35-2041	AAA6462	9–10	Nickel	<13
35-2041	AAA6462	9–10	Potassium	35700
35-2041	AAA6462	9–10	Selenium	<4
35-2041	AAA6462	9–10	Thorium	21
35-2041	AAA6462	9–10	Titanium	564
35-2041	AAA6462	9–10	Uranium	<8
35-2041	AAA6462	9–10	Zinc	42

TABLE A-6

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(c)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2049	AAA6496	12–13	Arsenic	<4
35-2049	AAA6496	12–13	Barium	128
35-2049	AAA6496	12–13	Calcium	2800
35-2049	AAA6496	12–13	Cadmium	<3
35-2049	AAA6496	12–13	Chromium	<12
35-2049	AAA6496	12–13	Copper	10
35-2049	AAA6496	12–13	Iron	13900
35-2049	AAA6496	12–13	Mercury	<5
35-2049	AAA6496	12–13	Potassium	31600
35-2049	AAA6496	12–13	Manganese	378
35-2049	AAA6496	12–13	Nickel	<13
35-2049	AAA6496	12–13	Lead	30
35-2049	AAA6496	12–13	Antimony	<4
35-2049	AAA6496	12–13	Selenium	<4
35-2049	AAA6496	12–13	Thorium	14
35-2049	AAA6496	12–13	Titanium	801
35-2049	AAA6496	12–13	Uranium	<8
35-2049	AAA6496	12–13	Zinc	70
35-2049	AAA6497	19–20	Arsenic	<4
35-2049	AAA6497	19–20	Barium	134
35-2049	AAA6497	19–20	Calcium	1900
35-2049	AAA6497	19–20	Cadmium	<3
35-2049	AAA6497	19–20	Chromium	<12
35-2049	AAA6497	19–20	Copper	9
35-2049	AAA6497	19–20	Iron	8800
35-2049	AAA6497	19–20	Mercury	<5
35-2049	AAA6497	19–20	Potassium	33600
35-2049	AAA6497	19–20	Manganese	295
35-2049	AAA6497	19–20	Nickel	<13
35-2049	AAA6497	19–20	Lead	19
35-2049	AAA6497	19–20	Antimony	<4
35-2049	AAA6497	19–20	Selenium	<4
35-2049	AAA6497	19–20	Thorium	17
35-2049	AAA6497	19–20	Titanium	593
35-2049	AAA6497	19–20	Uranium	<8
35-2049	AAA6497	19–20	Zinc	46
35-2049	AAA6495	8–9	Arsenic	<4
35-2049	AAA6495	8–9	Barium	188
35-2049	AAA6495	8–9	Calcium	4300
35-2049	AAA6495	8–9	Cadmium	<3
35-2049	AAA6495	8–9	Chromium	13
35-2049	AAA6495	8–9	Copper	17
35-2049	AAA6495	8–9	Iron	17500
35-2049	AAA6495	8–9	Mercury	<5
35-2049	AAA6495	8–9	Potassium	26500
35-2049	AAA6495	8–9	Manganese	462
35-2049	AAA6495	8–9	Nickel	27
35-2049	AAA6495	8–9	Lead	34
35-2049	AAA6495	8–9	Antimony	<4

TABLE A-6 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(c)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2049	AAA6495	8–9	Selenium	<4
35-2049	AAA6495	8–9	Thorium	22
35-2049	AAA6495	8–9	Titanium	1330
35-2049	AAA6495	8–9	Uranium	<8
35-2049	AAA6495	8–9	Zinc	100
35-2050	AAA6499	11.5–12.5	Arsenic	<4
35-2050	AAA6499	11.5–12.5	Barium	123
35-2050	AAA6499	11.5–12.5	Calcium	2100
35-2050	AAA6499	11.5–12.5	Cadmium	<3
35-2050	AAA6499	11.5–12.5	Chromium	<12
35-2050	AAA6499	11.5–12.5	Copper	<8
35-2050	AAA6499	11.5–12.5	Iron	10200
35-2050	AAA6499	11.5–12.5	Mercury	<5
35-2050	AAA6499	11.5–12.5	Potassium	33700
35-2050	AAA6499	11.5–12.5	Manganese	601
35-2050	AAA6499	11.5–12.5	Nickel	<13
35-2050	AAA6499	11.5–12.5	Lead	17
35-2050	AAA6499	11.5–12.5	Antimony	<4
35-2050	AAA6499	11.5–12.5	Selenium	<4
35-2050	AAA6499	11.5–12.5	Thorium	14
35-2050	AAA6499	11.5–12.5	Titanium	600
35-2050	AAA6499	11.5–12.5	Uranium	<8
35-2050	AAA6499	11.5–12.5	Zinc	51
35-2050	AAA6500	19–20	Arsenic	5
35-2050	AAA6500	19–20	Barium	123
35-2050	AAA6500	19–20	Calcium	2500
35-2050	AAA6500	19–20	Cadmium	<3
35-2050	AAA6500	19–20	Chromium	<12
35-2050	AAA6500	19–20	Copper	<8
35-2050	AAA6500	19–20	Iron	9300
35-2050	AAA6500	19–20	Mercury	<5
35-2050	AAA6500	19–20	Potassium	33900
35-2050	AAA6500	19–20	Manganese	311
35-2050	AAA6500	19–20	Nickel	<13
35-2050	AAA6500	19–20	Lead	11
35-2050	AAA6500	19–20	Antimony	<4
35-2050	AAA6500	19–20	Selenium	<4
35-2050	AAA6500	19–20	Thorium	9
35-2050	AAA6500	19–20	Titanium	580
35-2050	AAA6500	19–20	Uranium	15
35-2050	AAA6500	19–20	Zinc	47
35-2050	AAA6498	9–10	Arsenic	<4
35-2050	AAA6498	9–10	Barium	118
35-2050	AAA6498	9–10	Calcium	2500
35-2050	AAA6498	9–10	Cadmium	<3
35-2050	AAA6498	9–10	Chromium	<12
35-2050	AAA6498	9–10	Copper	<8
35-2050	AAA6498	9–10	Iron	9300
35-2050	AAA6498	9–10	Mercury	<5

TABLE A-6 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(c)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2050	AAA6498	9–10	Potassium	34800
35-2050	AAA6498	9–10	Manganese	257
35-2050	AAA6498	9–10	Nickel	<13
35-2050	AAA6498	9–10	Lead	15
35-2050	AAA6498	9–10	Antimony	<4
35-2050	AAA6498	9–10	Selenium	<4
35-2050	AAA6498	9–10	Thorium	13
35-2050	AAA6498	9–10	Titanium	575
35-2050	AAA6498	9–10	Uranium	<8
35-2050	AAA6498	9–10	Zinc	48
35-2051	AAA6527	14–15	Arsenic	<4
35-2051	AAA6527	14–15	Barium	135
35-2051	AAA6527	14–15	Calcium	1800
35-2051	AAA6527	14–15	Cadmium	<3
35-2051	AAA6527	14–15	Chromium	<12
35-2051	AAA6527	14–15	Copper	11
35-2051	AAA6527	14–15	Iron	11300
35-2051	AAA6527	14–15	Mercury	<5
35-2051	AAA6527	14–15	Potassium	33500
35-2051	AAA6527	14–15	Manganese	362
35-2051	AAA6527	14–15	Nickel	<13
35-2051	AAA6527	14–15	Lead	<7
35-2051	AAA6527	14–15	Antimony	<4
35-2051	AAA6527	14–15	Selenium	<4
35-2051	AAA6527	14–15	Thorium	19
35-2051	AAA6527	14–15	Titanium	690
35-2051	AAA6527	14–15	Uranium	<8
35-2051	AAA6527	14–15	Zinc	39
35-2051	AAA6528	17–18	Arsenic	<4
35-2051	AAA6528	17–18	Barium	136
35-2051	AAA6528	17–18	Calcium	2400
35-2051	AAA6528	17–18	Cadmium	<3
35-2051	AAA6528	17–18	Chromium	<12
35-2051	AAA6528	17–18	Copper	9
35-2051	AAA6528	17–18	Iron	17500
35-2051	AAA6528	17–18	Mercury	<5
35-2051	AAA6528	17–18	Potassium	34300
35-2051	AAA6528	17–18	Manganese	630
35-2051	AAA6528	17–18	Nickel	<13
35-2051	AAA6528	17–18	Lead	20
35-2051	AAA6528	17–18	Antimony	<4
35-2051	AAA6528	17–18	Selenium	<4
35-2051	AAA6528	17–18	Thorium	25
35-2051	AAA6528	17–18	Titanium	986
35-2051	AAA6528	17–18	Uranium	<8
35-2051	AAA6528	17–18	Zinc	63
35-2051	AAA6525	3.5–4.5	Arsenic	<4
35-2051	AAA6525	3.5–4.5	Barium	174
35-2051	AAA6525	3.5–4.5	Calcium	2200

TABLE A-6 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(c)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2051	AAA6525	3.5–4.5	Cadmium	<3
35-2051	AAA6525	3.5–4.5	Chromium	<12
35-2051	AAA6525	3.5–4.5	Copper	<8
35-2051	AAA6525	3.5–4.5	Iron	12000
35-2051	AAA6525	3.5–4.5	Mercury	<5
35-2051	AAA6525	3.5–4.5	Potassium	33600
35-2051	AAA6525	3.5–4.5	Manganese	343
35-2051	AAA6525	3.5–4.5	Nickel	<13
35-2051	AAA6525	3.5–4.5	Lead	21
35-2051	AAA6525	3.5–4.5	Antimony	<4
35-2051	AAA6525	3.5–4.5	Selenium	<4
35-2051	AAA6525	3.5–4.5	Thorium	16
35-2051	AAA6525	3.5–4.5	Titanium	897
35-2051	AAA6525	3.5–4.5	Uranium	<8
35-2051	AAA6525	3.5–4.5	Zinc	42
35-2051	AAA6526	9–10	Arsenic	<4
35-2051	AAA6526	9–10	Barium	134
35-2051	AAA6526	9–10	Calcium	6600
35-2051	AAA6526	9–10	Cadmium	<3
35-2051	AAA6526	9–10	Chromium	<12
35-2051	AAA6526	9–10	Copper	11
35-2051	AAA6526	9–10	Iron	12200
35-2051	AAA6526	9–10	Mercury	<5
35-2051	AAA6526	9–10	Potassium	34700
35-2051	AAA6526	9–10	Manganese	355
35-2051	AAA6526	9–10	Nickel	<13
35-2051	AAA6526	9–10	Lead	18
35-2051	AAA6526	9–10	Antimony	5
35-2051	AAA6526	9–10	Selenium	<4
35-2051	AAA6526	9–10	Thorium	19
35-2051	AAA6526	9–10	Titanium	710
35-2051	AAA6526	9–10	Uranium	<8
35-2051	AAA6526	9–10	Zinc	42
35-2052	AAA6531	14–15	Arsenic	<4
35-2052	AAA6531	14–15	Barium	108
35-2052	AAA6531	14–15	Calcium	1600
35-2052	AAA6531	14–15	Cadmium	<3
35-2052	AAA6531	14–15	Chromium	<12
35-2052	AAA6531	14–15	Copper	<8
35-2052	AAA6531	14–15	Iron	9000
35-2052	AAA6531	14–15	Mercury	<5
35-2052	AAA6531	14–15	Potassium	34500
35-2052	AAA6531	14–15	Manganese	255
35-2052	AAA6531	14–15	Nickel	<13
35-2052	AAA6531	14–15	Lead	16
35-2052	AAA6531	14–15	Antimony	<4
35-2052	AAA6531	14–15	Selenium	<4
35-2052	AAA6531	14–15	Thorium	14
35-2052	AAA6531	14–15	Titanium	560

TABLE A-6 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(c)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2052	AAA6531	14–15	Uranium	<8
35-2052	AAA6531	14–15	Zinc	48
35-2052	AAA6532	18.8–20	Arsenic	<4
35-2052	AAA6532	18.8–20	Barium	115
35-2052	AAA6532	18.8–20	Calcium	2300
35-2052	AAA6532	18.8–20	Cadmium	<3
35-2052	AAA6532	18.8–20	Chromium	<12
35-2052	AAA6532	18.8–20	Copper	<8
35-2052	AAA6532	18.8–20	Iron	9300
35-2052	AAA6532	18.8–20	Mercury	<5
35-2052	AAA6532	18.8–20	Potassium	35000
35-2052	AAA6532	18.8–20	Manganese	318
35-2052	AAA6532	18.8–20	Nickel	<13
35-2052	AAA6532	18.8–20	Lead	16
35-2052	AAA6532	18.8–20	Antimony	<4
35-2052	AAA6532	18.8–20	Selenium	<4
35-2052	AAA6532	18.8–20	Thorium	20
35-2052	AAA6532	18.8–20	Titanium	602
35-2052	AAA6532	18.8–20	Uranium	9
35-2052	AAA6532	18.8–20	Zinc	68
35-2052	AAA6532	18.8–20	Arsenic	<4
35-2052	AAA6532	18.8–20	Barium	124
35-2052	AAA6532	18.8–20	Calcium	2400
35-2052	AAA6532	18.8–20	Cadmium	<3
35-2052	AAA6532	18.8–20	Chromium	<12
35-2052	AAA6532	18.8–20	Copper	9
35-2052	AAA6532	18.8–20	Iron	9200
35-2052	AAA6532	18.8–20	Mercury	<5
35-2052	AAA6532	18.8–20	Potassium	35900
35-2052	AAA6532	18.8–20	Manganese	301
35-2052	AAA6532	18.8–20	Nickel	<13
35-2052	AAA6532	18.8–20	Lead	18
35-2052	AAA6532	18.8–20	Antimony	<4
35-2052	AAA6532	18.8–20	Selenium	<4
35-2052	AAA6532	18.8–20	Thorium	18
35-2052	AAA6532	18.8–20	Titanium	584
35-2052	AAA6532	18.8–20	Uranium	12
35-2052	AAA6532	18.8–20	Zinc	57
35-2052	AAA6529	4–5	Arsenic	<4
35-2052	AAA6529	4–5	Barium	161
35-2052	AAA6529	4–5	Calcium	3000
35-2052	AAA6529	4–5	Cadmium	<3
35-2052	AAA6529	4–5	Chromium	<12
35-2052	AAA6529	4–5	Copper	<8
35-2052	AAA6529	4–5	Iron	12000
35-2052	AAA6529	4–5	Mercury	<5
35-2052	AAA6529	4–5	Potassium	34200
35-2052	AAA6529	4–5	Manganese	338
35-2052	AAA6529	4–5	Nickel	<13

TABLE A-6 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(c)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2052	AAA6529	4–5	Lead	15
35-2052	AAA6529	4–5	Antimony	<4
35-2052	AAA6529	4–5	Selenium	<4
35-2052	AAA6529	4–5	Thorium	14
35-2052	AAA6529	4–5	Titanium	792
35-2052	AAA6529	4–5	Uranium	<8
35-2052	AAA6529	4–5	Zinc	57
35-2052	AAA6530	9–10	Arsenic	<4
35-2052	AAA6530	9–10	Barium	145
35-2052	AAA6530	9–10	Calcium	1900
35-2052	AAA6530	9–10	Cadmium	<3
35-2052	AAA6530	9–10	Chromium	<12
35-2052	AAA6530	9–10	Copper	13
35-2052	AAA6530	9–10	Iron	9300
35-2052	AAA6530	9–10	Mercury	<5
35-2052	AAA6530	9–10	Potassium	34300
35-2052	AAA6530	9–10	Manganese	174
35-2052	AAA6530	9–10	Nickel	<13
35-2052	AAA6530	9–10	Lead	19
35-2052	AAA6530	9–10	Antimony	<4
35-2052	AAA6530	9–10	Selenium	<4
35-2052	AAA6530	9–10	Thorium	16
35-2052	AAA6530	9–10	Titanium	757
35-2052	AAA6530	9–10	Uranium	<8
35-2052	AAA6530	9–10	Zinc	40
35-2053	AAA6511	14–15	Arsenic	<4
35-2053	AAA6511	14–15	Barium	113
35-2053	AAA6511	14–15	Calcium	2100
35-2053	AAA6511	14–15	Cadmium	<3
35-2053	AAA6511	14–15	Chromium	<12
35-2053	AAA6511	14–15	Copper	15
35-2053	AAA6511	14–15	Iron	12800
35-2053	AAA6511	14–15	Mercury	<5
35-2053	AAA6511	14–15	Potassium	33000
35-2053	AAA6511	14–15	Manganese	370
35-2053	AAA6511	14–15	Nickel	<13
35-2053	AAA6511	14–15	Lead	17
35-2053	AAA6511	14–15	Antimony	<4
35-2053	AAA6511	14–15	Selenium	<4
35-2053	AAA6511	14–15	Thorium	18
35-2053	AAA6511	14–15	Titanium	785
35-2053	AAA6511	14–15	Uranium	<8
35-2053	AAA6511	14–15	Zinc	50
35-2053	AAA6512	17.5–18.5	Arsenic	<4
35-2053	AAA6512	17.5–18.5	Barium	109
35-2053	AAA6512	17.5–18.5	Calcium	2400
35-2053	AAA6512	17.5–18.5	Cadmium	<3
35-2053	AAA6512	17.5–18.5	Chromium	<12
35-2053	AAA6512	17.5–18.5	Copper	<8

TABLE A-6 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(c)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2053	AAA6512	17.5–18.5	Iron	12500
35-2053	AAA6512	17.5–18.5	Mercury	<5
35-2053	AAA6512	17.5–18.5	Potassium	33300
35-2053	AAA6512	17.5–18.5	Manganese	421
35-2053	AAA6512	17.5–18.5	Nickel	<13
35-2053	AAA6512	17.5–18.5	Lead	26
35-2053	AAA6512	17.5–18.5	Antimony	<4
35-2053	AAA6512	17.5–18.5	Selenium	<4
35-2053	AAA6512	17.5–18.5	Thorium	26
35-2053	AAA6512	17.5–18.5	Titanium	709
35-2053	AAA6512	17.5–18.5	Uranium	12
35-2053	AAA6512	17.5–18.5	Zinc	72
35-2053	AAA6508	3–4	Arsenic	<4
35-2053	AAA6508	3–4	Barium	226
35-2053	AAA6508	3–4	Calcium	3100
35-2053	AAA6508	3–4	Cadmium	<3
35-2053	AAA6508	3–4	Chromium	<12
35-2053	AAA6508	3–4	Copper	<8
35-2053	AAA6508	3–4	Iron	13700
35-2053	AAA6508	3–4	Mercury	<5
35-2053	AAA6508	3–4	Potassium	32500
35-2053	AAA6508	3–4	Manganese	411
35-2053	AAA6508	3–4	Nickel	<13
35-2053	AAA6508	3–4	Lead	21
35-2053	AAA6508	3–4	Antimony	<4
35-2053	AAA6508	3–4	Selenium	<4
35-2053	AAA6508	3–4	Thorium	9
35-2053	AAA6508	3–4	Titanium	1220
35-2053	AAA6508	3–4	Uranium	<8
35-2053	AAA6508	3–4	Zinc	46
35-2053	AAA6508	3–4	Arsenic	<4
35-2053	AAA6508	3–4	Barium	209
35-2053	AAA6508	3–4	Calcium	2600
35-2053	AAA6508	3–4	Cadmium	<3
35-2053	AAA6508	3–4	Chromium	<12
35-2053	AAA6508	3–4	Copper	<8
35-2053	AAA6508	3–4	Iron	13100
35-2053	AAA6508	3–4	Mercury	<5
35-2053	AAA6508	3–4	Potassium	32700
35-2053	AAA6508	3–4	Manganese	412
35-2053	AAA6508	3–4	Nickel	<13
35-2053	AAA6508	3–4	Lead	21
35-2053	AAA6508	3–4	Antimony	<4
35-2053	AAA6508	3–4	Selenium	<4
35-2053	AAA6508	3–4	Thorium	17
35-2053	AAA6508	3–4	Titanium	1070
35-2053	AAA6508	3–4	Uranium	<8
35-2053	AAA6508	3–4	Zinc	42
35-2053	AAA6510	9–10	Arsenic	<4

TABLE A-6 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(c)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2053	AAA6510	9–10	Barium	104
35-2053	AAA6510	9–10	Calcium	1600
35-2053	AAA6510	9–10	Cadmium	<3
35-2053	AAA6510	9–10	Chromium	<12
35-2053	AAA6510	9–10	Copper	<8
35-2053	AAA6510	9–10	Iron	9800
35-2053	AAA6510	9–10	Mercury	<5
35-2053	AAA6510	9–10	Potassium	34200
35-2053	AAA6510	9–10	Manganese	238
35-2053	AAA6510	9–10	Nickel	<13
35-2053	AAA6510	9–10	Lead	18
35-2053	AAA6510	9–10	Antimony	<4
35-2053	AAA6510	9–10	Selenium	<4
35-2053	AAA6510	9–10	Thorium	18
35-2053	AAA6510	9–10	Titanium	567
35-2053	AAA6510	9–10	Uranium	<8
35-2053	AAA6510	9–10	Zinc	48
35-2054	AAA6515	14–15	Arsenic	<4
35-2054	AAA6515	14–15	Barium	119
35-2054	AAA6515	14–15	Calcium	2400
35-2054	AAA6515	14–15	Cadmium	<3
35-2054	AAA6515	14–15	Chromium	<12
35-2054	AAA6515	14–15	Copper	<8
35-2054	AAA6515	14–15	Iron	9400
35-2054	AAA6515	14–15	Mercury	<5
35-2054	AAA6515	14–15	Potassium	33800
35-2054	AAA6515	14–15	Manganese	258
35-2054	AAA6515	14–15	Nickel	<13
35-2054	AAA6515	14–15	Lead	22
35-2054	AAA6515	14–15	Antimony	<4
35-2054	AAA6515	14–15	Selenium	<4
35-2054	AAA6515	14–15	Thorium	20
35-2054	AAA6515	14–15	Titanium	562
35-2054	AAA6515	14–15	Uranium	<8
35-2054	AAA6515	14–15	Zinc	47
35-2054	AAA6516	19–20	Arsenic	<4
35-2054	AAA6516	19–20	Barium	130
35-2054	AAA6516	19–20	Calcium	2100
35-2054	AAA6516	19–20	Cadmium	<3
35-2054	AAA6516	19–20	Chromium	<12
35-2054	AAA6516	19–20	Copper	<8
35-2054	AAA6516	19–20	Iron	10300
35-2054	AAA6516	19–20	Mercury	<5
35-2054	AAA6516	19–20	Potassium	33800
35-2054	AAA6516	19–20	Manganese	409
35-2054	AAA6516	19–20	Nickel	<13
35-2054	AAA6516	19–20	Lead	19
35-2054	AAA6516	19–20	Antimony	<4
35-2054	AAA6516	19–20	Selenium	<4

TABLE A-6 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(c)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2054	AAA6516	19–20	Thorium	16
35-2054	AAA6516	19–20	Titanium	607
35-2054	AAA6516	19–20	Uranium	<8
35-2054	AAA6516	19–20	Zinc	45
35-2054	AAA6513	4–5	Arsenic	<4
35-2054	AAA6513	4–5	Barium	248
35-2054	AAA6513	4–5	Calcium	4000
35-2054	AAA6513	4–5	Cadmium	<3
35-2054	AAA6513	4–5	Chromium	<12
35-2054	AAA6513	4–5	Copper	<8
35-2054	AAA6513	4–5	Iron	13700
35-2054	AAA6513	4–5	Mercury	<5
35-2054	AAA6513	4–5	Potassium	29900
35-2054	AAA6513	4–5	Manganese	376
35-2054	AAA6513	4–5	Nickel	<13
35-2054	AAA6513	4–5	Lead	31
35-2054	AAA6513	4–5	Antimony	<4
35-2054	AAA6513	4–5	Selenium	<4
35-2054	AAA6513	4–5	Thorium	17
35-2054	AAA6513	4–5	Titanium	1320
35-2054	AAA6513	4–5	Uranium	<8
35-2054	AAA6513	4–5	Zinc	49
35-2054	AAA6514	8–9	Arsenic	<4
35-2054	AAA6514	8–9	Barium	167
35-2054	AAA6514	8–9	Calcium	2400
35-2054	AAA6514	8–9	Cadmium	<3
35-2054	AAA6514	8–9	Chromium	<12
35-2054	AAA6514	8–9	Copper	<8
35-2054	AAA6514	8–9	Iron	11800
35-2054	AAA6514	8–9	Mercury	<5
35-2054	AAA6514	8–9	Potassium	32300
35-2054	AAA6514	8–9	Manganese	259
35-2054	AAA6514	8–9	Nickel	<13
35-2054	AAA6514	8–9	Lead	28
35-2054	AAA6514	8–9	Antimony	<4
35-2054	AAA6514	8–9	Selenium	<4
35-2054	AAA6514	8–9	Thorium	18
35-2054	AAA6514	8–9	Titanium	936
35-2054	AAA6514	8–9	Uranium	<8
35-2054	AAA6514	8–9	Zinc	56
35-2055	AAA6482	14–15	Arsenic	<4
35-2055	AAA6482	14–15	Barium	110
35-2055	AAA6482	14–15	Calcium	1700
35-2055	AAA6482	14–15	Cadmium	<3
35-2055	AAA6482	14–15	Chromium	<12
35-2055	AAA6482	14–15	Copper	<8
35-2055	AAA6482	14–15	Iron	9200
35-2055	AAA6482	14–15	Mercury	<5
35-2055	AAA6482	14–15	Potassium	33500

TABLE A-6 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(c)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2055	AAA6482	14–15	Manganese	372
35-2055	AAA6482	14–15	Nickel	<13
35-2055	AAA6482	14–15	Lead	14
35-2055	AAA6482	14–15	Antimony	<4
35-2055	AAA6482	14–15	Selenium	<4
35-2055	AAA6482	14–15	Thorium	19
35-2055	AAA6482	14–15	Titanium	567
35-2055	AAA6482	14–15	Uranium	<8
35-2055	AAA6482	14–15	Zinc	31
35-2055	AAA6483	19–20	Arsenic	<4
35-2055	AAA6483	19–20	Barium	125
35-2055	AAA6483	19–20	Calcium	2200
35-2055	AAA6483	19–20	Cadmium	<3
35-2055	AAA6483	19–20	Chromium	<12
35-2055	AAA6483	19–20	Copper	<8
35-2055	AAA6483	19–20	Iron	9400
35-2055	AAA6483	19–20	Mercury	<5
35-2055	AAA6483	19–20	Potassium	33600
35-2055	AAA6483	19–20	Manganese	354
35-2055	AAA6483	19–20	Nickel	<13
35-2055	AAA6483	19–20	Lead	14
35-2055	AAA6483	19–20	Antimony	<4
35-2055	AAA6483	19–20	Selenium	<4
35-2055	AAA6483	19–20	Thorium	19
35-2055	AAA6483	19–20	Titanium	562
35-2055	AAA6483	19–20	Uranium	<8
35-2055	AAA6483	19–20	Zinc	43
35-2055	AAA6480	4–5	Arsenic	<4
35-2055	AAA6480	4–5	Barium	284
35-2055	AAA6480	4–5	Calcium	4700
35-2055	AAA6480	4–5	Cadmium	<3
35-2055	AAA6480	4–5	Chromium	<12
35-2055	AAA6480	4–5	Copper	<8
35-2055	AAA6480	4–5	Iron	13400
35-2055	AAA6480	4–5	Mercury	<5
35-2055	AAA6480	4–5	Potassium	29000
35-2055	AAA6480	4–5	Manganese	320
35-2055	AAA6480	4–5	Nickel	<13
35-2055	AAA6480	4–5	Lead	26
35-2055	AAA6480	4–5	Antimony	<4
35-2055	AAA6480	4–5	Selenium	<4
35-2055	AAA6480	4–5	Thorium	17
35-2055	AAA6480	4–5	Titanium	1770
35-2055	AAA6480	4–5	Uranium	<8
35-2055	AAA6480	4–5	Zinc	32
35-2055	AAA6481	9–10	Arsenic	<4
35-2055	AAA6481	9–10	Barium	124
35-2055	AAA6481	9–10	Calcium	2200
35-2055	AAA6481	9–10	Cadmium	<3

TABLE A-6 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(c)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2055	AAA6481	9–10	Chromium	<12
35-2055	AAA6481	9–10	Copper	<8
35-2055	AAA6481	9–10	Iron	9000
35-2055	AAA6481	9–10	Mercury	<5
35-2055	AAA6481	9–10	Potassium	33800
35-2055	AAA6481	9–10	Manganese	362
35-2055	AAA6481	9–10	Nickel	<13
35-2055	AAA6481	9–10	Lead	9
35-2055	AAA6481	9–10	Antimony	<4
35-2055	AAA6481	9–10	Selenium	<4
35-2055	AAA6481	9–10	Thorium	10
35-2055	AAA6481	9–10	Titanium	588
35-2055	AAA6481	9–10	Uranium	10
35-2055	AAA6481	9–10	Zinc	55
35-2056	AAA6486	13–14	Arsenic	<4
35-2056	AAA6486	13–14	Barium	131
35-2056	AAA6486	13–14	Calcium	2400
35-2056	AAA6486	13–14	Cadmium	<3
35-2056	AAA6486	13–14	Chromium	<12
35-2056	AAA6486	13–14	Copper	<8
35-2056	AAA6486	13–14	Iron	13300
35-2056	AAA6486	13–14	Mercury	<5
35-2056	AAA6486	13–14	Potassium	31200
35-2056	AAA6486	13–14	Manganese	627
35-2056	AAA6486	13–14	Nickel	<13
35-2056	AAA6486	13–14	Lead	18
35-2056	AAA6486	13–14	Antimony	<4
35-2056	AAA6486	13–14	Selenium	<4
35-2056	AAA6486	13–14	Thorium	13
35-2056	AAA6486	13–14	Titanium	740
35-2056	AAA6486	13–14	Uranium	<8
35-2056	AAA6486	13–14	Zinc	50
35-2056	AAA6487	19–20	Antimony	<4
35-2056	AAA6487	19–20	Arsenic	<4
35-2056	AAA6487	19–20	Barium	131
35-2056	AAA6487	19–20	Cadmium	<3
35-2056	AAA6487	19–20	Calcium	1900
35-2056	AAA6487	19–20	Chromium	<12
35-2056	AAA6487	19–20	Copper	<8
35-2056	AAA6487	19–20	Iron	12000
35-2056	AAA6487	19–20	Lead	19
35-2056	AAA6487	19–20	Manganese	505
35-2056	AAA6487	19–20	Mercury	<5
35-2056	AAA6487	19–20	Nickel	<13
35-2056	AAA6487	19–20	Potassium	32400
35-2056	AAA6487	19–20	Selenium	<4
35-2056	AAA6487	19–20	Thorium	23
35-2056	AAA6487	19–20	Titanium	689
35-2056	AAA6487	19–20	Uranium	<8

TABLE A-6 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(c)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2056	AAA6487	19–20	Zinc	52
35-2056	AAA6484	4–5	Arsenic	<4
35-2056	AAA6484	4–5	Barium	378
35-2056	AAA6484	4–5	Calcium	4300
35-2056	AAA6484	4–5	Cadmium	<3
35-2056	AAA6484	4–5	Chromium	26
35-2056	AAA6484	4–5	Copper	<8
35-2056	AAA6484	4–5	Iron	17200
35-2056	AAA6484	4–5	Mercury	<5
35-2056	AAA6484	4–5	Potassium	29200
35-2056	AAA6484	4–5	Manganese	384
35-2056	AAA6484	4–5	Nickel	<13
35-2056	AAA6484	4–5	Lead	25
35-2056	AAA6484	4–5	Antimony	<4
35-2056	AAA6484	4–5	Selenium	<4
35-2056	AAA6484	4–5	Thorium	17
35-2056	AAA6484	4–5	Titanium	2270
35-2056	AAA6484	4–5	Uranium	<8
35-2056	AAA6484	4–5	Zinc	37
35-2056	AAA6485	6–7	Arsenic	<4
35-2056	AAA6485	6–7	Barium	433
35-2056	AAA6485	6–7	Calcium	7500
35-2056	AAA6485	6–7	Cadmium	<3
35-2056	AAA6485	6–7	Chromium	14
35-2056	AAA6485	6–7	Copper	<8
35-2056	AAA6485	6–7	Iron	18000
35-2056	AAA6485	6–7	Mercury	<5
35-2056	AAA6485	6–7	Potassium	25400
35-2056	AAA6485	6–7	Manganese	748
35-2056	AAA6485	6–7	Nickel	<13
35-2056	AAA6485	6–7	Lead	90
35-2056	AAA6485	6–7	Antimony	<4
35-2056	AAA6485	6–7	Selenium	<4
35-2056	AAA6485	6–7	Thorium	18
35-2056	AAA6485	6–7	Titanium	2790
35-2056	AAA6485	6–7	Uranium	<8
35-2056	AAA6485	6–7	Zinc	64
35-2227	AAA6524		Arsenic	<4
35-2227	AAA6524		Arsenic	<4000
35-2227	AAA6524		Barium	<10
35-2227	AAA6524		Barium	<10000
35-2227	AAA6524		Calcium	<100
35-2227	AAA6524		Calcium	<100000
35-2227	AAA6524		Cadmium	<3
35-2227	AAA6524		Cadmium	<3000
35-2227	AAA6524		Chromium	<12
35-2227	AAA6524		Chromium	<12000
35-2227	AAA6524		Copper	<8
35-2227	AAA6524		Copper	<8000

TABLE A-6 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(c)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2227	AAA6524		Iron	14
35-2227	AAA6524		Iron	14000
35-2227	AAA6524		Mercury	<5
35-2227	AAA6524		Mercury	<5000
35-2227	AAA6524		Potassium	<100
35-2227	AAA6524		Potassium	<100000
35-2227	AAA6524		Manganese	<16
35-2227	AAA6524		Manganese	<16000
35-2227	AAA6524		Nickel	<13
35-2227	AAA6524		Nickel	<13000
35-2227	AAA6524		Lead	<7
35-2227	AAA6524		Lead	<7000
35-2227	AAA6524		Antimony	<4
35-2227	AAA6524		Antimony	<4000
35-2227	AAA6524		Selenium	<4
35-2227	AAA6524		Selenium	<4000
35-2227	AAA6524		Thorium	<8
35-2227	AAA6524		Thorium	<8000
35-2227	AAA6524		Titanium	<30
35-2227	AAA6524		Titanium	<30000
35-2227	AAA6524		Uranium	<8
35-2227	AAA6524		Uranium	<8000
35-2227	AAA6524		Zinc	<5
35-2227	AAA6524		Zinc	<5000

TABLE A-7

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(d)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2059	AAA6504	1–2	Arsenic	<4
35-2059	AAA6504	1–2	Barium	130
35-2059	AAA6504	1–2	Calcium	2600
35-2059	AAA6504	1–2	Cadmium	<3
35-2059	AAA6504	1–2	Chromium	<12
35-2059	AAA6504	1–2	Copper	<8
35-2059	AAA6504	1–2	Iron	12400
35-2059	AAA6504	1–2	Mercury	<5
35-2059	AAA6504	1–2	Potassium	33400
35-2059	AAA6504	1–2	Manganese	458
35-2059	AAA6504	1–2	Nickel	<13
35-2059	AAA6504	1–2	Lead	17
35-2059	AAA6504	1–2	Antimony	<4
35-2059	AAA6504	1–2	Selenium	<4
35-2059	AAA6504	1–2	Thorium	21
35-2059	AAA6504	1–2	Titanium	780
35-2059	AAA6504	1–2	Uranium	<8
35-2059	AAA6504	1–2	Zinc	48
35-2059	AAA6517	7.5–8.5	Arsenic	<4
35-2059	AAA6517	7.5–8.5	Barium	262
35-2059	AAA6517	7.5–8.5	Calcium	4000
35-2059	AAA6517	7.5–8.5	Cadmium	<3
35-2059	AAA6517	7.5–8.5	Chromium	<12
35-2059	AAA6517	7.5–8.5	Copper	<8
35-2059	AAA6517	7.5–8.5	Iron	12100
35-2059	AAA6517	7.5–8.5	Mercury	<5
35-2059	AAA6517	7.5–8.5	Potassium	31600
35-2059	AAA6517	7.5–8.5	Manganese	409
35-2059	AAA6517	7.5–8.5	Nickel	<13
35-2059	AAA6517	7.5–8.5	Lead	22
35-2059	AAA6517	7.5–8.5	Antimony	<4
35-2059	AAA6517	7.5–8.5	Selenium	<4
35-2059	AAA6517	7.5–8.5	Thorium	12
35-2059	AAA6517	7.5–8.5	Titanium	1000
35-2059	AAA6517	7.5–8.5	Uranium	<8
35-2059	AAA6517	7.5–8.5	Zinc	80
35-2059	AAA6518	14–15	Arsenic	<4
35-2059	AAA6518	14–15	Barium	92
35-2059	AAA6518	14–15	Calcium	2500
35-2059	AAA6518	14–15	Cadmium	<3
35-2059	AAA6518	14–15	Chromium	<12
35-2059	AAA6518	14–15	Copper	<8
35-2059	AAA6518	14–15	Iron	14400
35-2059	AAA6518	14–15	Mercury	<5
35-2059	AAA6518	14–15	Potassium	32800
35-2059	AAA6518	14–15	Manganese	422
35-2059	AAA6518	14–15	Nickel	<13
35-2059	AAA6518	14–15	Lead	14

TABLE A-7 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(d)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2059	AAA6518	14–15	Antimony	<4
35-2059	AAA6518	14–15	Selenium	<4
35-2059	AAA6518	14–15	Thorium	22
35-2059	AAA6518	14–15	Titanium	915
35-2059	AAA6518	14–15	Uranium	10
35-2059	AAA6518	14–15	Zinc	56
35-2059	AAA6519	17.5–18.5	Arsenic	<4
35-2059	AAA6519	17.5–18.5	Barium	151
35-2059	AAA6519	17.5–18.5	Calcium	3300
35-2059	AAA6519	17.5–18.5	Cadmium	<3
35-2059	AAA6519	17.5–18.5	Chromium	<12
35-2059	AAA6519	17.5–18.5	Copper	10
35-2059	AAA6519	17.5–18.5	Iron	18200
35-2059	AAA6519	17.5–18.5	Mercury	<5
35-2059	AAA6519	17.5–18.5	Potassium	30400
35-2059	AAA6519	17.5–18.5	Manganese	466
35-2059	AAA6519	17.5–18.5	Nickel	<13
35-2059	AAA6519	17.5–18.5	Lead	23
35-2059	AAA6519	17.5–18.5	Antimony	<4
35-2059	AAA6519	17.5–18.5	Selenium	<4
35-2059	AAA6519	17.5–18.5	Thorium	21
35-2059	AAA6519	17.5–18.5	Titanium	1070
35-2059	AAA6519	17.5–18.5	Uranium	<8
35-2059	AAA6519	17.5–18.5	Zinc	55
35-2060	AAA6520	4–5	Arsenic	<4
35-2060	AAA6520	4–5	Barium	901
35-2060	AAA6520	4–5	Calcium	9400
35-2060	AAA6520	4–5	Cadmium	<3
35-2060	AAA6520	4–5	Chromium	31
35-2060	AAA6520	4–5	Copper	27
35-2060	AAA6520	4–5	Iron	19800
35-2060	AAA6520	4–5	Mercury	<5
35-2060	AAA6520	4–5	Potassium	31200
35-2060	AAA6520	4–5	Manganese	527
35-2060	AAA6520	4–5	Nickel	<13
35-2060	AAA6520	4–5	Lead	40
35-2060	AAA6520	4–5	Antimony	<4
35-2060	AAA6520	4–5	Selenium	<4
35-2060	AAA6520	4–5	Thorium	12
35-2060	AAA6520	4–5	Titanium	2340
35-2060	AAA6520	4–5	Uranium	<8
35-2060	AAA6520	4–5	Zinc	129
35-2060	AAA6534	7.5–8.5	Arsenic	<4
35-2060	AAA6534	7.5–8.5	Barium	222
35-2060	AAA6534	7.5–8.5	Calcium	3300
35-2060	AAA6534	7.5–8.5	Cadmium	<3
35-2060	AAA6534	7.5–8.5	Chromium	<12
35-2060	AAA6534	7.5–8.5	Copper	<8
35-2060	AAA6534	7.5–8.5	Iron	11800

TABLE A-7 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(d)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2060	AAA6534	7.5–8.5	Mercury	<5
35-2060	AAA6534	7.5–8.5	Potassium	33000
35-2060	AAA6534	7.5–8.5	Manganese	378
35-2060	AAA6534	7.5–8.5	Nickel	<13
35-2060	AAA6534	7.5–8.5	Lead	18
35-2060	AAA6534	7.5–8.5	Antimony	<4
35-2060	AAA6534	7.5–8.5	Selenium	<4
35-2060	AAA6534	7.5–8.5	Thorium	24
35-2060	AAA6534	7.5–8.5	Titanium	818
35-2060	AAA6534	7.5–8.5	Uranium	<8
35-2060	AAA6534	7.5–8.5	Zinc	91
35-2060	AAA6535	14–15	Arsenic	<4
35-2060	AAA6535	14–15	Barium	100
35-2060	AAA6535	14–15	Calcium	2100
35-2060	AAA6535	14–15	Cadmium	<3
35-2060	AAA6535	14–15	Chromium	<12
35-2060	AAA6535	14–15	Copper	<8
35-2060	AAA6535	14–15	Iron	11700
35-2060	AAA6535	14–15	Mercury	<5
35-2060	AAA6535	14–15	Potassium	35300
35-2060	AAA6535	14–15	Manganese	375
35-2060	AAA6535	14–15	Nickel	<13
35-2060	AAA6535	14–15	Lead	19
35-2060	AAA6535	14–15	Antimony	<4
35-2060	AAA6535	14–15	Selenium	<4
35-2060	AAA6535	14–15	Thorium	23
35-2060	AAA6535	14–15	Titanium	710
35-2060	AAA6535	14–15	Uranium	<8
35-2060	AAA6535	14–15	Zinc	44
35-2060	AAA6536	17–18	Arsenic	<4
35-2060	AAA6536	17–18	Barium	128
35-2060	AAA6536	17–18	Calcium	2700
35-2060	AAA6536	17–18	Cadmium	<3
35-2060	AAA6536	17–18	Chromium	<12
35-2060	AAA6536	17–18	Copper	<8
35-2060	AAA6536	17–18	Iron	14200
35-2060	AAA6536	17–18	Mercury	<5
35-2060	AAA6536	17–18	Potassium	32900
35-2060	AAA6536	17–18	Manganese	328
35-2060	AAA6536	17–18	Nickel	<13
35-2060	AAA6536	17–18	Lead	22
35-2060	AAA6536	17–18	Antimony	<4
35-2060	AAA6536	17–18	Selenium	<4
35-2060	AAA6536	17–18	Thorium	21
35-2060	AAA6536	17–18	Titanium	806
35-2060	AAA6536	17–18	Uranium	<8
35-2060	AAA6536	17–18	Zinc	63
35-2061	AAA6547	.5–2.5	Arsenic	<4
35-2061	AAA6547	.5–2.5	Barium	104

TABLE A-7 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(d)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2061	AAA6547	.5–2.5	Calcium	2800
35-2061	AAA6547	.5–2.5	Cadmium	<3
35-2061	AAA6547	.5–2.5	Chromium	<12
35-2061	AAA6547	.5–2.5	Copper	<8
35-2061	AAA6547	.5–2.5	Iron	12500
35-2061	AAA6547	.5–2.5	Mercury	<5
35-2061	AAA6547	.5–2.5	Potassium	33900
35-2061	AAA6547	.5–2.5	Manganese	436
35-2061	AAA6547	.5–2.5	Nickel	<13
35-2061	AAA6547	.5–2.5	Lead	19
35-2061	AAA6547	.5–2.5	Antimony	<4
35-2061	AAA6547	.5–2.5	Selenium	<4
35-2061	AAA6547	.5–2.5	Thorium	16
35-2061	AAA6547	.5–2.5	Titanium	790
35-2061	AAA6547	.5–2.5	Uranium	<8
35-2061	AAA6547	.5–2.5	Zinc	41
35-2061	AAA6548	7.5–8.5	Arsenic	<4
35-2061	AAA6548	7.5–8.5	Barium	227
35-2061	AAA6548	7.5–8.5	Calcium	2700
35-2061	AAA6548	7.5–8.5	Cadmium	<3
35-2061	AAA6548	7.5–8.5	Chromium	<12
35-2061	AAA6548	7.5–8.5	Copper	9
35-2061	AAA6548	7.5–8.5	Iron	10600
35-2061	AAA6548	7.5–8.5	Mercury	<5
35-2061	AAA6548	7.5–8.5	Potassium	35500
35-2061	AAA6548	7.5–8.5	Manganese	363
35-2061	AAA6548	7.5–8.5	Nickel	<13
35-2061	AAA6548	7.5–8.5	Lead	18
35-2061	AAA6548	7.5–8.5	Antimony	<4
35-2061	AAA6548	7.5–8.5	Selenium	<4
35-2061	AAA6548	7.5–8.5	Thorium	21
35-2061	AAA6548	7.5–8.5	Titanium	777
35-2061	AAA6548	7.5–8.5	Uranium	9
35-2061	AAA6548	7.5–8.5	Zinc	73
35-2061	AAA6549	14–15	Arsenic	<4
35-2061	AAA6549	14–15	Barium	120
35-2061	AAA6549	14–15	Calcium	1900
35-2061	AAA6549	14–15	Cadmium	<3
35-2061	AAA6549	14–15	Chromium	<12
35-2061	AAA6549	14–15	Copper	<8
35-2061	AAA6549	14–15	Iron	10200
35-2061	AAA6549	14–15	Mercury	<5
35-2061	AAA6549	14–15	Potassium	33600
35-2061	AAA6549	14–15	Manganese	348
35-2061	AAA6549	14–15	Nickel	<13
35-2061	AAA6549	14–15	Lead	15
35-2061	AAA6549	14–15	Antimony	<4
35-2061	AAA6549	14–15	Selenium	<4
35-2061	AAA6549	14–15	Thorium	14

TABLE A-7 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(d)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2061	AAA6549	14–15	Titanium	613
35-2061	AAA6549	14–15	Uranium	<8
35-2061	AAA6549	14–15	Zinc	52
35-2061	AAA6549	14–15	Arsenic	<4
35-2061	AAA6549	14–15	Barium	123
35-2061	AAA6549	14–15	Calcium	1900
35-2061	AAA6549	14–15	Cadmium	<3
35-2061	AAA6549	14–15	Chromium	<12
35-2061	AAA6549	14–15	Copper	<8
35-2061	AAA6549	14–15	Iron	9600
35-2061	AAA6549	14–15	Mercury	<5
35-2061	AAA6549	14–15	Potassium	34300
35-2061	AAA6549	14–15	Manganese	363
35-2061	AAA6549	14–15	Nickel	<13
35-2061	AAA6549	14–15	Lead	17
35-2061	AAA6549	14–15	Antimony	<4
35-2061	AAA6549	14–15	Selenium	<4
35-2061	AAA6549	14–15	Thorium	19
35-2061	AAA6549	14–15	Titanium	570
35-2061	AAA6549	14–15	Uranium	<8
35-2061	AAA6549	14–15	Zinc	50
35-2061	AAA6551	17–18	Arsenic	<4
35-2061	AAA6551	17–18	Barium	109
35-2061	AAA6551	17–18	Calcium	1900
35-2061	AAA6551	17–18	Cadmium	<3
35-2061	AAA6551	17–18	Chromium	<12
35-2061	AAA6551	17–18	Copper	<8
35-2061	AAA6551	17–18	Iron	9500
35-2061	AAA6551	17–18	Mercury	<5
35-2061	AAA6551	17–18	Potassium	34300
35-2061	AAA6551	17–18	Manganese	371
35-2061	AAA6551	17–18	Nickel	<13
35-2061	AAA6551	17–18	Lead	16
35-2061	AAA6551	17–18	Antimony	<4
35-2061	AAA6551	17–18	Selenium	<4
35-2061	AAA6551	17–18	Thorium	14
35-2061	AAA6551	17–18	Titanium	555
35-2061	AAA6551	17–18	Uranium	<8
35-2061	AAA6551	17–18	Zinc	49
35-2062	AAA6552	1–2.5	Arsenic	<4
35-2062	AAA6552	1–2.5	Barium	125
35-2062	AAA6552	1–2.5	Calcium	3100
35-2062	AAA6552	1–2.5	Cadmium	<3
35-2062	AAA6552	1–2.5	Chromium	<12
35-2062	AAA6552	1–2.5	Copper	<8
35-2062	AAA6552	1–2.5	Iron	11400
35-2062	AAA6552	1–2.5	Mercury	<5
35-2062	AAA6552	1–2.5	Potassium	34800
35-2062	AAA6552	1–2.5	Manganese	372

TABLE A-7 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(d)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2062	AAA6552	1–2.5	Nickel	<13
35-2062	AAA6552	1–2.5	Lead	20
35-2062	AAA6552	1–2.5	Antimony	<4
35-2062	AAA6552	1–2.5	Selenium	<4
35-2062	AAA6552	1–2.5	Thorium	21
35-2062	AAA6552	1–2.5	Titanium	778
35-2062	AAA6552	1–2.5	Uranium	<8
35-2062	AAA6552	1–2.5	Zinc	44
35-2062	AAA6553	9–10	Arsenic	<4
35-2062	AAA6553	9–10	Barium	175
35-2062	AAA6553	9–10	Calcium	2600
35-2062	AAA6553	9–10	Cadmium	<3
35-2062	AAA6553	9–10	Chromium	<12
35-2062	AAA6553	9–10	Copper	<8
35-2062	AAA6553	9–10	Iron	10900
35-2062	AAA6553	9–10	Mercury	<5
35-2062	AAA6553	9–10	Potassium	34400
35-2062	AAA6553	9–10	Manganese	356
35-2062	AAA6553	9–10	Nickel	<13
35-2062	AAA6553	9–10	Lead	19
35-2062	AAA6553	9–10	Antimony	<4
35-2062	AAA6553	9–10	Selenium	<4
35-2062	AAA6553	9–10	Thorium	16
35-2062	AAA6553	9–10	Titanium	683
35-2062	AAA6553	9–10	Uranium	<8
35-2062	AAA6553	9–10	Zinc	57
35-2062	AAA6554	14–15	Arsenic	<4
35-2062	AAA6554	14–15	Barium	126
35-2062	AAA6554	14–15	Calcium	2000
35-2062	AAA6554	14–15	Cadmium	<3
35-2062	AAA6554	14–15	Chromium	<12
35-2062	AAA6554	14–15	Copper	<8
35-2062	AAA6554	14–15	Iron	10000
35-2062	AAA6554	14–15	Mercury	<5
35-2062	AAA6554	14–15	Potassium	34600
35-2062	AAA6554	14–15	Manganese	354
35-2062	AAA6554	14–15	Nickel	<13
35-2062	AAA6554	14–15	Lead	16
35-2062	AAA6554	14–15	Antimony	<4
35-2062	AAA6554	14–15	Selenium	<4
35-2062	AAA6554	14–15	Thorium	15
35-2062	AAA6554	14–15	Titanium	583
35-2062	AAA6554	14–15	Uranium	<8
35-2062	AAA6554	14–15	Zinc	50
35-2062	AAA6555	19–20	Arsenic	<4
35-2062	AAA6555	19–20	Barium	133
35-2062	AAA6555	19–20	Calcium	2000
35-2062	AAA6555	19–20	Cadmium	<3
35-2062	AAA6555	19–20	Chromium	<12

TABLE A-7 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(d)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2062	AAA6555	19–20	Copper	12
35-2062	AAA6555	19–20	Iron	10200
35-2062	AAA6555	19–20	Mercury	<5
35-2062	AAA6555	19–20	Potassium	34500
35-2062	AAA6555	19–20	Manganese	355
35-2062	AAA6555	19–20	Nickel	<13
35-2062	AAA6555	19–20	Lead	17
35-2062	AAA6555	19–20	Antimony	<4
35-2062	AAA6555	19–20	Selenium	<4
35-2062	AAA6555	19–20	Thorium	13
35-2062	AAA6555	19–20	Titanium	600
35-2062	AAA6555	19–20	Uranium	<8
35-2062	AAA6555	19–20	Zinc	48
35-2057	AAA6564	5–8	Arsenic	5
35-2057	AAA6564	5–8	Barium	204
35-2057	AAA6564	5–8	Calcium	3700
35-2057	AAA6564	5–8	Cadmium	<3
35-2057	AAA6564	5–8	Chromium	37
35-2057	AAA6564	5–8	Copper	<8
35-2057	AAA6564	5–8	Iron	19900
35-2057	AAA6564	5–8	Mercury	<5
35-2057	AAA6564	5–8	Potassium	27900
35-2057	AAA6564	5–8	Manganese	310
35-2057	AAA6564	5–8	Nickel	<13
35-2057	AAA6564	5–8	Lead	18
35-2057	AAA6564	5–8	Antimony	<4
35-2057	AAA6564	5–8	Selenium	<4
35-2057	AAA6564	5–8	Thorium	22
35-2057	AAA6564	5–8	Titanium	1660
35-2057	AAA6564	5–8	Uranium	<8
35-2057	AAA6564	5–8	Zinc	55
35-2057	AAA6565	8–10	Arsenic	<4
35-2057	AAA6565	8–10	Barium	196
35-2057	AAA6565	8–10	Calcium	4500
35-2057	AAA6565	8–10	Cadmium	<3
35-2057	AAA6565	8–10	Chromium	20
35-2057	AAA6565	8–10	Copper	<8
35-2057	AAA6565	8–10	Iron	16300
35-2057	AAA6565	8–10	Mercury	<5
35-2057	AAA6565	8–10	Potassium	30600
35-2057	AAA6565	8–10	Manganese	304
35-2057	AAA6565	8–10	Nickel	<13
35-2057	AAA6565	8–10	Lead	16
35-2057	AAA6565	8–10	Antimony	5
35-2057	AAA6565	8–10	Selenium	<4
35-2057	AAA6565	8–10	Thorium	17
35-2057	AAA6565	8–10	Titanium	975
35-2057	AAA6565	8–10	Uranium	<8

TABLE A-7 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(d)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2057	AAA6565	8–10	Zinc	50
35-2057	AAA6566	10–15.2	Arsenic	<4
35-2057	AAA6566	10–15.2	Barium	164
35-2057	AAA6566	10–15.2	Calcium	3100
35-2057	AAA6566	10–15.2	Cadmium	<3
35-2057	AAA6566	10–15.2	Chromium	<12
35-2057	AAA6566	10–15.2	Copper	<8
35-2057	AAA6566	10–15.2	Iron	12400
35-2057	AAA6566	10–15.2	Mercury	<5
35-2057	AAA6566	10–15.2	Potassium	31200
35-2057	AAA6566	10–15.2	Manganese	318
35-2057	AAA6566	10–15.2	Nickel	<13
35-2057	AAA6566	10–15.2	Lead	14
35-2057	AAA6566	10–15.2	Antimony	<4
35-2057	AAA6566	10–15.2	Selenium	<4
35-2057	AAA6566	10–15.2	Thorium	15
35-2057	AAA6566	10–15.2	Titanium	802
35-2057	AAA6566	10–15.2	Uranium	<8
35-2057	AAA6566	10–15.2	Zinc	37
35-2058	AAA6567	5–8	Arsenic	<4
35-2058	AAA6567	5–8	Barium	116
35-2058	AAA6567	5–8	Calcium	2200
35-2058	AAA6567	5–8	Cadmium	<3
35-2058	AAA6567	5–8	Chromium	15
35-2058	AAA6567	5–8	Copper	<8
35-2058	AAA6567	5–8	Iron	9000
35-2058	AAA6567	5–8	Mercury	<5
35-2058	AAA6567	5–8	Potassium	34200
35-2058	AAA6567	5–8	Manganese	357
35-2058	AAA6567	5–8	Nickel	<13
35-2058	AAA6567	5–8	Lead	10
35-2058	AAA6567	5–8	Antimony	<4
35-2058	AAA6567	5–8	Selenium	<4
35-2058	AAA6567	5–8	Thorium	16
35-2058	AAA6567	5–8	Titanium	563
35-2058	AAA6567	5–8	Uranium	<8
35-2058	AAA6567	5–8	Zinc	33
35-2058	AAA6568	8–10	Arsenic	<4
35-2058	AAA6568	8–10	Barium	70
35-2058	AAA6568	8–10	Calcium	2200
35-2058	AAA6568	8–10	Cadmium	<3
35-2058	AAA6568	8–10	Chromium	<12
35-2058	AAA6568	8–10	Copper	<8
35-2058	AAA6568	8–10	Iron	12800
35-2058	AAA6568	8–10	Mercury	<5
35-2058	AAA6568	8–10	Potassium	33700
35-2058	AAA6568	8–10	Manganese	527
35-2058	AAA6568	8–10	Nickel	<13
35-2058	AAA6568	8–10	Lead	12

TABLE A-7 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(d)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2058	AAA6568	8–10	Antimony	<4
35-2058	AAA6568	8–10	Selenium	<4
35-2058	AAA6568	8–10	Thorium	15
35-2058	AAA6568	8–10	Titanium	703
35-2058	AAA6568	8–10	Uranium	<8
35-2058	AAA6568	8–10	Zinc	76
35-2058	AAA6569	10–18.2	Arsenic	<4
35-2058	AAA6569	10–18.2	Barium	196
35-2058	AAA6569	10–18.2	Calcium	3900
35-2058	AAA6569	10–18.2	Cadmium	<3
35-2058	AAA6569	10–18.2	Chromium	24
35-2058	AAA6569	10–18.2	Copper	9
35-2058	AAA6569	10–18.2	Iron	16700
35-2058	AAA6569	10–18.2	Mercury	<5
35-2058	AAA6569	10–18.2	Potassium	30500
35-2058	AAA6569	10–18.2	Manganese	404
35-2058	AAA6569	10–18.2	Nickel	16
35-2058	AAA6569	10–18.2	Lead	24
35-2058	AAA6569	10–18.2	Antimony	<4
35-2058	AAA6569	10–18.2	Selenium	<4
35-2058	AAA6569	10–18.2	Thorium	20
35-2058	AAA6569	10–18.2	Titanium	1180
35-2058	AAA6569	10–18.2	Uranium	9
35-2058	AAA6569	10–18.2	Zinc	57
35-2058	AAA6569	10–18.2	Arsenic	<4
35-2058	AAA6569	10–18.2	Barium	190
35-2058	AAA6569	10–18.2	Calcium	3700
35-2058	AAA6569	10–18.2	Cadmium	<3
35-2058	AAA6569	10–18.2	Chromium	27
35-2058	AAA6569	10–18.2	Copper	<8
35-2058	AAA6569	10–18.2	Iron	16400
35-2058	AAA6569	10–18.2	Mercury	<5
35-2058	AAA6569	10–18.2	Potassium	31000
35-2058	AAA6569	10–18.2	Manganese	404
35-2058	AAA6569	10–18.2	Nickel	17
35-2058	AAA6569	10–18.2	Lead	19
35-2058	AAA6569	10–18.2	Antimony	<4
35-2058	AAA6569	10–18.2	Selenium	<4
35-2058	AAA6569	10–18.2	Thorium	19
35-2058	AAA6569	10–18.2	Titanium	1140
35-2058	AAA6569	10–18.2	Uranium	<8
35-2058	AAA6569	10–18.2	Zinc	69
35-2046	AAA6541	0–.5	Arsenic	<4
35-2046	AAA6541	0–.5	Barium	121
35-2046	AAA6541	0–.5	Calcium	4300
35-2046	AAA6541	0–.5	Cadmium	<3
35-2046	AAA6541	0–.5	Chromium	<12
35-2046	AAA6541	0–.5	Copper	10
35-2046	AAA6541	0–.5	Iron	11000

TABLE A-7 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-009(d)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2046	AAA6541	0–.5	Mercury	<5
35-2046	AAA6541	0–.5	Potassium	33100
35-2046	AAA6541	0–.5	Manganese	456
35-2046	AAA6541	0–.5	Nickel	<13
35-2046	AAA6541	0–.5	Lead	15
35-2046	AAA6541	0–.5	Antimony	<4
35-2046	AAA6541	0–.5	Selenium	<4
35-2046	AAA6541	0–.5	Thorium	24
35-2046	AAA6541	0–.5	Titanium	668
35-2046	AAA6541	0–.5	Uranium	<8
35-2046	AAA6541	0–.5	Zinc	52
35-2047	AAA6542	0–.5	Arsenic	<4
35-2047	AAA6542	0–.5	Barium	73
35-2047	AAA6542	0–.5	Calcium	4300
35-2047	AAA6542	0–.5	Cadmium	<3
35-2047	AAA6542	0–.5	Chromium	<12
35-2047	AAA6542	0–.5	Copper	<8
35-2047	AAA6542	0–.5	Iron	11400
35-2047	AAA6542	0–.5	Mercury	<5
35-2047	AAA6542	0–.5	Potassium	31900
35-2047	AAA6542	0–.5	Manganese	425
35-2047	AAA6542	0–.5	Nickel	<13
35-2047	AAA6542	0–.5	Lead	17
35-2047	AAA6542	0–.5	Antimony	<4
35-2047	AAA6542	0–.5	Selenium	<4
35-2047	AAA6542	0–.5	Thorium	15
35-2047	AAA6542	0–.5	Titanium	760
35-2047	AAA6542	0–.5	Uranium	<8
35-2047	AAA6542	0–.5	Zinc	74
35-2048	AAA6543	0–.5	Arsenic	<4
35-2048	AAA6543	0–.5	Barium	149
35-2048	AAA6543	0–.5	Calcium	3900
35-2048	AAA6543	0–.5	Cadmium	<3
35-2048	AAA6543	0–.5	Chromium	<12
35-2048	AAA6543	0–.5	Copper	<8
35-2048	AAA6543	0–.5	Iron	10600
35-2048	AAA6543	0–.5	Mercury	<5
35-2048	AAA6543	0–.5	Potassium	32600
35-2048	AAA6543	0–.5	Manganese	417
35-2048	AAA6543	0–.5	Nickel	<13
35-2048	AAA6543	0–.5	Lead	21
35-2048	AAA6543	0–.5	Antimony	<4
35-2048	AAA6543	0–.5	Selenium	<4
35-2048	AAA6543	0–.5	Thorium	21
35-2048	AAA6543	0–.5	Titanium	681
35-2048	AAA6543	0–.5	Uranium	<8
35-2048	AAA6543	0–.5	Zinc	43

TABLE A-8

X-RAY FLUORESCENCE RESULTS FOR PRS Nos. 35-014(e_2) and 35-016(i)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2165	AAC1295	0–.5	Arsenic	<4
35-2165	AAC1295	0–.5	Barium	211
35-2165	AAC1295	0–.5	Calcium	6270
35-2165	AAC1295	0–.5	Cadmium	<3
35-2165	AAC1295	0–.5	Chromium	17.9
35-2165	AAC1295	0–.5	Copper	12.3
35-2165	AAC1295	0–.5	Iron	16400
35-2165	AAC1295	0–.5	Mercury	<5
35-2165	AAC1295	0–.5	Potassium	29100
35-2165	AAC1295	0–.5	Manganese	709
35-2165	AAC1295	0–.5	Nickel	34.6
35-2165	AAC1295	0–.5	Lead	69.6
35-2165	AAC1295	0–.5	Antimony	<4
35-2165	AAC1295	0–.5	Selenium	<4
35-2165	AAC1295	0–.5	Thorium	<8
35-2165	AAC1295	0–.5	Titanium	1624
35-2165	AAC1295	0–.5	Uranium	<8
35-2165	AAC1295	0–.5	Zinc	362
35-2166	AAC1296	0–1	Arsenic	<4
35-2166	AAC1296	0–1	Barium	74.9
35-2166	AAC1296	0–1	Calcium	1650
35-2166	AAC1296	0–1	Cadmium	<3
35-2166	AAC1296	0–1	Chromium	32.1
35-2166	AAC1296	0–1	Copper	<8
35-2166	AAC1296	0–1	Iron	11700
35-2166	AAC1296	0–1	Mercury	<5
35-2166	AAC1296	0–1	Potassium	34400
35-2166	AAC1296	0–1	Manganese	373
35-2166	AAC1296	0–1	Nickel	<13
35-2166	AAC1296	0–1	Lead	21.4
35-2166	AAC1296	0–1	Antimony	<4
35-2166	AAC1296	0–1	Selenium	<4
35-2166	AAC1296	0–1	Thorium	17.9
35-2166	AAC1296	0–1	Titanium	595
35-2166	AAC1296	0–1	Uranium	<8
35-2166	AAC1296	0–1	Zinc	60.6
35-2166	AAC1297	1–2	Arsenic	<4
35-2166	AAC1297	1–2	Barium	67.4
35-2166	AAC1297	1–2	Calcium	1210
35-2166	AAC1297	1–2	Cadmium	<3
35-2166	AAC1297	1–2	Chromium	53.3
35-2166	AAC1297	1–2	Copper	<8
35-2166	AAC1297	1–2	Iron	11000
35-2166	AAC1297	1–2	Mercury	<5
35-2166	AAC1297	1–2	Potassium	34900
35-2166	AAC1297	1–2	Manganese	354
35-2166	AAC1297	1–2	Nickel	20.2
35-2166	AAC1297	1–2	Lead	21.4

TABLE A-8 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS Nos. 35-014(e_2) and 35-016(i)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2166	AAC1297	1–2	Antimony	<4
35-2166	AAC1297	1–2	Selenium	<4
35-2166	AAC1297	1–2	Thorium	18.9
35-2166	AAC1297	1–2	Titanium	511
35-2166	AAC1297	1–2	Uranium	<8
35-2166	AAC1297	1–2	Zinc	52.7
35-2166	AAC1298	2–3	Arsenic	<4
35-2166	AAC1298	2–3	Barium	50.3
35-2166	AAC1298	2–3	Calcium	1740
35-2166	AAC1298	2–3	Cadmium	<3
35-2166	AAC1298	2–3	Chromium	13.8
35-2166	AAC1298	2–3	Copper	<8
35-2166	AAC1298	2–3	Iron	11600
35-2166	AAC1298	2–3	Mercury	<5
35-2166	AAC1298	2–3	Potassium	33300
35-2166	AAC1298	2–3	Manganese	397
35-2166	AAC1298	2–3	Nickel	<13
35-2166	AAC1298	2–3	Lead	17.3
35-2166	AAC1298	2–3	Antimony	4.19
35-2166	AAC1298	2–3	Selenium	<4
35-2166	AAC1298	2–3	Thorium	17.4
35-2166	AAC1298	2–3	Titanium	667
35-2166	AAC1298	2–3	Uranium	10.8
35-2166	AAC1298	2–3	Zinc	54.7

TABLE A-9

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-016(f)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2154	AAC1207	0–.5	Arsenic	<4
35-2154	AAC1207	0–.5	Barium	272
35-2154	AAC1207	0–.5	Calcium	9810
35-2154	AAC1207	0–.5	Cadmium	<3
35-2154	AAC1207	0–.5	Chromium	<12
35-2154	AAC1207	0–.5	Copper	11.7
35-2154	AAC1207	0–.5	Iron	16100
35-2154	AAC1207	0–.5	Mercury	6.35
35-2154	AAC1207	0–.5	Potassium	28000
35-2154	AAC1207	0–.5	Manganese	375
35-2154	AAC1207	0–.5	Nickel	26.9
35-2154	AAC1207	0–.5	Lead	25.3
35-2154	AAC1207	0–.5	Antimony	<4
35-2154	AAC1207	0–.5	Selenium	<4
35-2154	AAC1207	0–.5	Thorium	18.1
35-2154	AAC1207	0–.5	Titanium	1766
35-2154	AAC1207	0–.5	Uranium	<8
35-2154	AAC1207	0–.5	Zinc	104
35-2155	AAC1208	0–1	Arsenic	12.5
35-2155	AAC1208	0–1	Barium	151
35-2155	AAC1208	0–1	Calcium	2600
35-2155	AAC1208	0–1	Cadmium	<3
35-2155	AAC1208	0–1	Chromium	<12
35-2155	AAC1208	0–1	Copper	<8
35-2155	AAC1208	0–1	Iron	13100
35-2155	AAC1208	0–1	Mercury	<5
35-2155	AAC1208	0–1	Potassium	31100
35-2155	AAC1208	0–1	Manganese	310
35-2155	AAC1208	0–1	Nickel	<13
35-2155	AAC1208	0–1	Lead	17.4
35-2155	AAC1208	0–1	Antimony	<4
35-2155	AAC1208	0–1	Selenium	<4
35-2155	AAC1208	0–1	Thorium	14.8
35-2155	AAC1208	0–1	Titanium	1036
35-2155	AAC1208	0–1	Uranium	<8
35-2155	AAC1208	0–1	Zinc	80
35-2155	AAC1209	1–2	Arsenic	<4
35-2155	AAC1209	1–2	Barium	169
35-2155	AAC1209	1–2	Calcium	3480
35-2155	AAC1209	1–2	Cadmium	<3
35-2155	AAC1209	1–2	Chromium	22.9
35-2155	AAC1209	1–2	Copper	<8
35-2155	AAC1209	1–2	Iron	13700
35-2155	AAC1209	1–2	Mercury	<5
35-2155	AAC1209	1–2	Potassium	31300
35-2155	AAC1209	1–2	Manganese	384
35-2155	AAC1209	1–2	Nickel	<13
35-2155	AAC1209	1–2	Lead	24.2
35-2155	AAC1209	1–2	Antimony	<4

TABLE A-9 (continued)

X-RAY FLUORESCENCE RESULTS FOR PRS No. 35-016(f)

Location ID	Sample ID	Depth (ft)	Analyte	Result (mg/kg)
35-2155	AAC1209	1–2	Selenium	<4
35-2155	AAC1209	1–2	Thorium	12.8
35-2155	AAC1209	1–2	Titanium	1178
35-2155	AAC1209	1–2	Uranium	<8
35-2155	AAC1209	1–2	Zinc	55.5
35-2155	AAC1210	2–3	Arsenic	<4
35-2155	AAC1210	2–3	Barium	63.4
35-2155	AAC1210	2–3	Calcium	1710
35-2155	AAC1210	2–3	Cadmium	<3
35-2155	AAC1210	2–3	Chromium	32.1
35-2155	AAC1210	2–3	Copper	<8
35-2155	AAC1210	2–3	Iron	11800
35-2155	AAC1210	2–3	Mercury	<5
35-2155	AAC1210	2–3	Potassium	34200
35-2155	AAC1210	2–3	Manganese	439
35-2155	AAC1210	2–3	Nickel	15.5
35-2155	AAC1210	2–3	Lead	26.6
35-2155	AAC1210	2–3	Antimony	<4
35-2155	AAC1210	2–3	Selenium	<4
35-2155	AAC1210	2–3	Thorium	24.9
35-2155	AAC1210	2–3	Titanium	698
35-2155	AAC1210	2–3	Uranium	<8
35-2155	AAC1210	2–3	Zinc	34.5

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 the 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: 35-009(b), 35-014(a), and 35-014(f). Data quality for the entire data set can be found in Chapter 4 of this RFI report.

TABLE B-1

DATA QUALITY EVALUATION FOR PRS No. 35-003(h)

Request No.	Location ID	Sample ID	Analyte Suite	QC Parameter	Explanation
17049	35-2027-B2	AAA6606	SVOC	Hold Time	Extraction hold time missed by 3 days. No target analytes detected, therefore impact on data quality is minimal.
17219	35-2027-B1	AAA6605	Metals	Accuracy	Due to poor recovery from laboratory control sample, the reported value(s) for the following analyte(s) should be regarded as unusable: Sb.

TABLE B-2

DATA QUALITY EVALUATION FOR PRS Nos. 35-003(j and k), 35-014(d), and 35-015(b)

Request No.	Location ID	Sample ID	Analyte Suite	QC Parameter	Explanation
16397	35-2083-S1	AAA6368	SVOC	Sensitivity	Sample EQLs elevated 10x due to hydrocarbon contamination. Samples analyzed at 1:10 dilution. TICs present.
16397	35-2084-S1	AAA6373	SVOC	Sensitivity	Sample EQLs elevated 10x due to hydrocarbon contamination. Samples analyzed at 1:10 dilution. TICs present.
16397	35-2086-S1	AAA6375	SVOC	Sensitivity	Sample EQLs elevated 10x due to hydrocarbon contamination. Samples analyzed at 1:10 dilution. TICs present.
16397	35-2087-S1	AAA6376	SVOC	Sensitivity	Sample EQLs elevated 10x due to hydrocarbon contamination. Samples analyzed at 1:10 dilution. TICs present.
16397	35-2088-S1	AAA6377	SVOC	Sensitivity	Sample EQLs elevated 10x due to hydrocarbon contamination. Samples analyzed at 1:10 dilution. TICs present.
16407	35-2081-S1	AAA6366	SVOC	Accuracy	Estimated total recoverable petroleum hydrocarbons: 3700 mg/kg.
16407	35-2082-S1	AAA6367	SVOC	Accuracy	Estimated total recoverable petroleum hydrocarbons: 790 mg/kg
16407	35-2085-S1	AAA6374	SVOC	Accuracy	Estimated total recoverable petroleum hydrocarbons: 33 mg/kg
16407	35-2089-A1	AAA6385	SVOC	Accuracy	Estimated total recoverable petroleum hydrocarbons: 1700 mg/kg
16407	35-2089-A2	AAA6386	SVOC	Accuracy	Estimated total recoverable petroleum hydrocarbons: 310 mg/kg
16407	35-2089-A3	AAA6387	SVOC	Accuracy	Estimated total recoverable petroleum hydrocarbons: 340 mg/kg
16407	35-2089-A4	AAA6388	SVOC	Accuracy	Estimated total recoverable petroleum hydrocarbons: 400 mg/kg
16407	35-2089-A5	AAA6389	SVOC	Accuracy	Estimated total recoverable petroleum hydrocarbons: none
16407	35-2089-A6	AAA6390	SVOC	Accuracy	Estimated total recoverable petroleum hydrocarbons: none
16407	35-2090-A1	AAA6391	SVOC	Accuracy	Estimated total recoverable petroleum hydrocarbons: 1300 mg/kg
16407	35-2090-A2	AAA6392	SVOC	Accuracy	Estimated total recoverable petroleum hydrocarbons: 6.3 mg/kg
16407	35-2090-A3	AAA6393	SVOC	Accuracy	Estimated total recoverable petroleum hydrocarbons: none
16407	35-2090-A4	AAA6394	SVOC	Accuracy	Estimated total recoverable petroleum hydrocarbons: none
16407	35-2090-A5	AAA6395	SVOC	Accuracy	Estimated total recoverable petroleum hydrocarbons: none
16407	35-2090-A5	AAA6396	SVOC	Accuracy	Total recoverable petroleum hydrocarbons: none
16407	35-2090-A6	AAA6397	SVOC	Accuracy	Estimated total recoverable petroleum hydrocarbons: 9.3 mg/kg

TABLE B-3

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

Request No.	Location ID	Sample ID	Analyte Suite	QC Parameter	Explanation
21675	35-2121-A1	AAC1288	Metals	Accuracy	Due to poor recovery from matrix spike sample, the reported result for Mn should be regarded as estimated and biased low, and the reported detection limit for Sb should be regarded as estimated.

TABLE B-4

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

Request No.	Location ID	Sample ID	Analyte Suite	QC Parameter	Explanation
21665	35-2152-S1	AAC1291	PAH Screen	Accuracy	TICs reported: C10-C20 hydrocarbons, 190 mg/kg (quantitated as tetradecane)
21665	35-2153-A1	AAC1292	VOC Screen	Accuracy	Low internal standard areas due to matrix effect; sample EQLs should be regarded as estimated and biased low.

TABLE B-5

DATA QUALITY EVALUATION FOR PRS No. 35-009(a)

Request No.	Location ID	Sample ID	Analyte Suite	QC Parameter	Explanation
16470	35-2035-B1	AAA6381	SVOC	Accuracy	Chrysene-d10 internal standard area count outside criteria. Reported result for bis(2-ethylhexyl) phthalate should be regarded as estimated.
16518	35	All samples	Metals	Completeness	Samples were not analyzed for Zn.
16518	35	All samples	Metals	Accuracy	Recovery from post-digestion spike for GFAA analysis of As and Se is outside control limits. Sample results qualified as "UJ" (nondetects) or "J" (detects).
16519	35	All samples	Metals	Completeness	Samples were not analyzed for Zn.
16519	35	All samples	Metals	Accuracy	Recovery from post-digestion spike for GFAA analysis of As and Se is outside control limits. Sample results qualified as "UJ" (nondetects) or "J" (detects).

TABLE B-6

DATA QUALITY EVALUATION FOR PRS No. 35-009(c)

Request No.	Location ID	Sample ID	Analyte Suite	QC Parameter	Explanation
16670	35-2049-B1	AAA6497	SVOC Screen	Accuracy	Linear range of instrument exceeded. Results for the following analyte should be regarded as estimated: diethyl phthalate.
16671	35-2056-B1	AAA6484	VOC	Accuracy	Acetone contamination in blank sample at < 5x EQL. Sample result should be regarded as the quantitation limit.
16672	35	AAA6490, AAA6495, AAA6513	PCB	Hold Time	Analysis hold time missed by 12 days. Sample results should be regarded as estimates.
16672	35-2049-B3	AAA6497	VOC	Accuracy	Acetone contamination in blank at <5x EQL. Sample result should be regarded as the quantitation limit.
16672	35-2053-B3	AAA6511	VOC	Accuracy	Acetone contamination in blank at <5x EQL. Sample result should be regarded as the quantitation limit.
16673	35-2052-B4	AAA6532	VOC	Accuracy	Acetone contamination in blank at <5x EQL. Sample result should be regarded as the quantitation limit.
16674	35-2051-B1	AAA6525	VOC Screen	Accuracy	Acetone and trichloropropane contamination in blank. Sample results attributed to laboratory contamination.
16674	35-2051-B2	AAA6526	VOC Screen	Accuracy	Acetone and trichloropropane contamination in blank. Sample results attributed to laboratory contamination.
16674	35-2051-B3	AAA6527	VOC Screen	Accuracy	Acetone and trichloropropane contamination in blank. Sample results attributed to laboratory contamination.
16674	35-2051-B4	AAA6528	VOC Screen	Accuracy	Acetone and trichloropropane contamination in blank. Sample results attributed to laboratory contamination.
16674	35-2052-B1	AAA6529	VOC Screen	Accuracy	Acetone and trichloropropane contamination in blank. Sample results attributed to laboratory contamination.
16674	35-2052-B2	AAA6530	VOC Screen	Accuracy	Acetone and trichloropropane contamination in blank. Sample results attributed to laboratory contamination.
16674	35-2052-B3	AAA6531	VOC Screen	Accuracy	Acetone and trichloropropane contamination in blank. Sample results attributed to laboratory contamination.
16674	35-2052-B4	AAA6532	VOC Screen	Accuracy	Acetone and trichloropropane contamination in blank. Sample results attributed to laboratory contamination.
16674	35-2052-B4	AAA6533	VOC Screen	Accuracy	Acetone and trichloropropane contamination in blank. Sample results attributed to laboratory contamination.
16680	35-2052-B4	AAA6532	Metals	Accuracy	Due to poor recovery from laboratory control sample, the reported detection limit for Sb should be regarded as estimated.

TABLE B-7

DATA QUALITY EVALUATION FOR PRS No. 35-009(d)

Request No.	Location ID	Sample ID	Analyte Suite	QC Parameter	Explanation
16713	35	All samples	VOC	Accuracy	Acetone and 2-butanone in blank sample at <5x EQL. Sample results attributed to laboratory contamination.
16713	35-2046-S1	AAA6541	SVOC	Accuracy	Unidentified organic compounds present in sample.
16713	35-2047-S1	AAA6542	SVOC	Accuracy	Unidentified organic compounds present in sample.
16713	35-2048-S1	AAA6543	SVOC	Accuracy	Unidentified organic compounds present in sample.
16713	35-2060-B1	AAA6520	SVOC	Accuracy	Unidentified organic compounds present in sample.
16713	35-2061-B1	AAA6547	SVOC	Accuracy	Unidentified organic compounds present in sample.
16715	35-2060-B1	AAA6520	VOC	Accuracy	Acetone in sample may be partially due to laboratory contamination. The reported result for acetone should be regarded as estimated and biased high.
16715	35-2061-B1	AAA6547	VOC	Accuracy	Acetone in sample may be partially due to laboratory contamination. The reported result for acetone should be regarded as estimated and biased high.
16718	35-2057-B3	AAA6564	VOC	Accuracy	Due to high level of acetone present, sample was diluted. The reported result for acetone should be regarded as estimated.
16744	35-2058-B1	AAA6567	VOC	Accuracy	Due to outside criteria Continuing Calibration Verification, the reported result for acetone should be regarded as estimated.
16744	35-2058-B2	AAA6568	VOC	Accuracy	Due to outside criteria Continuing Calibration Verification, the reported results for the following analyte(s) should be regarded as estimated: acetone and carbon disulfide.
16744	35-2058-B3	AAA6569	VOC	Accuracy	Due to outside criteria Continuing Calibration Verification, the reported results for the following analyte(s) should be regarded as estimated: acetone and carbon disulfide.
16766	35-2057-B1	AAA6564	Metals	Precision	The percent differences for ICPES serial dilutions of sodium, strontium, and vanadium were outside criteria. The reported result for the following analytes should be regarded as estimated: sodium, strontium, and vanadium.

TABLE B-8

DATA QUALITY EVALUATION FOR PRS No. 35-014(b)

Request No.	Location ID	Sample ID	Analyte Suite	QC Parameter	Explanation
16301	35-2072-A1	AAA3819	SVOC	Accuracy	Phthalate contamination present in sample; also present in blank sample. Attributed to laboratory contamination.
16301	35-2072-A1	AAA3819	SVOC	Sensitivity	Large unresolved saturated hydrocarbon peak in chromatogram. Sample analyzed at medium level quantitation; EQLs elevated >10x.
16301	35-2072-A2	AAA3820	SVOC	Sensitivity	Large unresolved saturated hydrocarbon peak in chromatogram. Sample analyzed at medium level quantitation; EQLs elevated >10x.
16301	35-2072-A3	AAA3823	SVOC	Sensitivity	Large unresolved saturated hydrocarbon peak in chromatogram. Sample analyzed at medium level quantitation; EQLs elevated >10x.
16301	35-2072-A3	AAA3821	SVOC	Sensitivity	Large unresolved saturated hydrocarbon peak in chromatogram. Sample analyzed at medium level quantitation; EQLs elevated >10x.

TABLE B-9

DATA QUALITY EVALUATION FOR PRS Nos. 35-014(e_2) and 35-016(i)

Request No.	Location ID	Sample ID	Analyte Suite	QC Parameter	Explanation
21665	35-2165-S1	AAC1295	PAH Screen	Accuracy	C10-C20 hydrocarbons reported: 11 mg/kg (quantitated as tetradecane)
21665	35-2165-S1	AAC1295	VOC Screen	Accuracy	Low internal standard area due to matrix effect; sample EQLs should be regarded as estimated and biased low.
21673	35-2146-A1	AAC1187	SVOC	Accuracy	TICs reported: unsaturated hydrocarbons, 0.810 mg/kg.

TABLE B-10

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

Request No.	Location ID	Sample ID	Analyte Suite	QC Parameter	Explanation
21598	35-2154-S1	AAC1207	PAH Screen	Hold Time	Analysis hold time exceeded by 18 days; no compounds detected therefore impact on data quality is minimal.
21598	35-2155-A2	AAC1209	VOC Screen	Accuracy	Low internal standard area due to hydrocarbon interference; sample EQLs should be regarded as estimated and biased low.

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]).

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).

RFI results for PRS Nos. 35-003(d, l, q, and r) will be presented in an RFI report, which will be submitted on June 5, 1996. RFI results for PRS No. 35-004(b) are discussed in Section 5.6 in Chapter 5.0 of this RFI report; RFI results for PRS No. 35-016(e) are discussed in Section 5.7. 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.

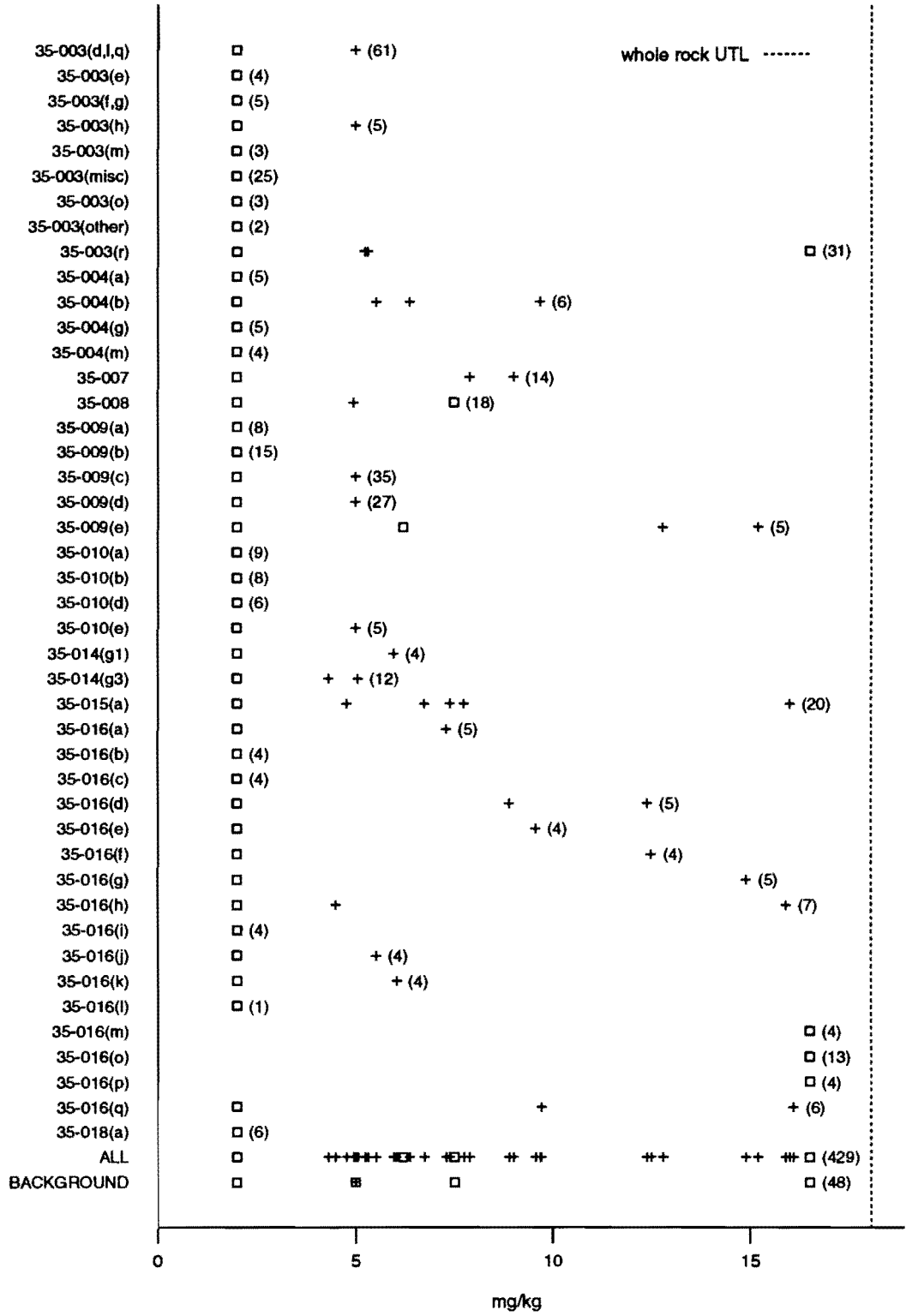

Figure AI-1. Distribution of arsenic in TA-35 PRSs.

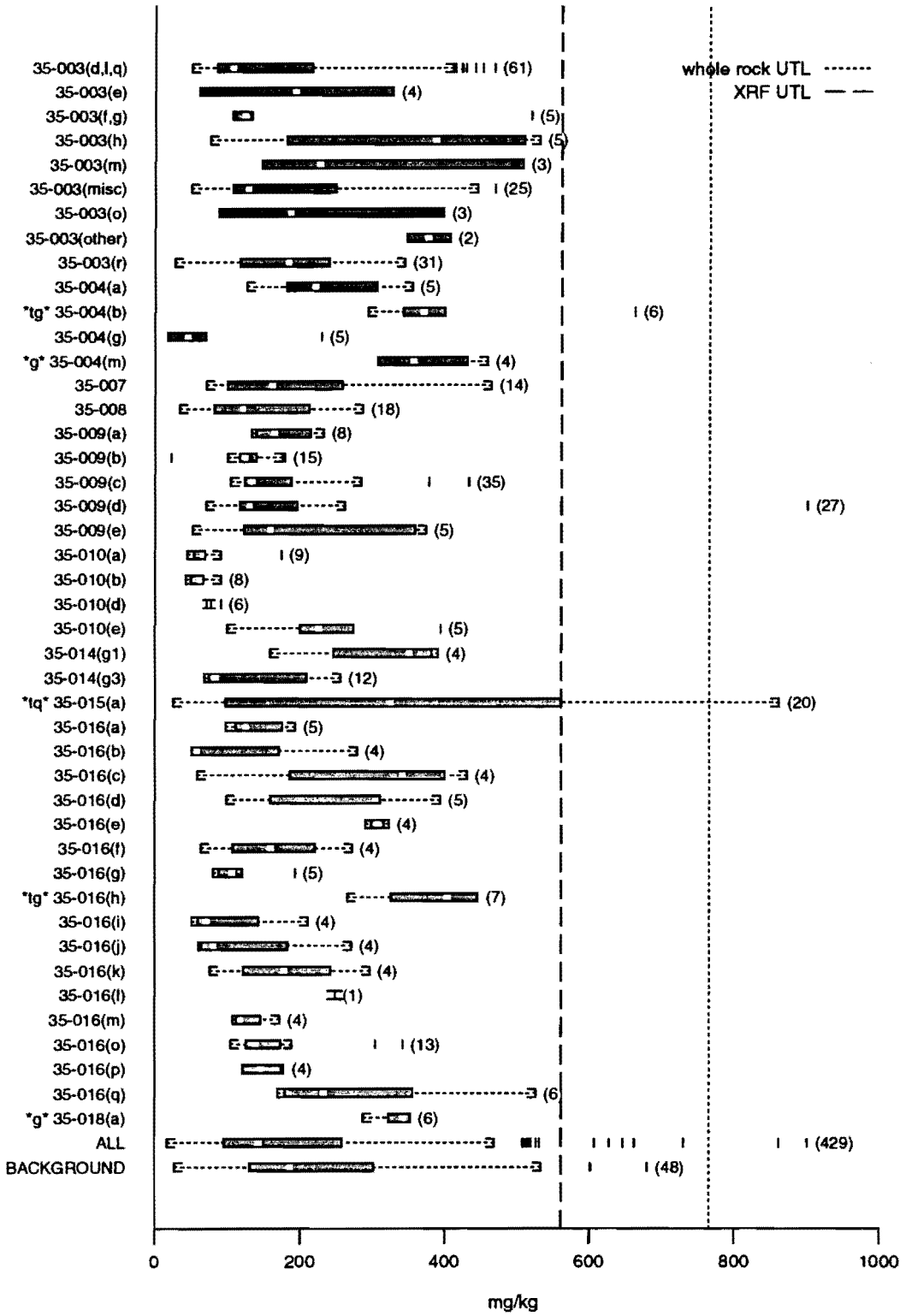

Figure AI-2. Distribution of barium in TA-35 PRSs.

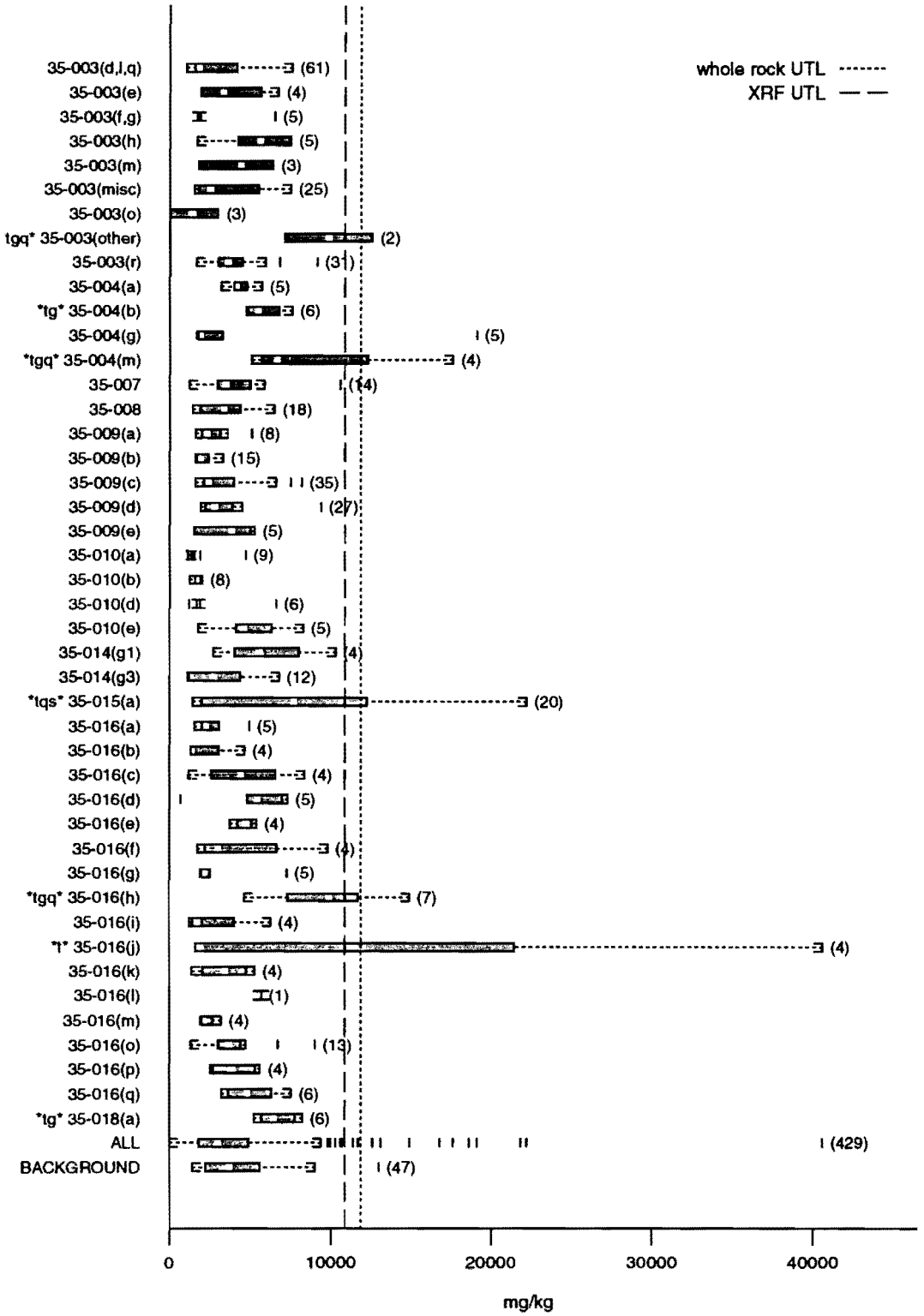

Figure AI-3. Distribution of calcium in TA-35 PRSs.

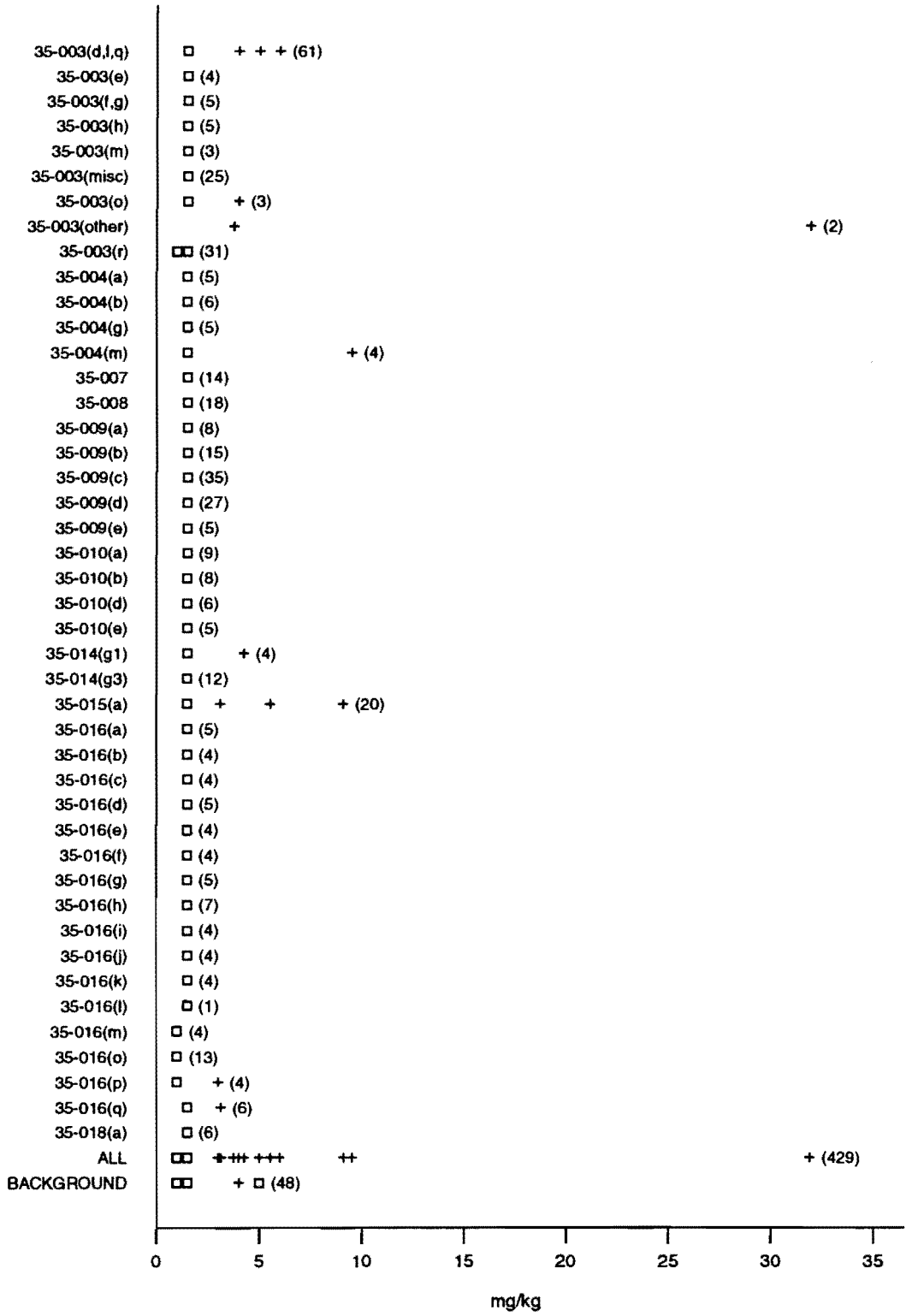

Figure AI-4. Distribution of cadmium in TA-35 PRSs.

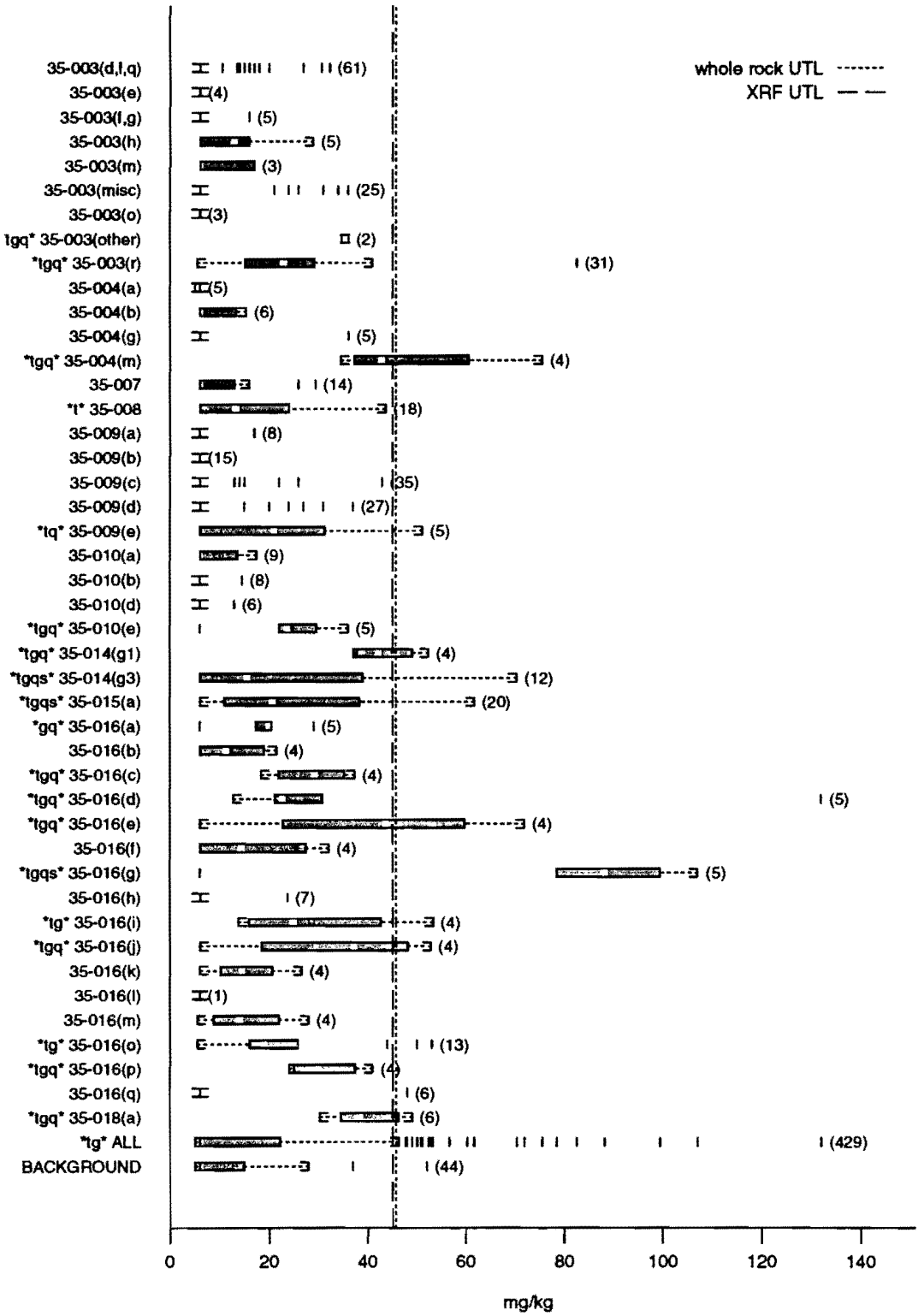

Figure AI-5. Distribution of chromium in TA-35 PRSs.

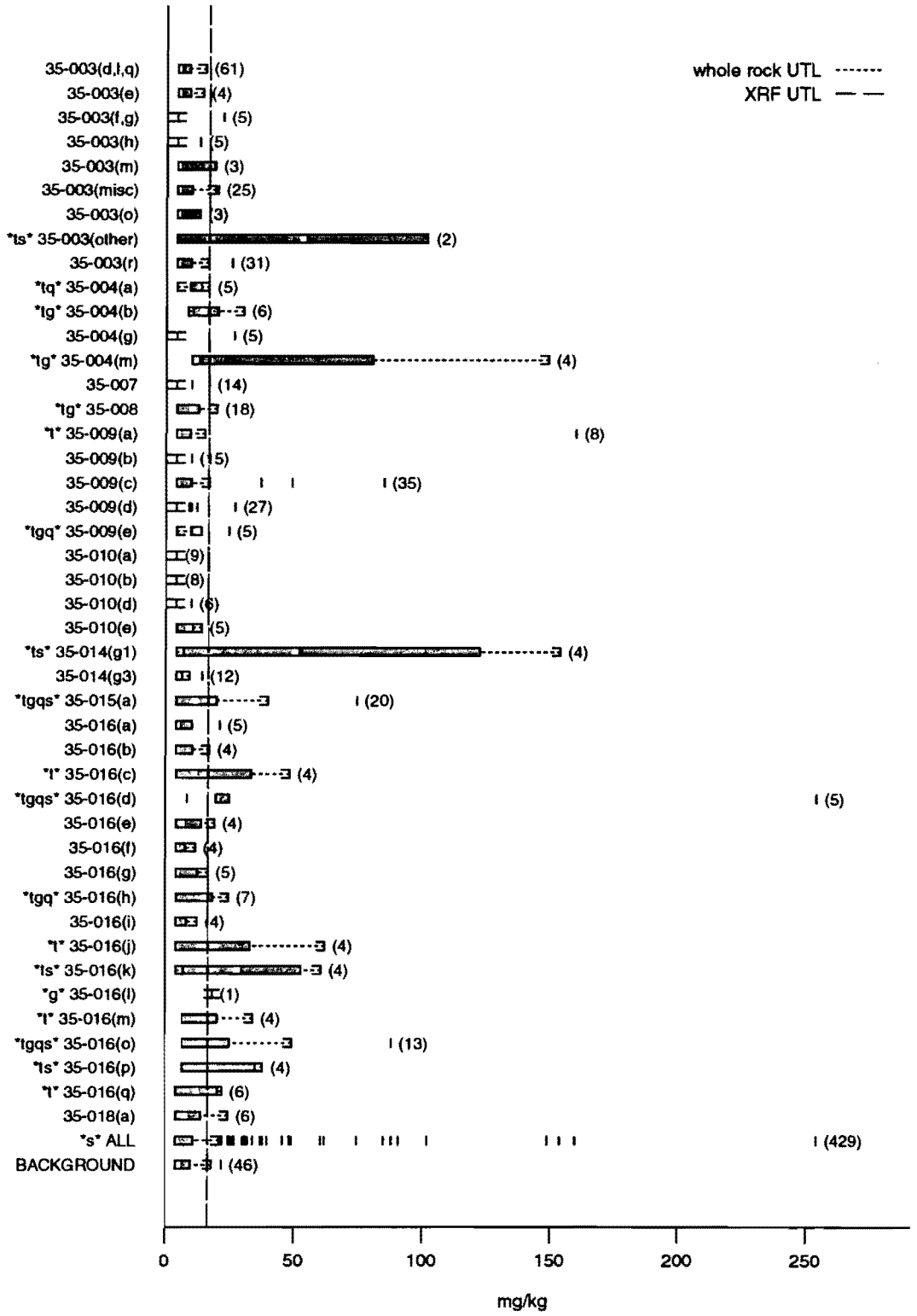

Figure AI-6. Distribution of copper in TA-35 PRSs.

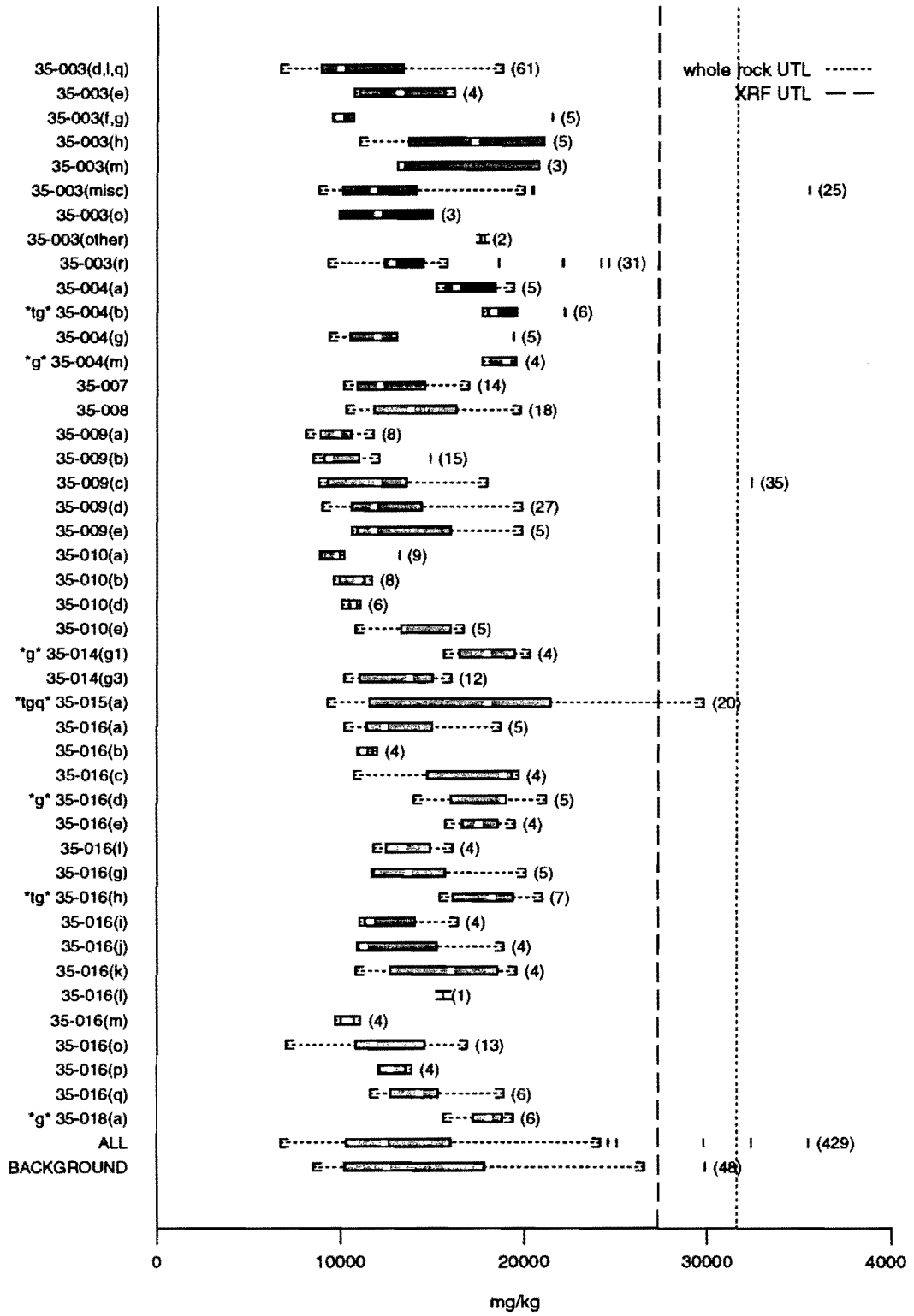

Figure AI-7. Distribution of iron in TA-35 PRSs.

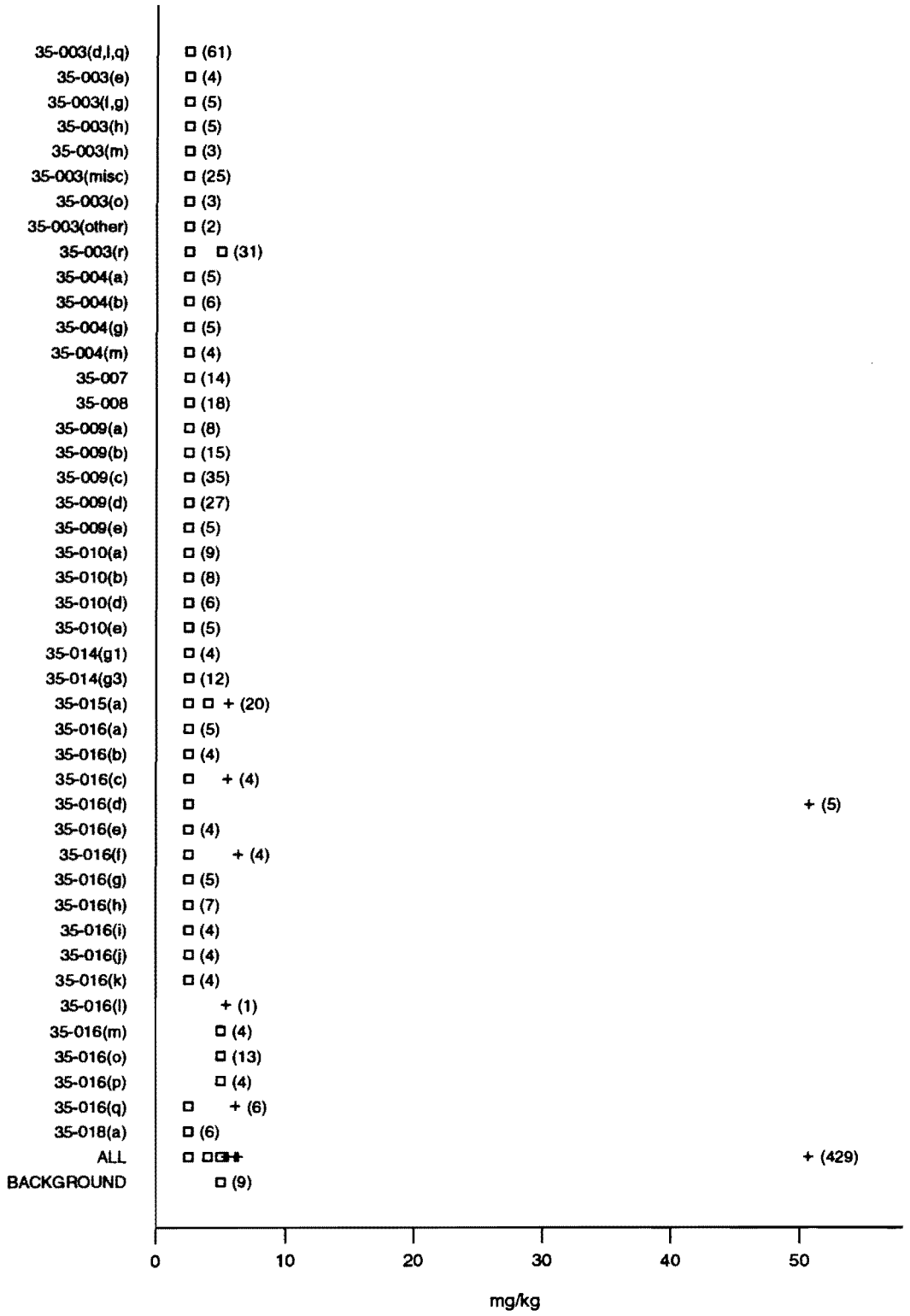

Figure AI-8. Distribution of mercury in TA-35 PRSs.

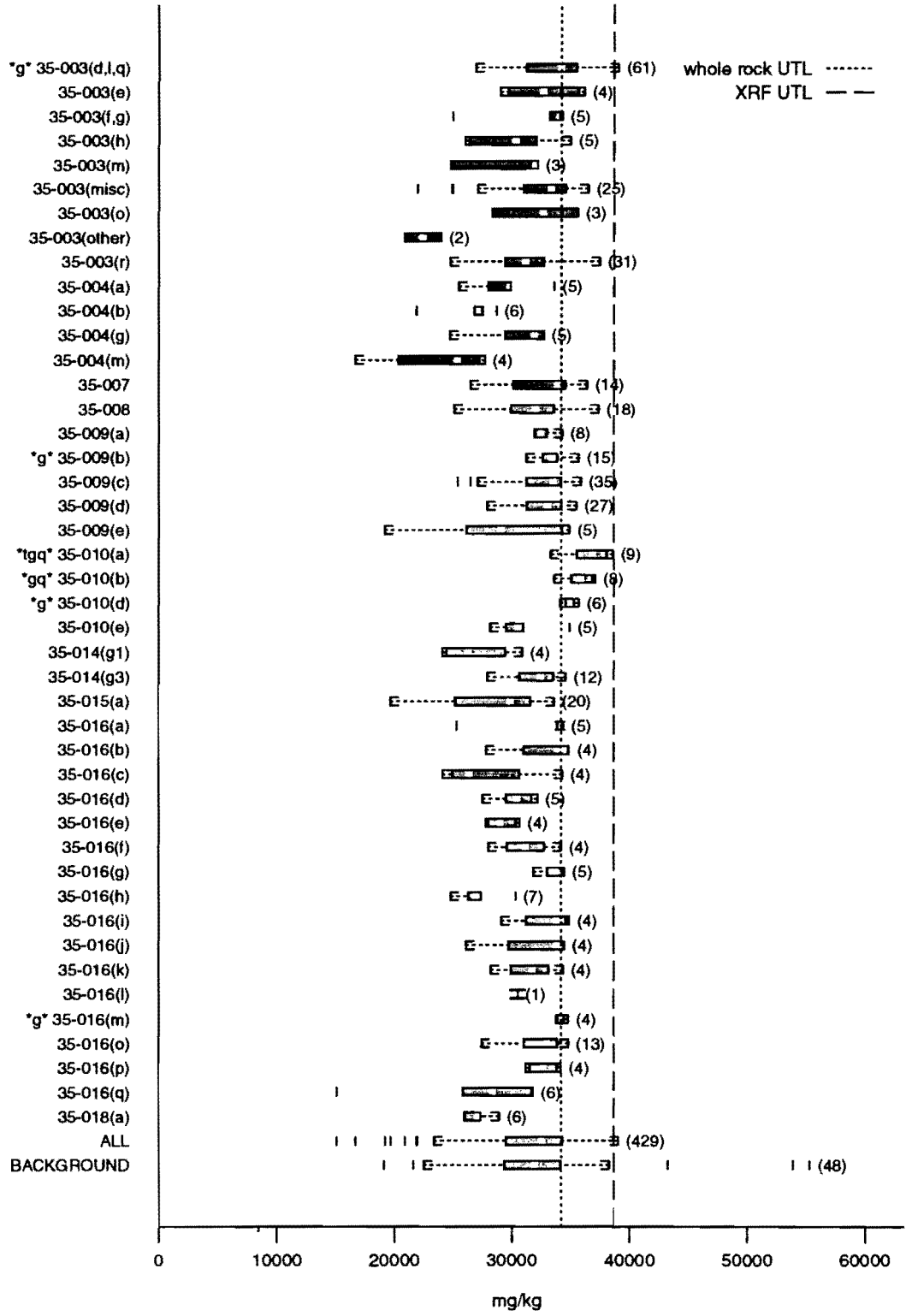

Figure AI-9. Distribution of potassium in TA-35 PRSs.

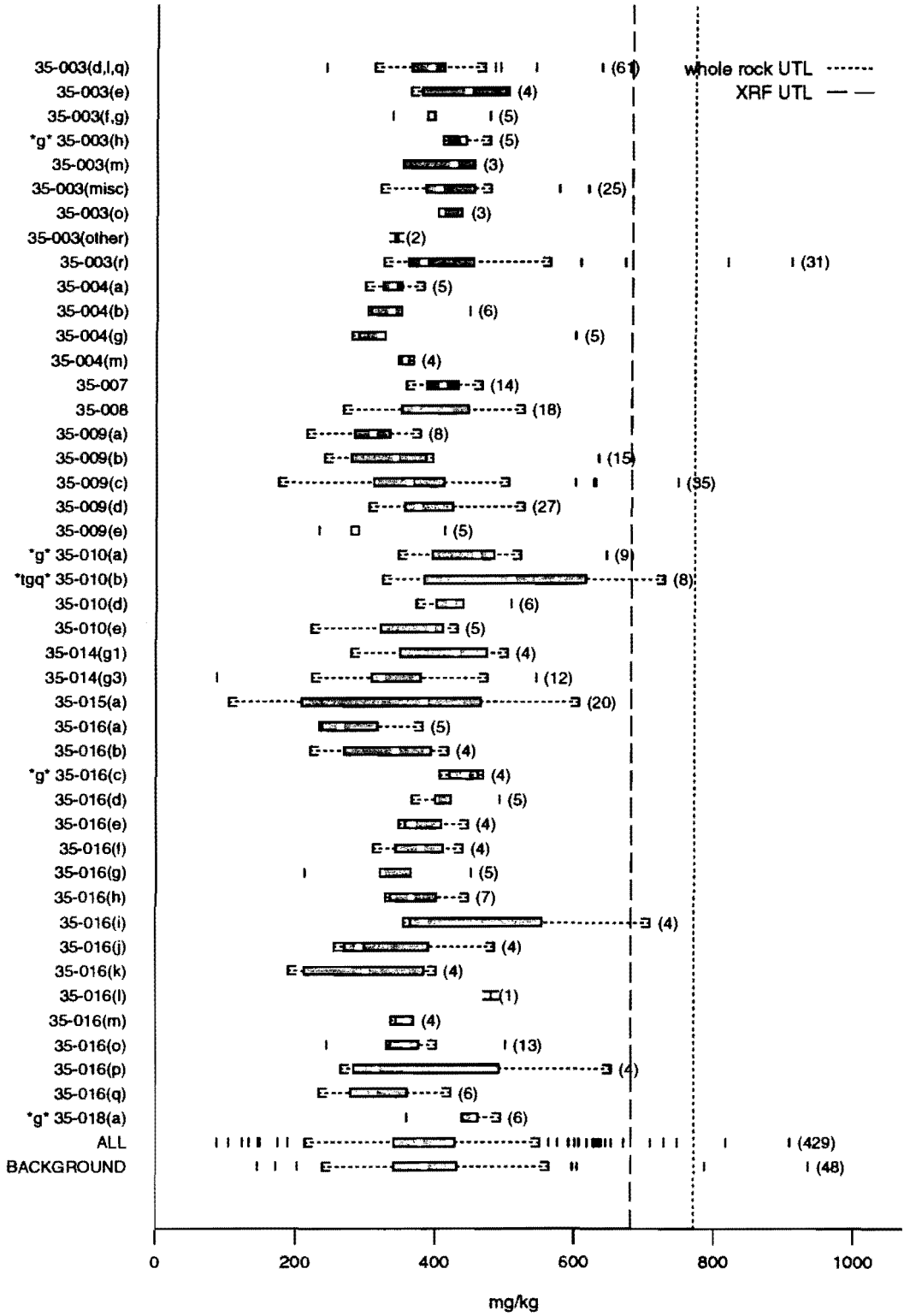

Figure AI-10. Distribution of manganese in TA-35 PRSs.

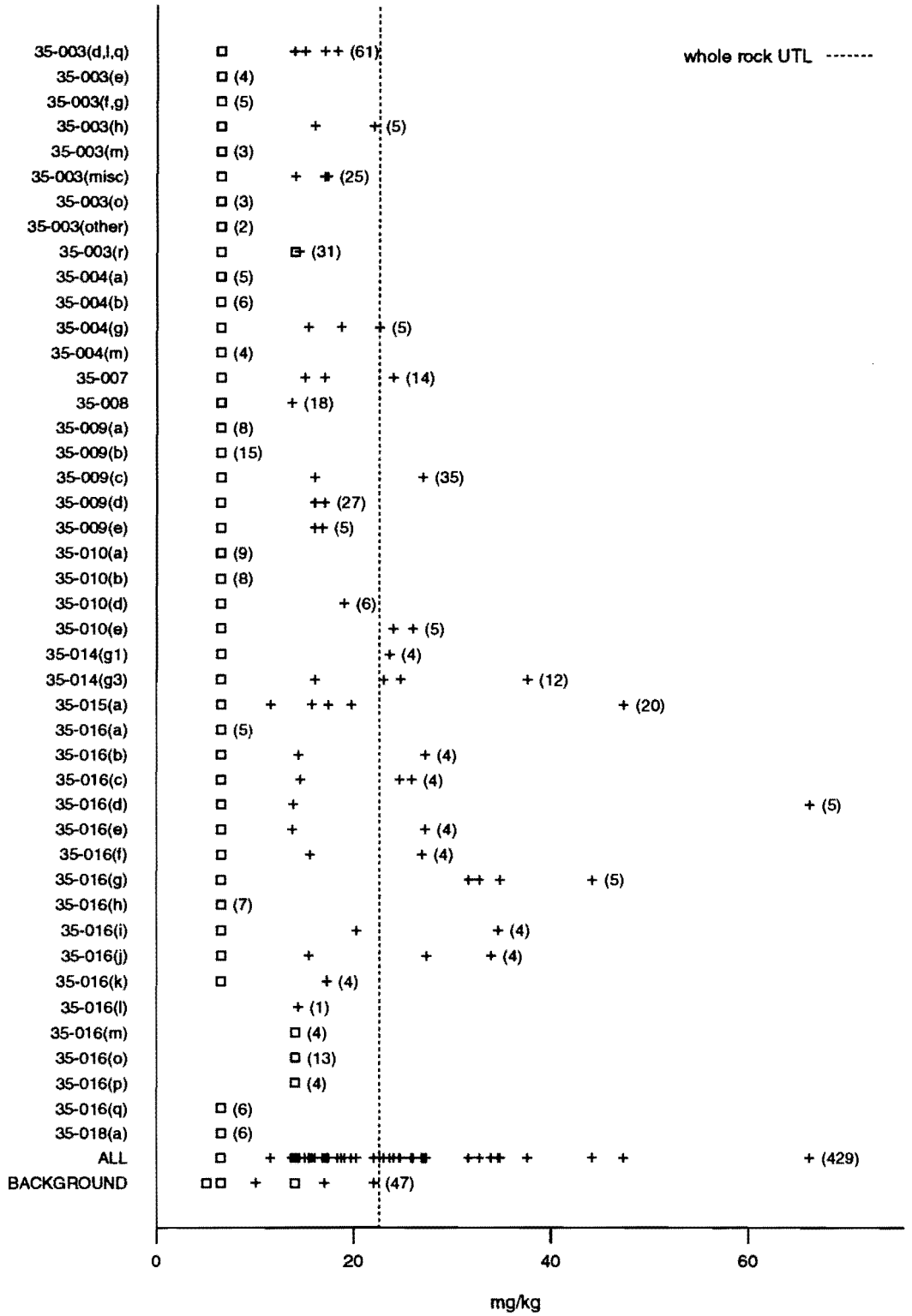

Figure AI-11. Distribution of nickel in TA-35 PRSs.

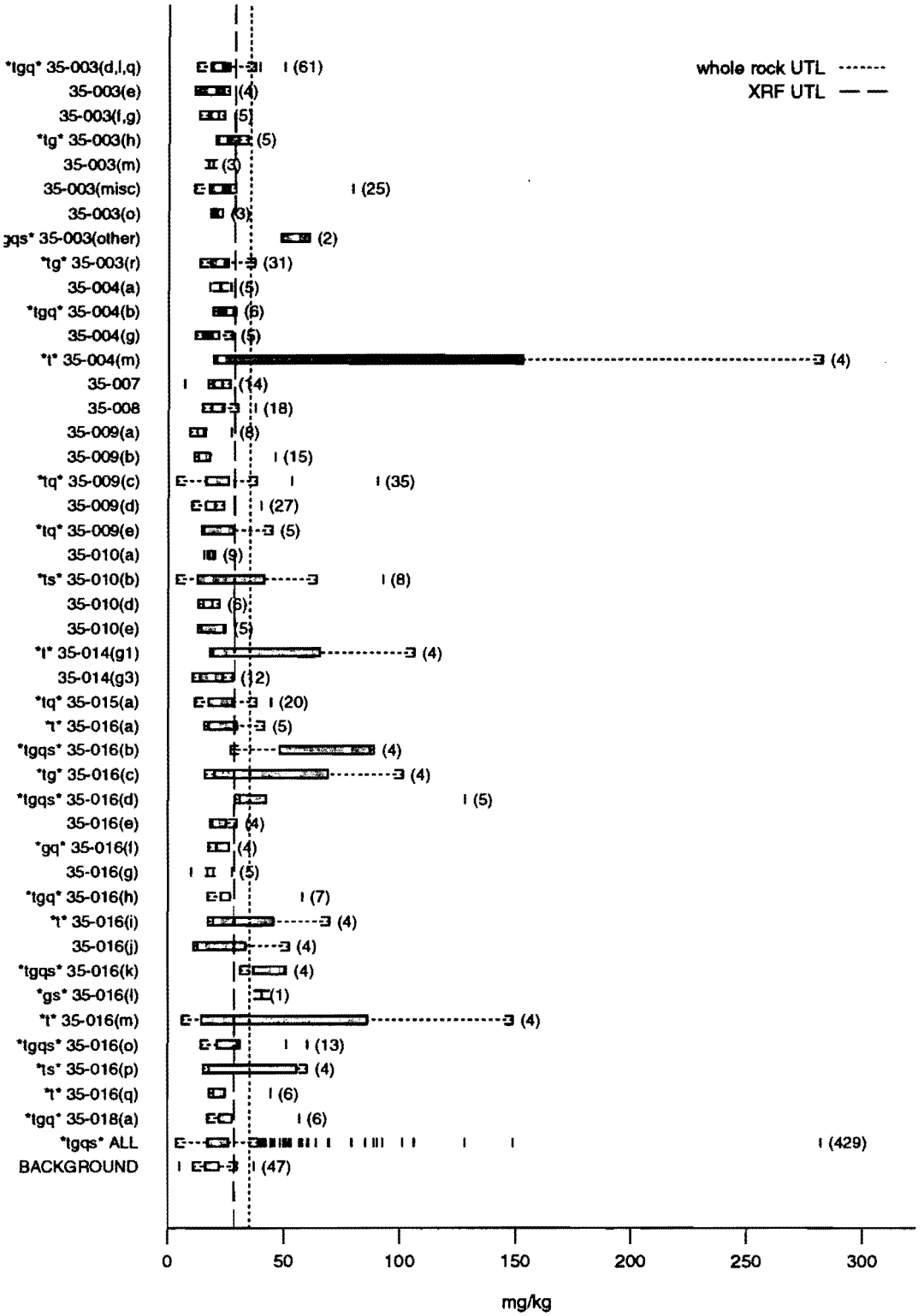

Figure AI-12. Distribution of lead in TA-35 PRSs.

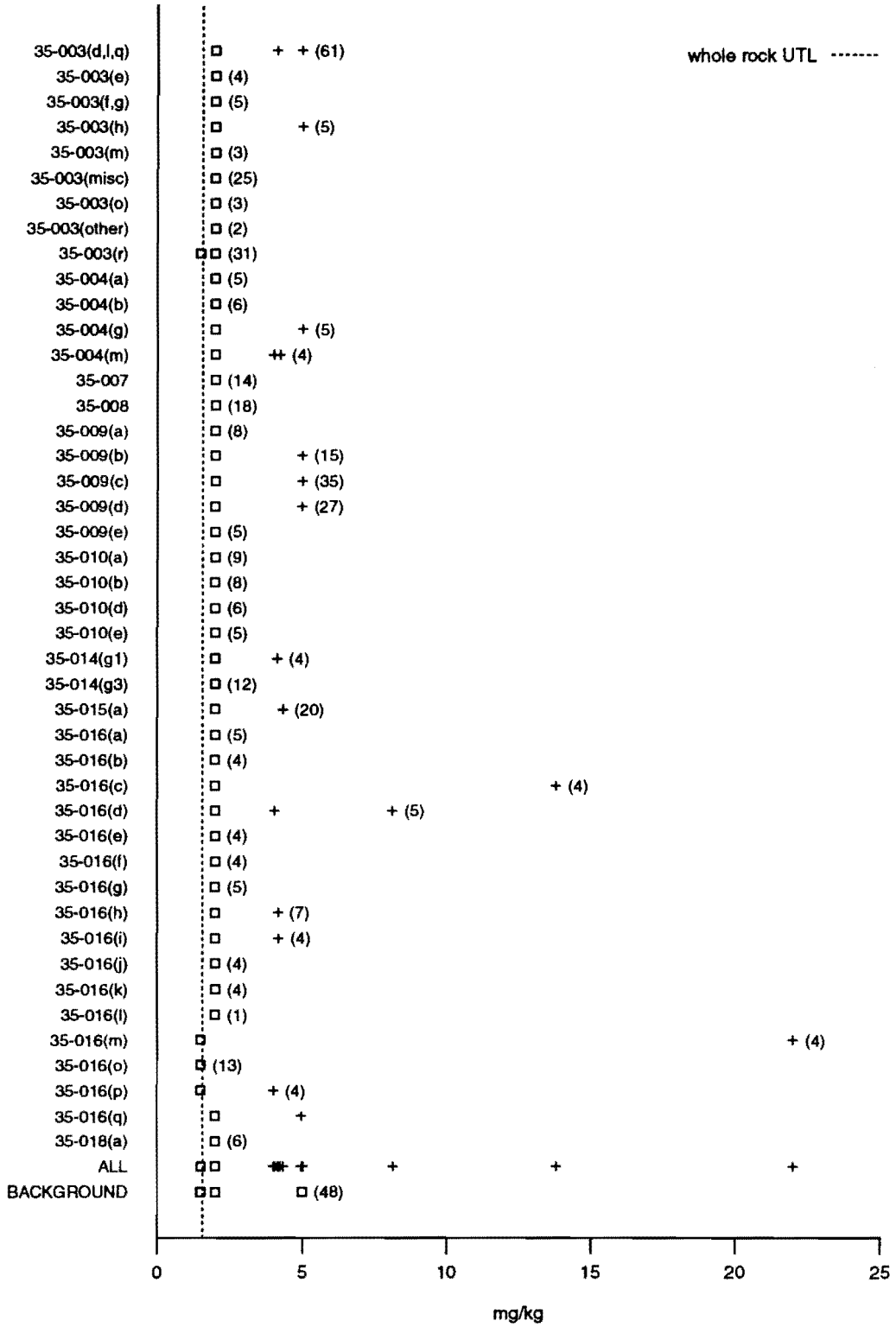

Figure AI-13. Distribution of antimony in TA-35 PRSs.

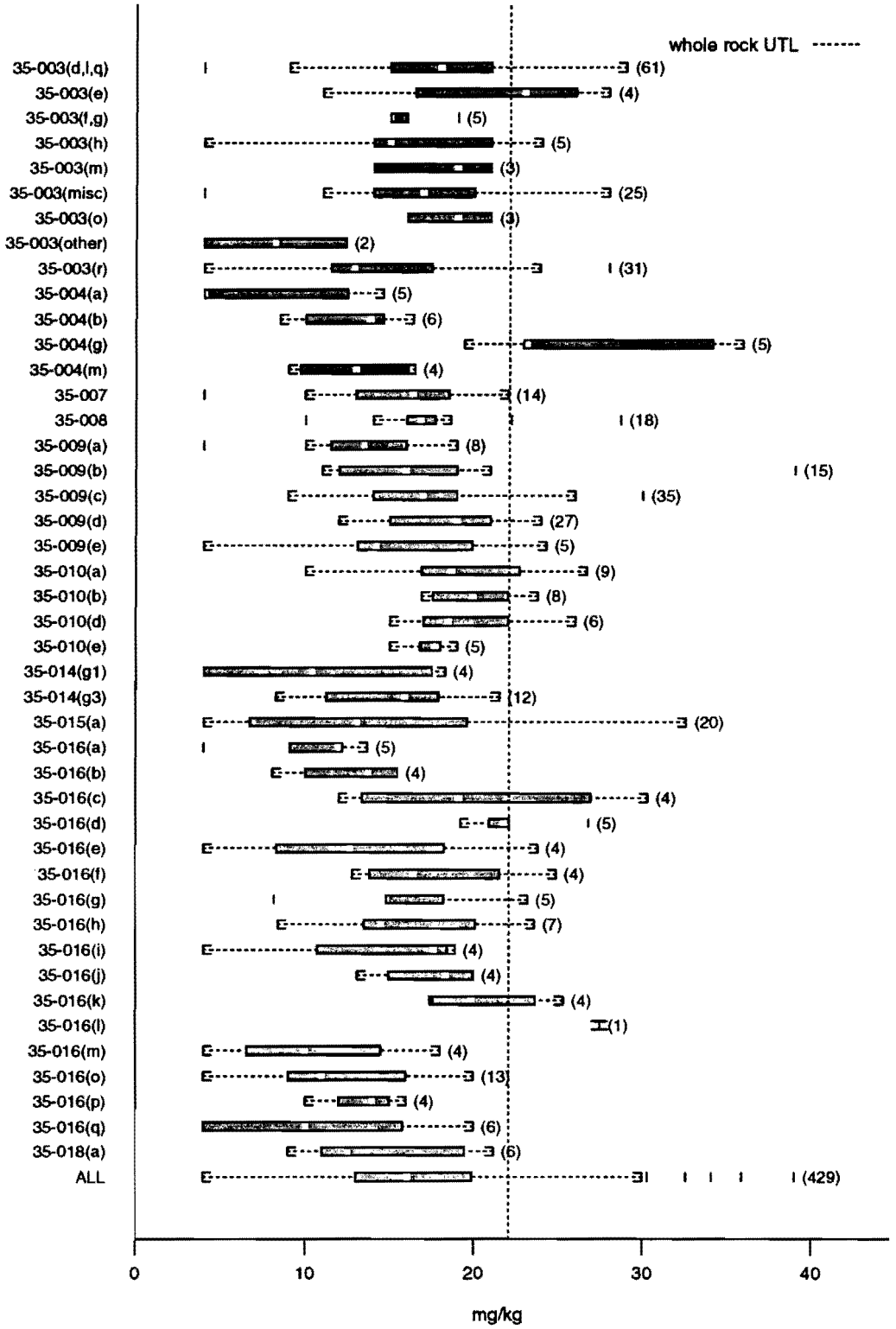

Figure AI-14. Distribution of thorium in TA-35 PRSs.

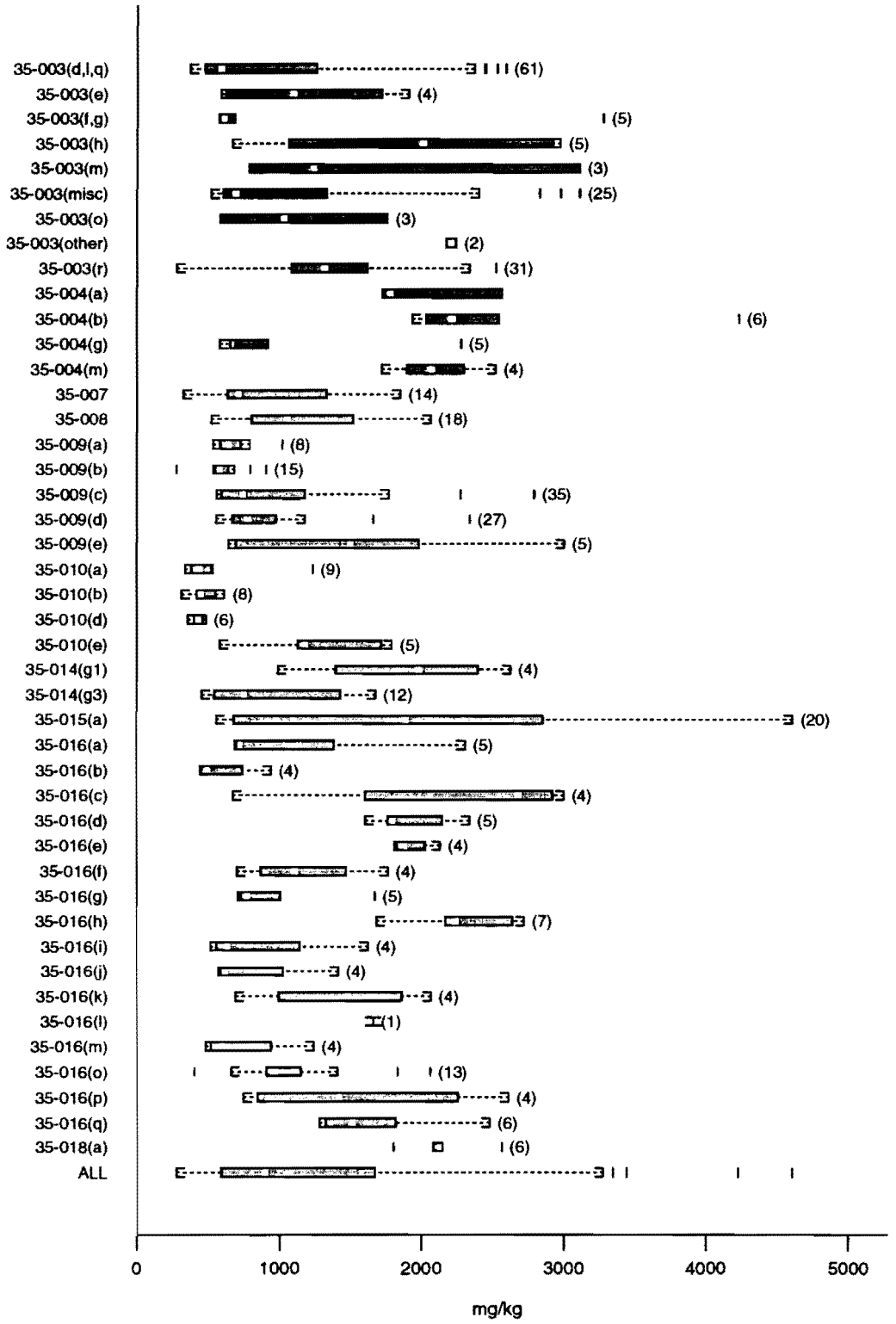

Figure AI-15. Distribution of titanium in TA-35 PRSs.

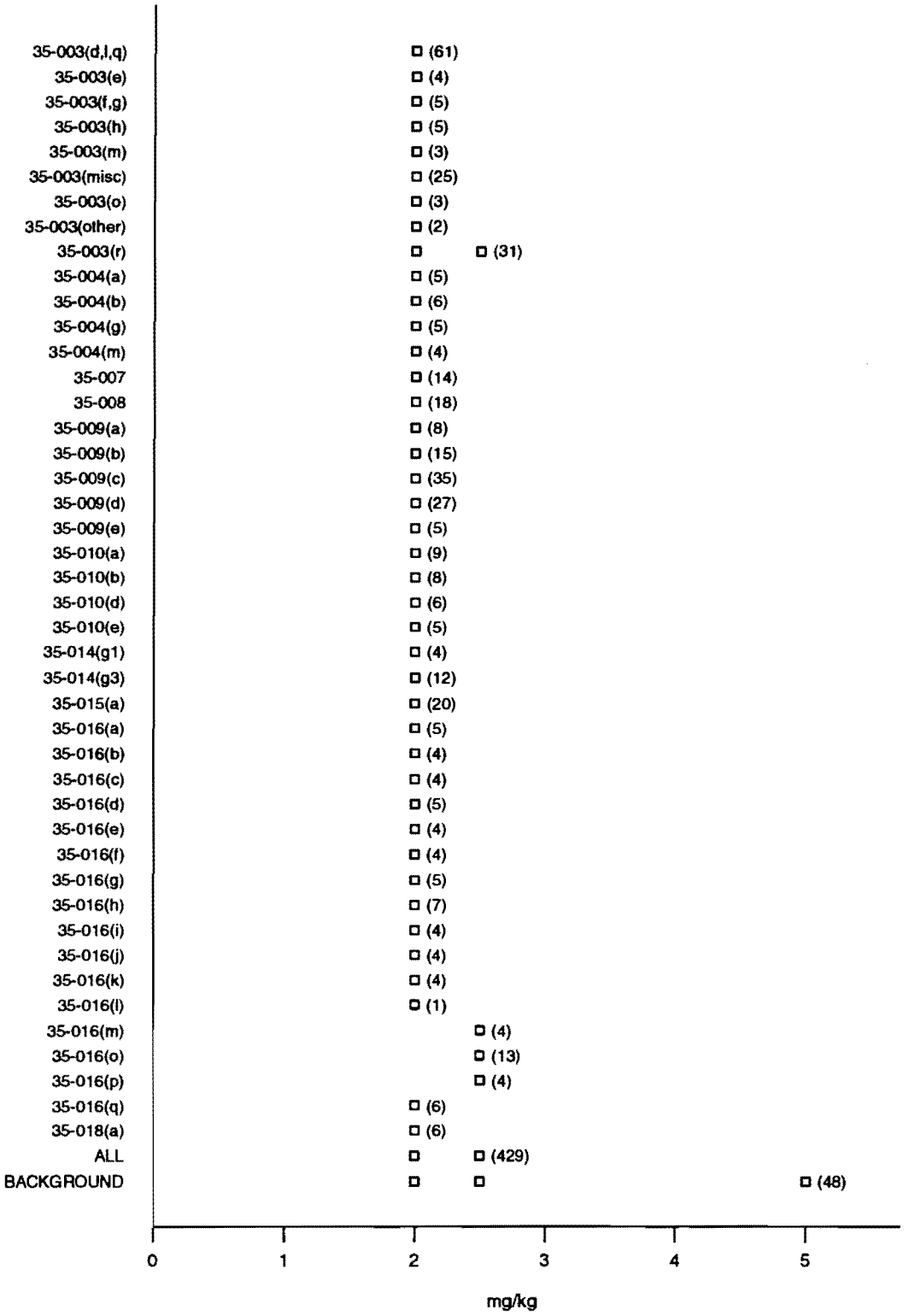

Figure AI-16. Distribution of selenium (uniformly nondetect) in TA-35 PRSs.

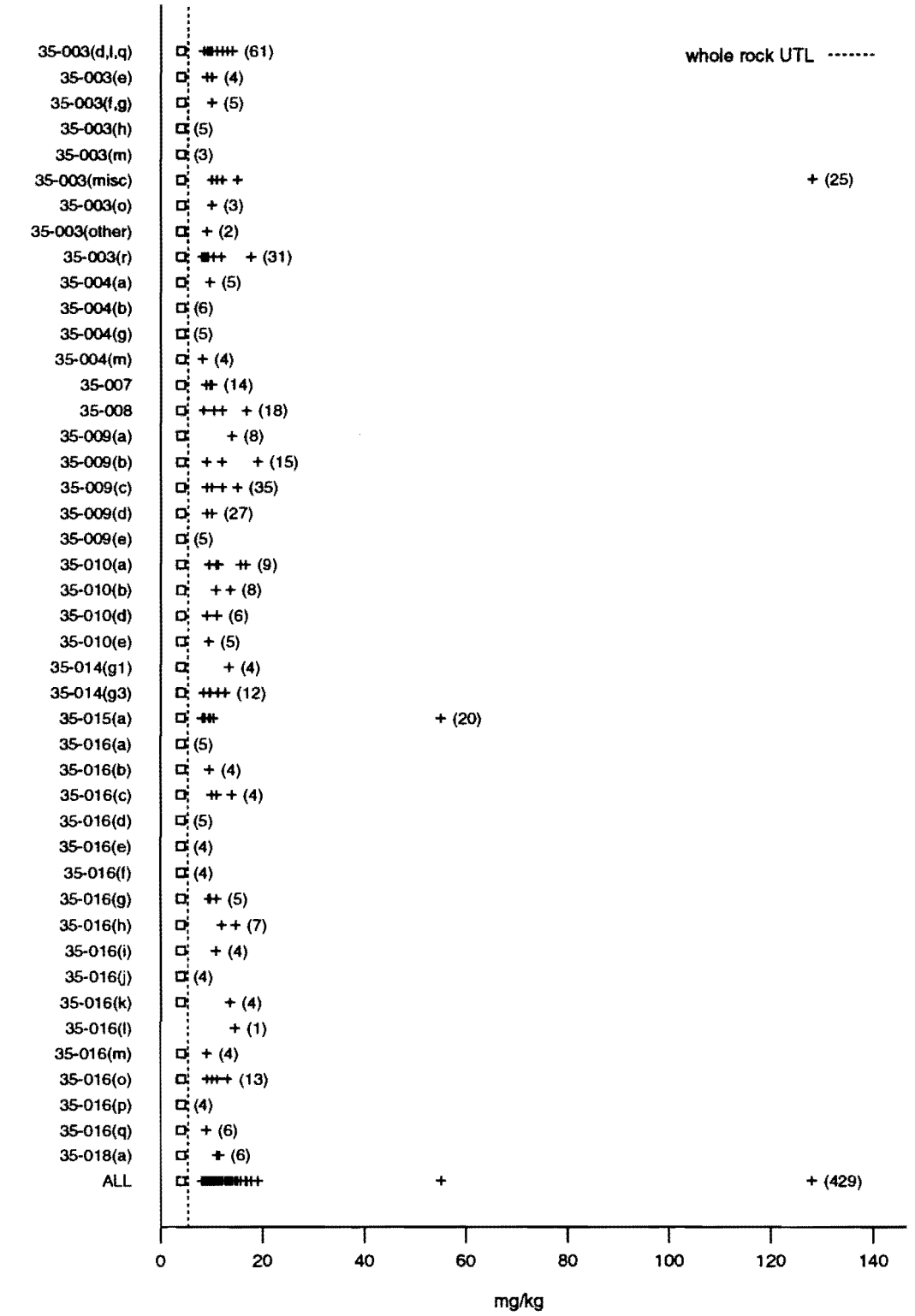

Figure AI-17. Distribution (point plot) of uranium in TA-35 PRSs.

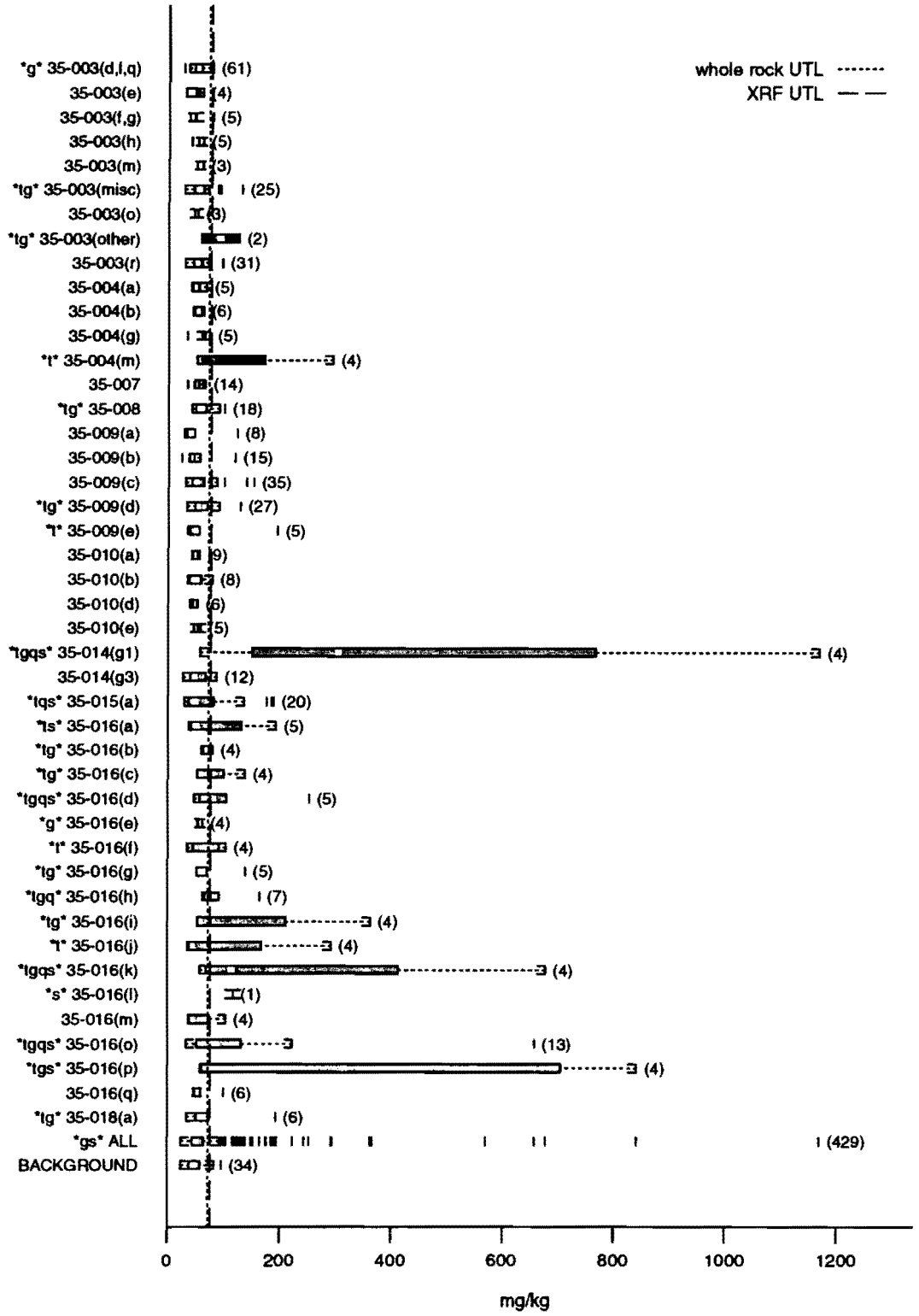

Figure AI-18. Distribution of zinc in TA-35 PRSs.

Attachment II

Geological Logs

ATTACHMENT II. GEOLOGICAL LOGS

This attachment contains geological logs for hollow-stem auger and hand-auger boreholes greater than 10 ft deep in the following potential release sites discussed in this Resource Conservation and Recovery Act facility investigation report.

- 35-003(h)
- 35-003(j)
- 35-003(k)
- 35-009(a)
- 35-009(b)
- 35-009(c)
- 35-009(d)

The geological logs contain lithologic descriptions, sample intervals and identification numbers, moisture content, and field screening values.

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Field Unit 4 Geological Log

Technical Area: **35**
Location ID: **35-2033**
Core Size: **3.25 in.**
Method: **Hollow-stem auger**

PRS No.: **35-009(a)**
Surface Elevation: **7,203 ft**
Total Depth: **20 ft**

Page: **1 of 1**
Date: **01-18-94**
Geologist: **Stephen Stellavato**
Field Team Leader: **Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							ASPHALT
-1							SAND: medium brown
-2							CLAY: brown, hard
-3							SAND: brown, medium grain
-4							SAND with CLAY and TUFF cobbles: light gray to light brown, medium grain
-5							SAND: light brown, medium grain
-6							TUFF: light gray,
-7							CLAY: red
-8		AAA6417		0	190		TUFF: light pink,consolidated
-9							
-10							
-11							
-12							Fractured TUFF: with red clay in weathered fractures
-13		AAA6418		0	250		TUFF: light pink, consolidated
-14							
-15							
-16							Fractured TUFF: with red clay in weathered fractures
-17		AAA6419		0	190		TUFF: light pink, consolidated
-18							
-19							
-20							

Field Unit 4 Geological Log

Technical Area:	35	PRS No.:	35-009(a)	Page:	1 of 1
Location ID:	35-2034	Surface Elevation:	7,202 ft	Date:	01-18-94
Core Size:	3.25 in.	Total Depth:	20 ft		
Method:	Hollow-stem auger			Geologist:	Stephen Stellavato
				Field Team Leader:	Stephen Stellavato

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							ASPHALT
-1							SAND: brown, medium grain, with some angular cobbles
-2							SAND: brown, medium grain
-3							CLAY: light brown, soft
							SAND: brown, medium grain
-4							SAND with CLAY and TUFF cobbles: light gray to light brown, medium grain
-5							TUFF: unconsolidated, light pink
-6		AAA6420		0	190		TUFF: light pink, consolidated, weathered fracture at 9.5 ft
-7							
-8							
-9							
-10							
-11							
-12							
-13							
-14		AAA6421		0	190		Fractured TUFF: light pink, weathered, with light red clay in fractures
-15							TUFF: light pink,consolidated
-16							
-17							
-18							
-19							
-20		AAA6422		0	190		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(a)**	Page:	**1 of 1**
Location ID:	**35-2035**	Surface Elevation:	**7,195 ft**	Date:	**12-09-93**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger with 5-ft core barrel**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							SAND with CLAY and TUFF cobbles: light brown, medium grain
-1							
-2		AAA6381		0	200		TUFF: pink
-3							
-4							
-5							
-6							
-7							
-8							
-9							CLAY: hard, red-orange
-10		AAA6382		0	200		Fractured TUFF: light pink, weathered at 16.8, 18.0 and 18.7 ft.
-11							
-12							
-13							
-14							
-15		AAA6383		0	200		
-16							
-17							
-18		AAA6384		0	200		
-19							
-20							

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(a)**	Page:	**1 of 1**
Location ID:	**35-2036**	Surface Elevation:	**7,193 ft**	Date:	**12-09-93**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger with 5-ft core barrel**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							SAND: light brown, medium grain
-1		AAA6401		0	220		Fractured TUFF: light pink, weathered along fractures
-2							
-3							
-4							
-5							
-6							
-7							
-8		AAA6402		0	220		
-9							
-10							
-11							
-12							
-13							
-14							
-15		AAA6403		0	220		TUFF: light pink
-16							
-17							
-18							
-19							
-20		AAA6404		0	220		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(a)**	Page:	**1 of 1**
Location ID:	**35-2037**	Surface Elevation:	**7,191 ft**	Date:	**12-09-93**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger with 5-ft core barrel**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							SAND: light brown, medium grain, 20% humus
-1							
-2							
-3							
-4		AAA6429 AAA6433		0	220		TUFF: light pink, weathered fracture zones at 6.5 ft and at 13.5 ft
-5							
-6							
-7							
-8							
-9							
-10		AAA6430		0	180		
-11							
-12							
-13							
-14		AAA6431		0	180		
-15							
-16							
-17							
-18							
-19							
-20		AAA6432		0	200		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(a)**	Page:	**1 of 1**
Location ID:	**35-2038**	Surface Elevation:	**7,187 ft**	Date:	**12-10-93**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger with 5-ft core barrel**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							Weathered TUFF: light pink, fracture at 3.5 ft
-1							
-2							
-3		AAA6437		0	230		
-4							TUFF: light pink, with weathered fracture at 4.8 ft
-5							TUFF: light pink, consolidated
-6							
-7							
-8							
-9							
-10		AAA6438		0	150		
-11							
-12							
-13							
-14							
-15		AAA6439		0	200		
-16							
-17							Fractured Tuff: weathered fracture zones at 17.0 and 19.5 ft
-18							
-19							
-20		AAA6440		0	200		

Field Unit 4 Geological Log

Technical Area:	35	PRS No.:	35-009(b)	Page:	1 of 1
Location ID:	35-2039	Surface Elevation:	7,200 ft	Date:	01-19-94
Core Size:	3.25 in.	Total Depth:	20 ft		
Method:	Hollow-stem auger			Geologist:	Stephen Stellavato
				Field Team Leader:	Stephen Stellavato

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							ASPHALT
-1							SAND: brown, medium grain, with some angular cobbles
-2							SAND with CLAY and TUFF cobbles: brown to light pink, medium grain
-3							SAND: brown, medium grain
-4							Weathered TUFF: dark pink to light brown, fractured, with clay and roots in fractures
-5							Fractured TUFF: unconsolidated, light pink
-6		AAA6409		0	200		TUFF: light pink, consolidated, weathered fracture at 11.4 ft
-7							
-8							
-9							
-10							
-11							
-12		AAA6410		0	160		
-13							
-14							
-15							
-16							
-17							
-18							
-19							
-20		AAA6411		0	160		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(b)**	Page:	**1 of 1**
Location ID:	**35-2040**	Surface Elevation:	**7,200 ft**	Date:	**01-19-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							ASPHALT
-1							SAND with large angular cobbles: brown, medium grain
-2							
-3							
-4							Weathered TUFF: dark pink
-5							SAND: brown, medium grain
-6							Weathered TUFF: dark pink
-7		AAA6412		0	160		SAND: brown, medium grain
-8							TUFF: light pink, consolidated, weathered clay-filled fracture at 8.5 ft
-9							
-10							
-11							
-12							
-13							
-14							
-15		AAA6413		0	160		
-16							
-17							
-18							
-19							
-20		AAA6414		0	200		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(b)**	Page:	**1 of 1**
Location ID:	**35-2041**	Surface Elevation:	**7,193 ft**	Date:	**01-20-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							ASPHALT
-1							SAND: with some subrounded cobbles, brown, medium grain
-2							
-3							Weathered TUFF: light pink
							NO RECOVERY
-4							SAND: with some subrounded cobbles, brown, medium grain
-5		AAA6461		0	160		Weathered TUFF: light pink
-6							TUFF: light pink, consolidated, clay filled fracture zone at 11.5 ft
-7							
-8							
-9							
-10		AAA6462 AAA6471		0	180		
-11							
-12							
-13							
-14							Fractured TUFF: light pink, consolidated, fracturefilled with light red clay
-15		AAA6463		0	160		
-16							
-17							
-18							
-19							
-20		AAA6474		0	160		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(b)**	Page:	**1 of 1**
Location ID:	**35-2042**	Surface Elevation:	**7,194 ft**	Date:	**01-20-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							ASPHALT
-1							SAND with large angular cobbles: brown, medium grain
-2							
-3							NO RECOVERY
-4							SAND with large angular cobbles: brown, medium grain
-5		AAA6464		0	160		
-6							SAND: light gray, some brown spotting, medium grain
-7		AAA6465		0	180		SAND and cobbles: subrounded, brown, medium grain
-8							TUFF: light pink, consolidated, clay filled fracture zone at 9.5 ft
-9							
-10							
-11							
-12							
-13							
-14							
-15		AAA6466		0	160		Fractured TUFF: light pink, consolidated, fracturefilled with light red clay
-16							
-17							
-18							
-19							
-20		AAA6467		0	200		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(c)**	Page:	**1 of 1**
Location ID:	**35-2049**	Surface Elevation:	**7,199 ft**	Date:	**01-25-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							CLAY with TUFF cobbles: dark brown, very hard,
-1							NO RECOVERY
-2							CLAY with TUFF cobbles: dark brown, very hard,
-3							Fractured TUFF: light pink, weathered fractures filled with hard, dark red clay
-4							
-5							TUFF: light pink, consolidated
-6							
-7							Fractured TUFF: light pink, large weathered fractures filled with hard, dark red clay
-8							
-9		AAA6495		0	200		
-10							TUFF: light pink, consolidated
-11							
-12							Fractured TUFF: light pink, weathered fractures filled with hard, dark red clay and roots
-13		AAA6496		0	200		
-14							TUFF: light pink, consolidated
-15							
-16							
-17							Fractured TUFF: light pink, weathered fracture zones
-18							
-19							
-20		AAA6497		0	200		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(c)**	Page:	**1 of 1**
Location ID:	**35-2050**	Surface Elevation:	**7,200 ft**	Date:	**01-25-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							CLAY: light red, very hard, with layer of wood at 0.7 ft
-1							
-2							NO RECOVERY
-3							
-4							SAND: light gray, medium grain, tuffaceous
-5							TUFF: light pink, with weathered fracture zones at 11.5 ft and 17.5 ft
-6							
-7							
-8							
-9							
-10		AAA6498		0	200		
-11							
-12		AAA6499		0	200		
-13							
-14							
-15							
-16							
-17							
-18							
-19							
-20		AAA6500		0	200		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(c)**	Page:	**1 of 1**
Location ID:	**35-2051**	Surface Elevation:	**7,196 ft**	Date:	**01-27-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							Clay with TUFF cobbles: light brown, very hard
-1							
-2							
-3							SAND and cobbles: light brown, medium grain
-4		AAA6525		0	200		TUFF: light gray, consolidated
-5							
-6							Fractured TUFF: light gray, consolidated, with weathered fracture zones throughout
-7							
-8							
-9							
-10		AAA6526		0	200		
-11							
-12							
-13							
-14							
-15		AAA6527		0	200		
-16							
-17							
-18		AAA6528		0	280		
-19							
-20							

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(c)**	Page:	**1 of 1**
Location ID:	**35-2052**	Surface Elevation:	**7,197 ft**	Date:	**01-27-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							SAND and cobbles: light brown, medium grain
-1							
-2							SAND: light gray, medium grain, tuffaceous
-3							
-4							SAND and cobbles: light gray, medium grain
-5		AAA6513		0	200		
-6							NO RECOVERY
-7							
-8							
-9		AAA6514					SAND: light brown, medium grain, with pieces of clay pipe
-10				0	200		TUFF: light pink, consolidated, with small weathered fracture zone at 19.5 ft
-11							
-12							
-13							
-14							
-15		AAA6515		0	200		
-16							
-17							
-18							
-19							
-20		AAA6516		0	200		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(c)**	Page:	**1 of 1**
Location ID:	**35-2053**	Surface Elevation:	**7,197 ft**	Date:	**01-26-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							SAND and cobbles: light brown, medium grain
-1							CLAY: dark brown, hard
-2							SAND: light brown, medium grain
-3							CLAY: dark red, hard
							SAND: light brown, medium grain
-4		AAA6508 AAA6509		0	230		Fractured TUFF: light pink, consolidated, with weathered fracture zones filled with hard, dark red clay and roots throughout
-5							
-6							
-7							
-8							
-9							
-10		AAA6510		0	200		
-11							
-12							
-13							
-14							
-15		AAA6511		0	200		
-16							
-17							
-18		AAA6512		0	220		
-19							
-20							

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(c)**	Page:	**1 of 1**
Location ID:	**35-2054**	Surface Elevation:	**7,198 ft**	Date:	**01-26-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							SAND and cobbles: light brown, medium grain
-1							TUFF: light pink, very hard
-2							SAND and cobbles: light brown, medium grain
-3							SAND: light pink, medium grain, tuffaceous
-4							SAND and cobbles: light brown, medium grain
-5		AAA6513		0	200		NO RECOVERY
-6							
-7							
-8							TUFF: light pink, consolidated, with weathered fracture zones fat 12.5 ft and 19.5 ft
-9		AAA6514		0	200		
-10							
-11							
-12							
-13							
-14							
-15		AAA6515		0	200		
-16							
-17							
-18							
-19							
-20		AAA6516		0	200		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(c)**	Page:	**1 of 1**
Location ID:	**35-2055**	Surface Elevation:	**7,197 ft**	Date:	**01-24-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							SAND and cobbles: light brown, fine grain
-1							NO RECOVERY
-2							CLAY and SAND: light brown
-3							CLAY: with some sand and angular tuff cobbles, dark brown, hard
-4							
-5		AAA6480		0	240		Fractured TUFF: light pink, weathered, with roots
-6							TUFF: light pink, with weathered fracture zones at 7.2 ft, 9.5 ft, and 13.6 ft
-7							
-8							
-9							
-10		AAA6481		0	220		
-11							
-12							
-13							
-14							
-15		AAA6482		0	180		
-16							
-17							Fractured TUFF: light pink, with large red pyroclasts, roots in fractures
-18							
-19							
-20		AAA6483		0	180		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(c)**	Page:	**1 of 1**
Location ID:	**35-2056**	Surface Elevation:	**7,199 ft**	Date:	**01-24-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							FINE SAND: light brown
-1							SAND with large angular cobbles: and roots, light brown
-2							FINE SAND: light brown
-3							CLAY: dark brown, hard
-4							Weathered TUFF: dark pink
-5		AAA6484		0	180		SAND: light pink, medium grain CLAY: dark red, hard
-6							Weathered TUFF: light pink CLAY: dark red, hard
-7		AAA6485		0	180		Fractured TUFF: light pink, consolidated, light red fracture zones
-8							
-9							
-10							
-11							TUFF: light pink, consolidated, fracture zone at 14 ft
-12							
-13							
-14		AAA6486		0	180		
-15							
-16							
-17							
-18							Fractured TUFF: light pink, consolidated, fracture filled with light red clay
-19							
-20		AAA6487		0	180		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(d)**	Page:	**1 of 1**
Location ID:	**35-2057**	Surface Elevation:	**7,191 ft**	Date:	**02-04-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hand auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							FINE SAND: light brown
-1					200		SAND and cobbles: light gray, tuffaceous
-2					200		TUFF: light gray, consolidated, fractures at 5.0 ft, 7.5 ft, 8.5 ft, and 11.5 ft.; large root at 11.5 ft.
-3				0	200		
-4					200		
-5					200		
-6					200		
-7		AAA6564		0.4	200		
-8					200		
-9		AAA6565		1.2	250		
-10					200		
-11					200		
-12		AAA6566			200		
-13					200		
-14					200		
-15							

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(d)**	Page:	**1 of 1**
Location ID:	**35-2058**	Surface Elevation:	**7,188 ft**	Date:	**02-04-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hand auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							FINE SAND: light brown, little humus
-1					170		SAND and cobbles: light gray, tuffaceous
-2					170		TUFF: light gray
-3				0	170		
-4					170		
-5					170		
-6					170		
-7		AAA6567		0	170		
-8					170		
-9		AAA6568		0	230		
-10					170		
-11					170		Fractured TUFF: fractures are weathered, roots at 13 to 15 ft.
-12					170		
-13		AAA6569			200		
-14		AAA6570		0	200		
-15					170		
-16					170		
-17					170		
-18					170		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(d)**	Page:	**1 of 1**
Location ID:	**35-2059**	Surface Elevation:	**7,178 ft**	Date:	**02-02-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							FINE SAND: light brown
-1							CLAY: light gray, very hard
-2		AAA6504		0	200		Large COBBLES: with broken clay pipe
-3							
-4							
-5							
-6							SAND and cobbles: light gray to dark brown, medium grain
-7							
-8		AAA6517		0	200		Fractured TUFF: light pink, consolidated, weathered fractures throughout
-9							
-10							
-11							
-12							
-13							
-14							
-15		AAA6518		0	200		
-16							
-17							
-18		AAA6519		0	200		
-19							
-20							

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(d)**	Page:	**1 of 1**
Location ID:	**35-2060**	Surface Elevation:	**7,177 ft**	Date:	**02-02-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							FINE SAND: light gray
-1							CLAY: very hard
-2				0	200		SAND and cobbles: light gray, fine grain
-3							NO RECOVERY
-4							SAND and cobbles: angular to sub-angular, quartz, arkose, granitic
-5		AAA6520		0	200		SAND: dark brown, medium grain
-6							NO RECOVERY
-7							SAND: dark brown, medium grain
-8		AAA6534		4.0	200		Fractured TUFF: light pink, consolidated, weathered fractures throughout
-9							
-10							
-11							
-12							
-13					200		
-14							
-15		AAA6535		3.0	200		
-16							
-17							
-18		AAA6536		0	200		
-19							
-20							

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(d)**	Page:	**1 of 1**
Location ID:	**35-2061**	Surface Elevation:	**7,176 ft**	Date:	**02-03-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							FINE SAND: light brown
-1							TUFF: light gray, very hard
-2		AAA6547		0	200		SAND: light gray, tuffaceous
-3							Large COBBLES: with broken clay pipe, NOTE: no core recovered, description derived from cuttings
-4							
-5							
-6							
-7							
-8		AAA6534		0	200		SAND and cobbles: dark brown, medium grain
-9							TUFF: light gray, consolidated, weathered fractures at 9.4 ft, 14.5 ft, 16.5 ft, and 17.5 ft
-10							
-11							
-12							
-13							
-14							
-15		AAA6535		0	200		
-16							
-17							
-18		AAA6536		0	200		
-19							
-20							

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(d)**	Page:	**1 of 1**
Location ID:	**35-2062**	Surface Elevation:	**7,174 ft**	Date:	**02-03-94**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							FINE SAND: light brown
-1							
-2		AAA6552		0	200		SAND and cobbles: light gray, tuffaceous
-3							Large COBBLES: NOTE: no core recovered, description derived from cuttings
-4							
-5							
-6							
-7							
-8							SAND and cobbles: dark brown, medium grain
-9							
-10		AAA6553		0	200		TUFF: light gray, consolidated
-11							Fractured TUFF: with dark red clay and some roots
-12							
-13							
-14							
-15		AAA6554		0	200		
-16							TUFF: light gray, consolidated, fracture at 19.5 ft
-17							
-18							
-19							
-20		AAA6555		0	200		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(a)**	Page:	**1 of 1**
Location ID:	**35-2221**	Surface Elevation:	**7,193 ft**	Date:	**12-10-93**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**	Geologist:	**Stephen Stellavato**
Method:	**Hollow-stem auger with 5-ft core barrel**			Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							NO RECOVERY
-1							
-2							SAND: light brown, medium grain
-3							Weathered TUFF: light pink,
-4							Fractured TUFF: light pink, weathered along fractures
-5		AAA6441		0	200		TUFF: light pink, with weathered fracture zone at 8.9 ft
-6							
-7							
-8							
-9							
-10		AAA6442		0	200		
-11							
-12							
-13							
-14							Fractured TUFF: light pink, large weathered fracture at 14-15 ft interval
-15		AAA6443		0	230		
-16							
-17							
-18							
-19		AAA6444 AAA6445		0	180		
-20							

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-009(a)**	Page:	**1 of 1**
Location ID:	**35-2222**	Surface Elevation:	**7,190 ft**	Date:	**12-10-93**
Core Size:	**3.25 in.**	Total Depth:	**20 ft**		
Method:	**Hollow-stem auger with 5-ft core barrel**			Geologist:	**Stephen Stellavato**
				Field Team Leader:	**Stephen Stellavato**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							SAND: light brown, medium grain
-1							
-2							Weathered TUFF: light pink
-3							TUFF: light pink, consolidated, with wethered fracture at 10.0 ft
-4		AAA6446		0	200		
-5							
-6							
-7							
-8							
-9							
-10		AAA6447		0	230		
-11							
-12							
-13							
-14							
-15		AAA6448		0	200		
-16							
-17							
-18							
-19							
-20		AAA6449		0	230		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-003(j)**	Page:	**1 of 1**
Location ID:	**35-2288**	Surface Elevation:	**7,207 ft**	Date:	**12-18-95**
Core Size:	**4 in.**	Total Depth:	**10 ft**	Geologist:	**Leslie Sontag**
Method:	**Hollow-stem auger**			Field Team Leader:	**Leslie Sontag**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							FILL MATERIAL: sand, red
-1							FILL MATERIAL: gray, clay with sand
-2		0435-95-0211		0	90		
-3							TUFF: crystalline, red to gray
-4		0435-95-0212		0	80		
-5							
-6							
-7		0435-95-0213		0	100		
-8							
-9							
-10		0435-95-0214		0	80		

Field Unit 4 Geological Log

Technical Area: **35**
Location ID: **35-2289**
Core Size: **4 in.**
Method: **Hollow-stem auger**
PRS No.: **35-003(j)**
Surface Elevation: **7,207 ft**
Total Depth: **10 ft**
Page: **1 of 1**
Date: **12-18-95**
Geologist: **Leslie Sontag**
Field Team Leader: **Leslie Sontag**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							FILL MATERIAL: sand, red
-1							FILL MATERIAL: red to gray, clay with sand
-2		0435-95-0215		0	80		
-3							
-4		0435-95-0216		0	100		Weathered TUFF: crystalline, red to gray
-5							
-6							
-7		0435-95-0217		0	100		
-8							
-9							
-10		0435-95-0218		0	80		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-003(k)**	Page:	**1 of 1**
Location ID:	**35-2291**	Surface Elevation:	**7,205 ft**	Date:	**12-18-95**
Core Size:	**4 in.**	Total Depth:	**10 ft**	Geologist:	**Leslie Sontag**
Method:	**Hollow-stem auger**			Field Team Leader:	**Leslie Sontag**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							FILL MATERIAL: red, sand with cobbles
-1							
-2		0435-95-0219		0	90		FILL MATERIAL: brown to red, clay with cobbles
-3							
-4		0435-95-0220		0	100		
-5							
-6							TUFF: crystalline, gray to red
-7		0435-95-0221		0	80		
-8							
-9							
-10		0435-95-0222		0	70		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-003(k)**	Page:	**1 of 1**
Location ID:	**35-2292**	Surface Elevation:	**7,206 ft**	Date:	**12-18-95**
Core Size:	**4 in.**	Total Depth:	**10 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Leslie Sontag**
				Field Team Leader:	**Leslie Sontag**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							ASPHALT
-1							FILL MATERIAL: clay, with cobbles and sand, red to brown
-2		0435-95-0223		0	100		
-3							TUFF: crystalline, red to gray
-4							
-5		0435-95-0224		0	90		
-6							
-7		0435-95-0225		0	90		
-8							
-9							
-10		0435-95-0226		0	90		

Field Unit 4 Geological Log

Technical Area:	**35**	PRS No.:	**35-003(k)**	Page:	**1 of 1**
Location ID:	**35-2293**	Surface Elevation:	**7,204 ft**	Date:	**12-18-95**
Core Size:	**4 in.**	Total Depth:	**10 ft**		
Method:	**Hollow-stem auger**			Geologist:	**Leslie Sontag**
				Field Team Leader:	**Leslie Sontag**

Depth in feet	Sample Interval	Sample ID	Moisture (Dry / Wet)	OVA (ppm)	Beta-gamma (cpm)	Lithology	Description
0							FILL MATERIAL: clay, with cobbles and sand, brown
-1							
-2		0435-95-0227		0	90		
-3							FILL MATERIAL: clayey, brown
-4		0435-95-0228		0	90		
-5							
-6							TUFF: crystalline, gray
-7		0435-95-0229		0	80		
-8							
-9							
-10		0435-95-0230		0	90		CLAY: red TUFF: crystalline, gray