LANL
HSWA
FCA 1
TA 42
18

Ron K
Barbara
file
Terri ✓
Susan ✓

Los Alamos National Laboratory

ENVIRONMENTAL RESTORATION

University of California
Environmental Restoration, MS M992
Los Alamos, New Mexico 87545
505-665-4557
FAX 505-665-4747

U. S. Department of Energy
Los Alamos Area Office, MS A316
Los Alamos, New Mexico 87544
505-665-7203
FAX 505-665-4504

ENTERED

Date: October 6, 1995
Refer to: EM/ER:95-539

OCT 12 1995

Mr. David Neleigh
NM Federal Facilities Section
Multimedia Planning & Permitting Division
US EPA Region 6, 6PD-N
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

SUBJECT: SUBMITTAL OF THE RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION (RFI) REPORT FOR POTENTIAL RELEASE SITES (PRSs) IN TECHNICAL AREA (TA) 42

Dear Neleigh:

Enclosed are two copies of the Los Alamos National Laboratory's RFI Report concerning PRSs 42-001(a), 42-001(b), 42-001(c), 42-002(a), 42-002(b), and 42-003 in TA-42. The report documents the field work performed as detailed in the approved RFI Work Plan for Operable Unit 1129 and the results of the sampling. This RFI Report is due to your office on September 29, 1995.

Please ask your office to contact Allyn Pratt or Bob Simeone of our staff at (505) 667-4308 or (505) 667-0587, respectively, 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

2517

Environmental Restoration

An Equal Opportunity Employer/Operated by the University of California

TR

Enclosure: Two Copies of RFI Report for PRSs in TA-42

Cy (w/enc.):
B. Garcia, NMED-HRMB
D. Griswold, ERD, AL, MS A906
J. Harry, EM/ER, MS M992
A. Pratt, EES-13, MS J521
E. Merrill, EM-453, DOE-HQ
T. Taylor, LAAO, MS A316
B. Simeone, LAAO, MS A316
N. Weber, Bureau Chief, NMED-AIP
J. White, ESH-19, MS K498
S. Yanicak, NMED-AIP
EM/ER File, MS M992
RPF, MS M707

Cy (w/o enc.):
T. Baca, EM, MS J591
T. Glatzmaier, DDEES/ER, MS M992
D. McInroy, EM/ER, MS M992
G. Rael, ERD, AL, MS A906
W. Spurgeon, EM-453, DOE-HQ
J. Vozella, LAAO, MS A316

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: Resource Conservation And Recovery Act Facility Investigation Report For Potential Release Sites In Technical Area 42

Name: _____ Date: 9-27-95

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

or

Tom Baca, Program Director
Environmental Management
Los Alamos National Laboratory

Name: _____ Date: 9/27/95

Joseph Vozella,
Acting Assistant Area Manager of
Environment Projects
Environment, Safety, and Health Branch
DOE-Los Alamos Area Office

or

Theodore J. Taylor
Program Manager
Environment Restoration Program
DOE-Los Alamos Area Office

RFI Report for Potential Release Sites

42-001(a)
42-001(b)
42-001(c)
42-002(a)
42-002(b)
42-003

(located in former Operable Unit 1129)

Field Unit 4

Environmental Restoration Project

August 1995

A Department of Energy
Environmental Cleanup Program

LIBRARY COPY

HSWA LANL 4/1129/42

LANL
4/1129/42

Los Alamos
NATIONAL LABORATORY

LA-UR-95-2881

CONTENTS i
List of Figures iii
List of Tables iv

ACRONYMS AND ABBREVIATIONS v

EXECUTIVE SUMMARY 1

1.0 INTRODUCTION 2
1.1 General Site History 2
1.2 RFI Overview 2
1.3 Field Activities 4

2.0 ENVIRONMENTAL SETTING 5
2.1 Climate 5
2.2 Geology 5
2.2.1 Geologic Setting 5
2.2.1.1 Stratigraphy 7
2.2.1.2 Structure 8
2.2.2 Soils 8
2.3 Hydrology 8
2.3.1 Surface Water Hydrology 9
2.3.2 Vadose Zone Hydrology 9
2.3.3 Saturated Zone Hydrology 9
2.4 Biological and Cultural Surveys 9
2.4.1 Biological Surveys 9
2.4.2 Cultural Surveys 10

3.0 APPROACH TO DATA ASSESSMENT AND ANALYSIS 12
3.1 Summary of QC Activities 12
3.1.1 Inorganic Analyses 12
3.1.2 Organic Analyses 13
3.1.3 Radiochemistry Analyses 13
3.1.4 High Explosives Analyses 14
3.1.5 Field QC Activities 14
3.2 Screening Assessment Methodology 15
3.2.1 Background Comparison 15
3.2.2 Screening Action Levels Comparison/Other Standards 18
3.2.3 Ecotoxicological Screening Assessment Methodology 19
3.2.3.1 Ranking of Habitat Condition and Receptor Accessibility to Constituents of Potential Concern 20
3.2.3.2 Comparison with Ecotoxicological Screening Action Levels 21

3.3 Risk Assessment Methodology 21
3.4 Development of Conclusions and Recommendations 21

4.0 SITE-SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS 22
4.1 Aggregate J 22
4.1.1 Previous Investigations 23
4.1.1.1 Environmental Surveillance Group Study 23
4.1.1.2 Environmental Protection Group Reconnaissance Study 24
4.1.2 Field Investigation 25
4.1.2.1 Results of Field Surveys 29
4.1.2.2 Results of Field Screening 32
4.1.3 Screening Assessment 32
4.1.3.1 Comparison with Background/SALs 34
4.1.3.2 Data Interpretation 37
4.1.3.3 Risk Assessment 37
4.1.3.4 Ecotoxicological Screening Assessment 38
4.1.4 Conclusions and Recommendations 38
4.1.5 Further Investigations 38

REFERENCES 41

APPENDICES 45
Appendix A Data Quality Evaluation 45
Appendix B Analytical Data Set for Aggregate J 49
Appendix C Geological Logs for Aggregate J 55
Appendix D Human Health Screening Assessment 61

LIST OF FIGURES

1	General location map for former TA-42.	3
2	Generalized cross section of Pajarito Plateau with approximate location of former TA-42.	6
3	Decision logic for identifying contaminants of concern in the human health screening assessment.	16
4	Decision logic for screening of ecotoxicological risk.	17
5	Habitat evaluation model for identifying PRSs that may be excluded from further consideration.	20
6	Potential release sites and sampling locations at former TA-42.	27
7	Schematic cross section through former TA-42; (A) north view, (B) east view, and (C) east view.	30
8	Former TA-42 site map showing reconnaissance sample locations, cross sections, and proposed Nuclear Safeguards Technology Laboratory.	31
9	Data summary for Aggregate J.	36
10	Aerial photograph of former TA-42 showing current site conditions, PRSs, and sample locations.	39
C-1	Geological log of borehole at location ID No. 42-1028.	57
C-2	Geological log of borehole at location ID No. 42-1029.	58
C-3	Geological log of borehole at location ID No. 42-1030.	59
C-4	Geological log of borehole at location ID No. 42-1031.	60
D-1	Organization of data tables for screening assessment purposes.	63

LIST OF TABLES

1	Results of the Investigation	1, 22
2	Threatened, Endangered, and Sensitive Species	10
3	Results of Environmental Surveillance Group Study After D&D	24
4	1991 EM-8 Reconnaissance Results for Near-Surface Sampling at Former TA-42	25
5	Analytical Results from 1991 EM-8 Reconnaissance Sampling at Former TA-42	26
6	Summary of OU 1129 Samples Collected at Former TA-42	28
7	Results from High-Volume Air Samplers	33
8	Constituents of Potential Concern Carried Forward to the SAL Comparison for Aggregate J	34
9	Comparison of Background Levels and Screening Action Levels with Constituents of Potential Concern in Aggregate J	35
A-1	Analytical Data Qualification Summary Table for Aggregate J	47
B-1	INC-12 Analytical Results of Sampling at Former TA-42	51
B-2	EDXRF Analysis Results of Lead Investigation at Former TA-42	52
B-3	Contract Laboratory Analytical Results	53
D-1	Screening Assessment for Radionuclides in Aggregate J	65
D-2	Screening Assessment for Lead in Aggregate J	69

ACRONYMS AND ABBREVIATIONS

CMS	corrective measures study
COC	contaminant of concern
COPC	constituent of potential concern
D&D	decontamination and decommissioning
DOE/AL	Department of Energy Albuquerque Operations Office
EC	expedited cleanup
EDL	estimated detection limit
EDXRF	energy dispersive x-ray fluorescence
ER	Environmental Restoration
ESAL	ecotoxicological screening action level
GFAA	graphite furnace atomic absorption
HVAS	high-volume air sampler
ICPMS	inductively coupled plasma mass spectroscopy
IWP	Installation Work Plan
MCA	multiple constituent analysis
MDA	minimum detectable activity
MS/MSD	matrix spike/matrix spike duplicate
Myr	million years
NFA	no further action
NSTL	Nuclear Safeguards Technology Laboratory
OU	Operable Unit
PCB	polychlorinated biphenyl
PRS	potential release site
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
SAL	screening action level
SAP	sampling and analysis plan
SVOC	semivolatile organic compound
TA	Technical Area
TCLP	toxicity characteristic leaching procedure
UTL	upper tolerance limit
VCA	voluntary corrective action
VOC	volatile organic compound

This page intentionally left blank

EXECUTIVE SUMMARY

This report describes the results of a Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) for Operable Unit (OU) 1129 to evaluate contamination at former Technical Area (TA) -42. The Department of Energy Albuquerque Operations Office (DOE/AL) used these results for construction validation of the Nuclear Safeguards Technology Laboratory (NSTL) to be constructed at the site. The PRSs at this site will now be recommended for no further action (NFA).

Sampling activities were conducted under the guidelines described in the May 1992 *RFI Work Plan for Operable Unit 1129* (LANL 1992, 7666) (hereafter referred to as "the work plan"). This investigation was considered to be the additional data gathering investigation (for which potential contaminants of concern [COCs] were already identified). The Environmental Protection Group reconnaissance study (see Section 4.1.1.2) was considered to be the Phase I investigation (in which the nature of contamination was determined).

TA-42 was the site of a radioactive waste incinerator facility that operated from 1951 to 1952. From 1957 to 1969 the incinerator facility was used to store and decontaminate equipment. The facilities were decommissioned, and the site was decontaminated in 1978. The following potential release sites (PRSs) in OU 1129 Aggregate J, which resulted from operations at former TA-42, were included in this characterization:

- 42-001(a), former location of an incinerator;
- 42-001(b and c), former location of two ash storage tanks;
- 42-002(a), former location of a building used as an indoor storage and decontamination area;
- 42-002(b), former outdoor decontamination area; and
- 42-003, former location of a septic tank and tile drain field.

There were no deviations from the revised sampling and analysis plan (SAP) for Aggregate J (LANL 1993, 48849). Activities described in this report were conducted in accordance with the Los Alamos National Laboratory (the Laboratory) Environmental Restoration (ER) Project administrative procedures and standard operating procedures. The results of the investigation of the PRSs are shown in Table 1.

TABLE 1

RESULTS OF THE INVESTIGATION

PRS	HSWA[a]		Proposed Action					
			NFA[b]	Accelerated Cleanup		Further Investigation		Rationale
	Yes	No		VCA[c]	EC[d]	Phase II	CMS[e]	
42-001(a)	X		X					Contamination below SALs[f] or UTLs[g]
42-001 (b and c)	X		X					Contamination below SALs or UTLs
42-002(b)	X		X					Contamination below SALs or UTLs
42-003	X		X					Contamination below SALs or UTLs
42-002(a)		X	X					Contamination below SALs or UTLs

a. HSWA = Hazardous and Solid Waste Amendments
b. NFA = no further action
c. VCA = voluntary corrective action
d. EC = expedited cleanup
e. CMS = corrective measures study
f. SAL = screening action level
g. UTL = upper tolerance limit (for soil background data)

1.0 INTRODUCTION

1.1 General Site History

A brief description of the general site history is presented below. For a more complete discussion, please refer to Section 3.4 of the work plan.

The area of former TA-42 is located within the boundaries of the current TA-55, the Plutonium Processing Facility. In 1951 an incinerator building was constructed to reduce the amount of radionuclide-contaminated waste produced at the Laboratory. The incinerator, which was never fully operational, was shut down less than one year after it was built (Harper and Garde 1981, 6286). Therefore, very little waste was probably associated with this facility. Structures associated with the incinerator include two ash storage tanks, a septic tank, a gas drip pot manhole, two water manholes, and a firehouse box. From 1957 to 1969 the building was used to store and decontaminate equipment. In the summer of 1969 an attempt was made to burn uncontaminated classified wastes at the incinerator (Harper and Garde 1981, 6286). However, by 1970 the process was discontinued, and all the combustibles were removed from the building (DOE 1987, 8663). In 1977 the building was decommissioned; in 1978 all the structures were removed during decontamination and decommissioning (D&D) (Harper and Garde 1981, 6286).

The handling of materials containing radionuclides (plutonium, uranium, tritium, americium, cesium, and others) has been documented (Enders 1965, 801; LASL circa 1977, 21560; Bradshaw 1977, 765; Meyer 1977, 875; Ahlquist 1978, 746). Other constituents of potential concern (COPCs) might have been generated because of grease, oil, solvents, and acids that were used during storage and decontamination of contaminated equipment.

Former TA-42 was chosen as the future construction site for the NSTL. The need for construction and the results from a reconnaissance sampling program accelerated the investigation of these selected PRSs (Fresquez 1991, 817).

The data in this RFI report are presented for a group of six PRSs designated as Aggregate J, which is the same grouping of PRSs that was described in the work plan. These PRSs were grouped together because of their geographical proximity and because they are all related to the same Laboratory operations (the incinerator facility and the decontamination area). Former TA-42 comprises Aggregate J (see Section 4.1 for details).

Aggregate J comprises the following PRSs:

- 42-001(a), former location of an incinerator;
- 42-001(b and c), former location of two ash storage tanks;
- 42-002(a), former location of a building used as an indoor storage and decontamination area;
- 42-002(b), former outdoor decontamination area; and
- 42-003, former location of a septic tank and tile drain field.

Figure 1 shows a general location map of former TA-42 and the associated PRSs.

1.2 RFI Overview

The objective of the RFI was to answer the following questions as stated in the SAP.

- Could potential COCs at former TA-42 be exposed during the construction phase of the NSTL?

- Based on the results from sampling and analysis, can a realistic remediation plan be developed if needed?

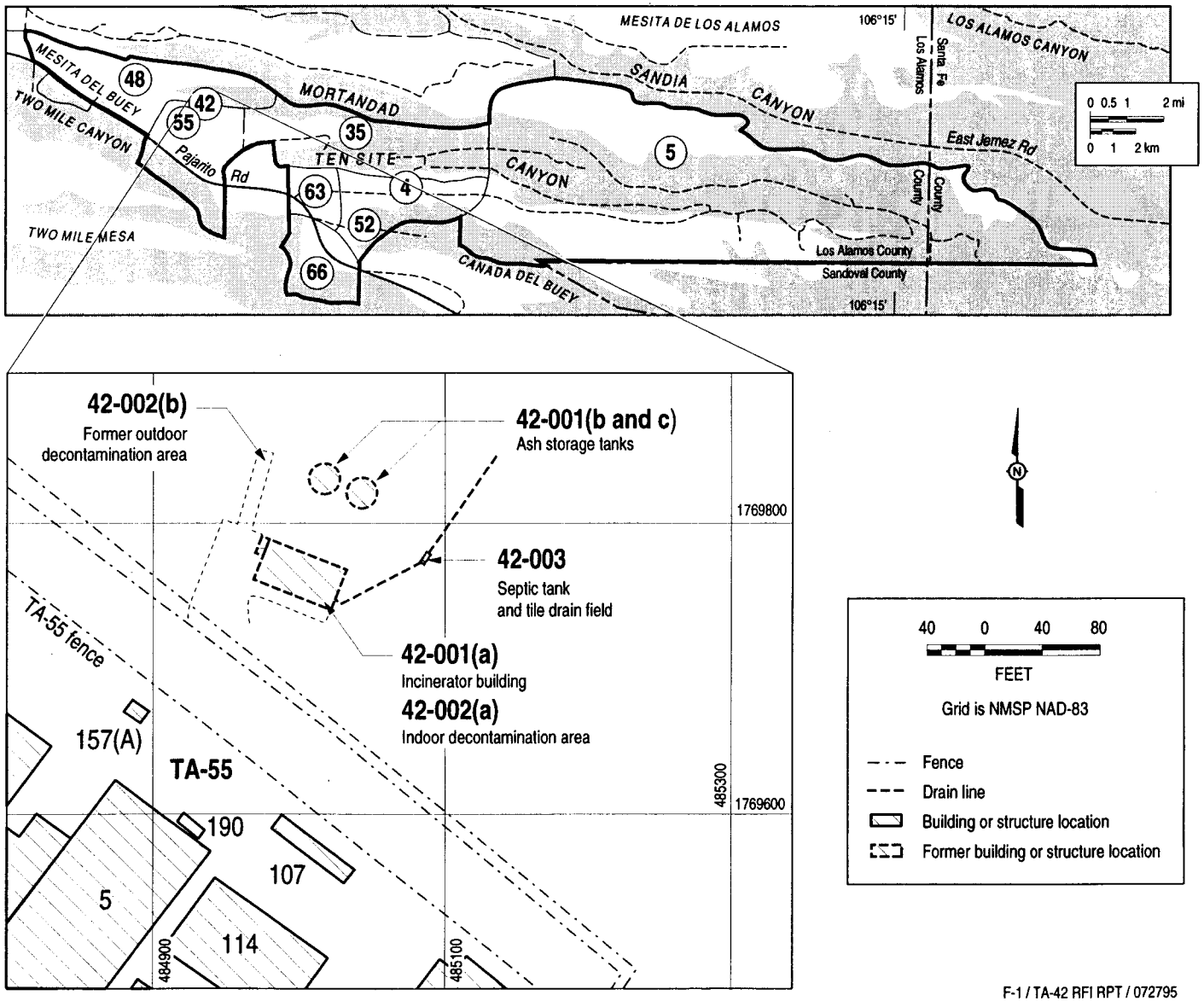


Figure 1. General location map for former TA-42.

- Is there any risk of exposure of the public or workers to COCs, and if there is, what is the risk of exposure from the amount and location of COCs at the site?

A description of the conceptual model is discussed in detail in Chapter 4.0 of the work plan.

The objective of the sampling was to detect and quantify contaminants and to estimate the extent of contamination at former TA-42.

1.3 Field Activities

The following field activities were conducted to support the investigation: an engineering survey, a radiation survey, a geologic survey, and sample collection. Samples were screened for radiation (alpha, beta, and gamma) and organic vapors before and during sampling. High-volume air samplers (HVASs) were installed on site to monitor dust emissions.

Sampling activities were conducted from July 18, 1992, to September 22, 1992. The OU 1129 field team used three methods to collect fill material, soil, and nonwelded tuff for sampling. They used a hand auger from the surface to a depth of 6 ft, a power-assisted hand auger for depths from 5 ft to 11 ft, and a hollow-stem auger for depths to 30 ft. They collected a total of 51 samples. See Section 4.1.2 for details.

There were no deviations from the work plan.

2.0 ENVIRONMENTAL SETTING

Former TA-42 was located in the north-central part of the Laboratory (within the current boundary of TA-55) off Pajarito Road on the Mesita del Buey. It is bounded by Mortandad Canyon to the north and east and by Two Mile Canyon to the south (see Figure 1). The elevation of TA-42 is approximately 7,300 ft above sea level.

The top of Mesita del Buey is composed of poorly developed, gravelly or coarse sandy soils ranging in thickness from 0 to 28 in. (Nyhan et al. 1978, 5702). These soils were derived from the Bandelier Tuff, which is the primary stratigraphic unit at TA-42 and has an approximate thickness of 650 ft. Surface waters from heavy thunderstorms and spring snowmelt flow directly into Mortandad Canyon. This surface water flow is directly responsible for the small drainage rills found on the top of the mesa and the larger drainage gullies that are characteristic of the canyon walls.

2.1 Climate

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

TA-42 is located in a semiarid, temperate mountain climate, typical of the northern New Mexico area. Normally, forty percent of the 18 in. of annual precipitation occurs from monsoon-type thunderstorms in July and August. Winter precipitation falls primarily as snow, with accumulations of about 51 in. annually.

Summers are usually sunny, with warm days and cool nights. Maximum daily temperatures usually do not exceed 90°F. High altitude, light winds, dry atmosphere, and clear skies allow night temperatures to drop into the 50s (°F) after even the warmest days. Brief afternoon thunderstorms are common in July and August and can also occur throughout late spring and early autumn. Vivid lightning, strong winds, and hail (sometimes damaging) are not uncommon with these storms. Lightning-caused fires sometimes occur in periods of drought.

Winter temperatures range from 15°F to 25°F at night and from 30°F to 50°F during the day. Occasionally, winter temperatures drop to 0°F or below. Winter snowfall is common in the TA-42 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.

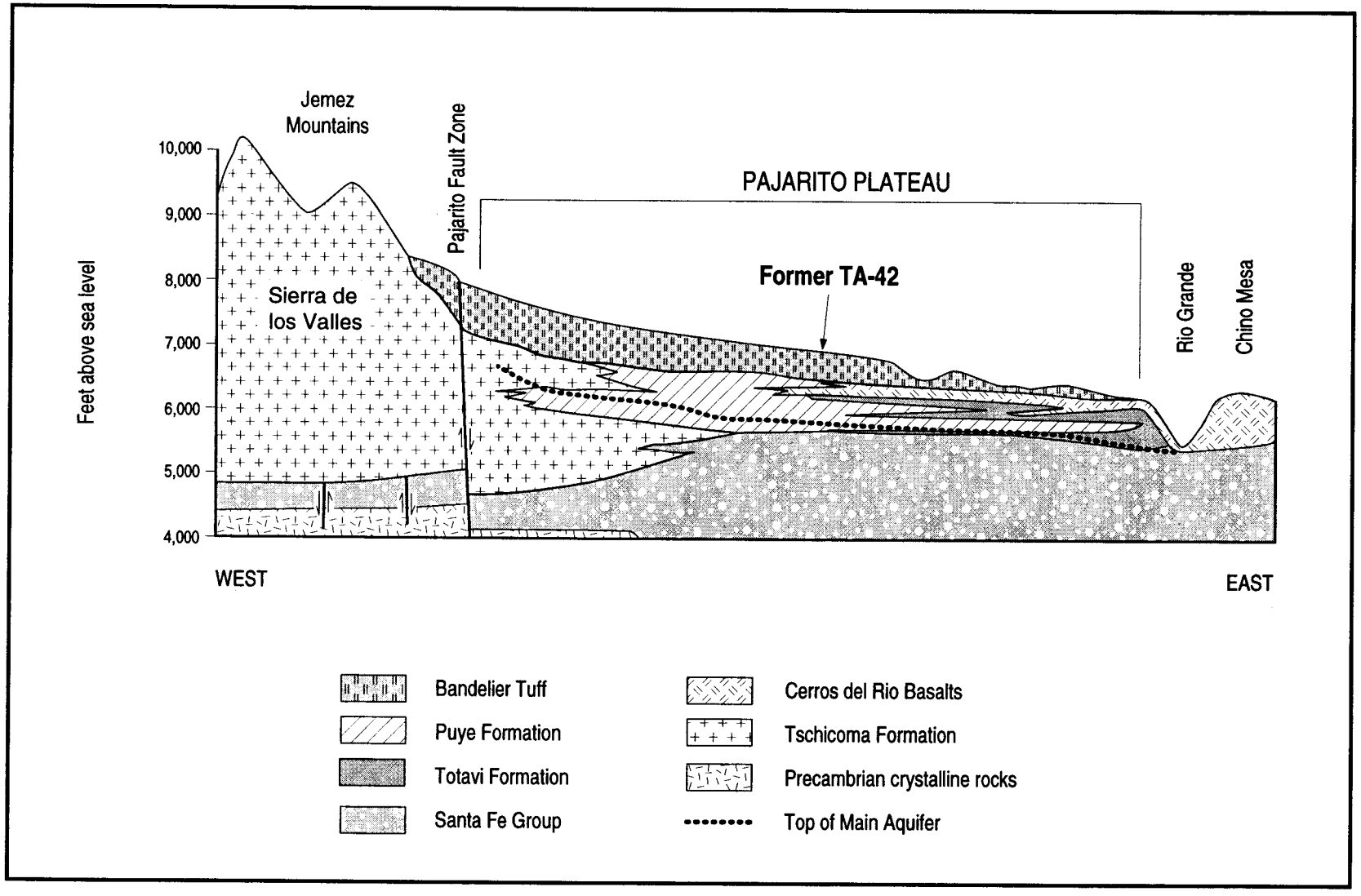
Winds are usually light and blow predominantly from the southwest to the northeast. However, strong winds are common in early spring, and winds can gust to more than 60 mph. Strong dust devils can develop on the tops of mesas in summer and can cause brief gusts of 75 mph or greater in the immediate area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

2.2 Geology

The following is a brief description of the geologic units underlying TA-42. For a more complete discussion of the geology of the TA-42 area, please refer to Chapter 2 of the work plan and Chapter 2 of the Installation Work Plan (IWP) for Environmental Restoration, Revision 4 (LANL 1995, 48637).

2.2.1 Geologic Setting

Figure 2 shows a generalized cross section of the geologic setting described below.



F 2 / TA-42 RFI RPT / 092095

Figure 2. Generalized cross section of Pajarito Plateau with approximate location of former TA-42.

2.2.1.1 Stratigraphy

TA-42 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 immediate west of the plateau. The Jemez volcanic field has been active for the last 13 million years (Myr), and the latest volcanic activity is estimated to have occurred about 60,000 years ago (Wolff and Gardner 1995, 48821).

The thicknesses of the stratigraphic units described below are taken from a core hole log by Gardner et al. (1993, 12582). Core hole SHB-1 was drilled to a total depth of 700 ft on Mesita del Buey just west of TA-55. The units below 700 ft are described by Purtymun (1995, 45344).

Bandelier Tuff

The Pajarito Plateau in the area of TA-42 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 325 ft thick in the area of TA-42.

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).

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 below.

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-42. These rocks have been dated at 2.0 to 4.6 Myr old (Gardner et al. 1986, 21527).

Puye Formation

Underlying the Bandelier Tuff is the Puye Formation, 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 Age to Pleistocene Age). Deep wells near the TA-42 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-42 has not been determined; however, nearby deep wells indicate an overall thickness of as much as 1,850 ft.

Totavi Formation

The Totavi Formation (formerly the Totavi Lentil) interfingers with the Puye Formation in the area of TA-42, thickening and possibly replacing the Puye Formation to the east. The Totavi Formation is a coarse, poorly consolidated conglomerate composed of granitic and metamorphic cobbles with an arkosic matrix. This

formation was probably deposited between 2.5 and 3.5 Myr ago. A deep well near TA-42 indicates that the Totavi Formation is 60 ft to 80 ft thick in the area of TA-42.

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-42, and some may be present in the subsurface near TA-42.

Santa Fe Group

Below the Totavi Formation are the formations of the Santa Fe Group, 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 Chamita Formation and the Tesuque Formation. The Chamita Formation has 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-42 has not been determined.

2.2.1.2 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 (see Figure 2).

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. TA-42 is located east of the Rendija Canyon segment (Vaniman and Wohletz 1993, 48809).

2.2.2 Soils

A large variety of soils has developed on the Pajarito Plateau because of interactions between 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 area of TA-42 are generally poorly developed because of the arid climate.

Soil formed on the mesa tops of the Pajarito Plateau as described by Nyhan et al. (1978, 5702) include the Carjo, Frijoles, Hackroy, Nyjack, Pogna, Prieta, Seaby, and Tocal series. The predominant soil at TA-42 is the Tocal series. This series is described as shallow, well-drained soil that formed in material from weathered tuff on slightly sloping mesa tops. Soil thickness ranges from 8 in to 20 in.

2.3 Hydrology

Presented below is a brief description of the surface and subsurface hydrology at TA-42. For a more complete discussion of the hydrology of the TA-42 area, please refer to Chapter 2 of the work plan and Chapter 2 of the IWP, Revision 4 (LANL 1995, 48637).

2.3.1 Surface Water Hydrology

Surface waters drain across the Pajarito Plateau and TA-42 eastward from the Jemez Mountains, then 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-42 flows directly into Mortandad Canyon, immediately north and east of TA-42, by way of drainage rills found on the top of the mesa and 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, and its source is likely storm water outfalls from Pajarito Road and outfalls from Laboratory facilities in the upper reaches of Mortandad Canyon west of TA-42.

2.3.2 Vadose Zone Hydrology

TA-42 overlies approximately 950 ft of unsaturated volcanic tuff, sediments, and basalts of the geologic formations discussed above. Studies of the moisture content of the Bandelier Tuff have not been conducted at TA-42; however, no shallow perched aquifers are known to be present beneath TA-42. 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, allowing higher moisture content in the more porous zones at depth.

2.3.3 Saturated Zone Hydrology

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

Studies performed near TA-42 have not indicated the presence of any shallow or perched aquifers (Devaurs and Purtymun 1985, 7415); therefore, the saturated zone under TA-42 appears to be restricted to the deep main aquifer. The top of the main aquifer at TA-42 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 area of TA-42.

Ground water in the main aquifer flows to the east toward the Rio Grande. The hydraulic gradient in the area of TA-42 is 60 ft 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.

For a more detailed discussion of the saturated zone hydrology, please refer to Section 2.5.2.2 of the IWP, Revision 4 (LANL 1995, 48637).

2.4 Biological and Cultural Surveys

2.4.1 Biological Surveys

Biological surveys for OU 1129 and OU 1147 were conducted in August 1991 and October 1991 by the Biological Resource Evaluations Team from the Environmental Protection Group (ESH-20). The objectives of these surveys were to identify wetlands and floodplains; identify the presence of any habitat for threatened, endangered, or sensitive species; and collect ancillary wildlife and habitat observations to support National Environmental Policy Act documentation needs (Dunham 1992, 31276). However, the surveys have not yet been incorporated into a spatial database for mapping by the ER Project.

Mortandad Canyon contains artificially and permanently flooded wetlands (sewage disposal ponds) that are mapped on the National Wetland Inventory maps. Also, Mortandad Canyon and Ten Site Canyon support perennial and intermittent flows, and upper Mortandad Canyon receives perennial sewage effluent discharges (Dunham 1992, 31276).

Habitats located on the mesa tops are piñon-juniper woodlands with an understory of blue gramma grass. Common midstory and understory plant species include mountain mahogany, wavyleaf oak, wild chrysanthemum, mountain muhly, sand dropseed, and wormwood. Mixed conifer forests occupy the north-facing canyon slopes, changing to an open ponderosa pine forest on the canyon floor. The mixed-conifer forest contains a midstory and understory of Gambel oak, wavyleaf oak, mountain mahogany, mountain muhly, little bluestem, wormwood, and Colorado barberry.

Based on general habitat conditions or known occurrences, a total of 24 species of threatened, endangered, or sensitive plants and animals were identified as potential species of concern (see Table 2) (Dunham 1992, 31276). Level 2 habitat evaluations confirmed whether appropriate habitat conditions exist in the area. Of the 2 mammal species, 7 bird species, and 15 plant species, the required habitat conditions were present only for spotted bats, which use a variety of habitats that include ponderosa pine and mixed-conifer plant communities. Spotted bats drink from open water and feed on aerial insects, which may cause them to be exposed to COPCs; therefore, a screening assessment is needed for spotted bats (which are candidates for listing under the Federal Endangered Species Act and are classified as endangered by the state of New Mexico). The potential for spotted bats to be exposed to COPCs associated with the site is analyzed in the screening assessment.

2.4.2 Cultural Surveys

Surveys were conducted in March 1992, April 1992, and May 1993 to identify cultural resources that may be impacted by ER Project site characterization activities. Although a number of cultural resources were identified in the general area, none were judged to be placed at risk by the characterization activities (Manz et al. 1994, 49508). Therefore, cultural resources do not need to be considered in the screening assessment.

TABLE 2

THREATENED, ENDANGERED, AND SENSITIVE SPECIES

Common Name	Scientific Name	Required Habitat Exists
Spotted bat	*Euderma maculatum*	Yes
Meadow jumping mouse	*Zapus hudsonius*	No
Northern goshawk	*Accipter gentilis*	No
Common black hawk	*Buteogallus anthracinus*	No
Broad-billed hummingbird	*Cynanthus latirostris*	No
Peregrine falcon	*Falco peregrinus*	No
Bald eagle	*Haliaeetus leucocephalus*	No
Mississippi kite	*Ictinia mississippiensis*	No
Mexican spotted owl	*Strix lucida*	No

TABLE 2 (continued)

THREATENED, ENDANGERED, AND SENSITIVE SPECIES

Common Name	Scientific Name	Required Habitat Exists
Tufted sand verbena	*Abrionia begelovii*	No
Sessile-flowered false carrot	*Aletes sessiliflorus*	No
Cyanic milkvetch	*Astragalus cyaneus*	No
Santa Fe milkvetch	*Astragalus feensis*	No
Mathew's woolly milkvetch	*Astragalus mollissimus*	No
Taos milkvetch	*Astragalus puniceus*	No
Checker lily	*Fritillaria atropurpurea*	No
Sandia alumroot	*Heuchera pulchella*	No
Wood lily	*Lilium philadelphicum* var. *andium*	No
Wright's fishhook cactus	*Mammillaria wrightii*	No
Santa Fe cholla	*Optunia virdiflora*	No
Pagosa phlox	*Phlox caryophylla*	No
Plank's catchfly	*Silene plankii*	No
Threadleaf horsebrush	*Tetradymia filifolia*	No
Gramma grass cactus	*Toumeya papyracantha*	No

3.0 APPROACH TO DATA ASSESSMENT AND ANALYSIS

The list of COPCs that were investigated during this phase of the RFI was based on results of the previous sampling that was conducted by the Environmental Surveillance Group and the Environmental Protection Group (Pratt et al. 1994, 41204). See Section 4.1.1 for details of previous investigations and the revised SAP for Aggregate J (LANL 1993, 48849), which provide the rationale for identifying the COPCs. Therefore, only the following COPCs were investigated: lead, ^{241}Am, ^{238}Pu, ^{239,240}Pu, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U, ^{235}U, and ^{238}U. Samples were collected at the locations of the PRSs, in areas where the reconnaissance showed the presence of radionuclides or metals, and in areas where excavation for future construction activities is planned.

The decision approach used for Aggregate J involved a series of quantitative steps that occurred after the field investigation, chemical analysis, and data reporting were complete. Evaluation of quality control (QC) activities for their potential impact on the succeeding data assessment steps (such as comparing the site data with background upper tolerance limits [UTLs], comparing site data with screening action levels [SALs] for human health and ecological impacts, and performing human health or ecological risk assessments) when necessary.

3.1 Summary of QC Activities

The analytical methods and protocols employed were chosen to provide data of the required quality to perform the screening assessment comparisons with background UTL and SAL values. The analytical suites were selected based on knowledge gained from the earlier reconnaissance study. QC procedures were implemented in the analytical laboratory to provide estimates of the bias and precision of the analytical measurements, as discussed in the following sections. Details regarding the qualification of analytical results for individual samples are given in Appendix A. The complete data set for Aggregate J, which contains the analytical results for all soil samples, can be found in Appendix B. All data were judged to be acceptable for performing the human health and ecotoxicological screening assessments despite the problems identified in Section 3.1 and Appendix A.

QC samples were also collected in the field to provide information regarding bias introduced because of sampling procedures and to evaluate the sampling precision. Field QC samples included bottle blanks and equipment rinsate blanks, which were collected for each sampling event, and field duplicate samples. Field duplicates are sample portions (called splits) from the same interval that are put into separate bottles and given unique bar code numbers; however, they have the same location ID numbers.

3.1.1 Inorganic Analyses

Soil samples underwent analysis for elemental lead employing one of three methods: graphite furnace atomic absorption (GFAA), inductively coupled plasma mass spectroscopy (ICPMS), or energy dispersive x-ray fluorescence (EDXRF). The ICPMS and EDXRF measurements were intended to provide screening-level results, which were confirmed by the GFAA analysis. The ICPMS and EDXRF results are suitable for performing the screening assessment for lead in Aggregate J but are not suitable for human health or ecological risk assessment. The GFAA analyses were performed according to Environmental Protection Agency (EPA) SW-846 Method 7421 (EPA 1986, 31732). The results may be used for the screening assessment but are not suitable for human health or ecological risk assessment because of the lack of adequate supporting QC data.

The ICPMS technique was employed for quick turnaround analysis of four soil samples collected in the first phase of the investigation and was conducted in-house by the former Isotope and Nuclear Chemistry Group (INC-12). A 0.5 g aliquot of each soil sample was digested in mineral acids, taken to near dryness, then diluted to the appropriate volume for analysis. A preparation blank was also analyzed concurrently

with the samples, and the sample results were corrected for the preparation blank results before reporting. The amount of the correction to the sample results is unknown. The estimated detection limit (EDL) for the ICPMS method is approximately 5 mg/kg. No supporting QC data are available for the ICPMS sample results; therefore, no statement regarding the precision or bias of the method can be made. However, the four soil samples that were analyzed by ICPMS were also analyzed by GFAA. The maximum result for lead obtained by either method has been used in the UTL comparison for the screening assessment.

The EDXRF method was implemented in the field and provided data for screening-level results only. Five confirmatory samples were submitted to a fixed-site laboratory for analysis by GFAA. A Spectrace 9000 provided portable field EDXRF analysis to measure the elemental lead content of 15 soil samples. The samples were first placed in 32-mm polyethylene sample cups and sealed with 4-µm polypropylene film. A count time of 260 s was employed to achieve an EDL of 15 mg/kg for lead; therefore, reported results less than 15 mg/kg should be regarded as estimated. No supporting QC data are available for the EDXRF sample results. The EDXRF and GFAA results were negatively correlated, with a correlation factor of 0.66 based on the analysis of five soil samples. The maximum result for lead obtained by either EDXRF or GFAA analysis has been used in the SAL comparison for the screening assessment.

It should be noted that the results obtained by EDXRF and SW-846 methods are not directly comparable. In general, higher elemental levels are measured using EDXRF because of the penetrating nature of x-rays. Fluorescence is observed from soil matrix elements (such as mineral crystals) as well as surface-adsorbed elements. The acid digestion procedure used to prepare samples for the SW-846 methods dissolves surface-adsorbed inorganic compounds but does not efficiently dissolve the mineral compounds, which comprise the soil matrix. Note that the Laboratory site-specific background levels have been determined using SW-846 methods of analysis, and therefore should not be directly compared to the EDXRF results.

The accuracy and precision of the GFAA analyses were assessed by measuring matrix spike/matrix spike duplicate (MS/MSD) sample pairs. For the first batch of seven soil samples, the spike recoveries were 38% and 39% for the MS/MSD pair, which indicates good precision but poor accuracy for the analysis. Consequently, the reported results for lead are potentially biased low and should be regarded as estimated for the following samples: Location ID No. 42-1021 (regular and duplicate), Location ID No. 42-1022, and Location ID No. 42-1023. The significant low bias should be considered in the screening assessment comparison with background because at least one of the sample results (Location ID No. 42-1023 [3 ft to 4.75 ft]) falls within 60% of the UTL value of 39 mg/kg. The low bias should not impact the results of the comparison with the lead SAL value of 400 mg/kg, which is an order of magnitude greater than any of the sample results.

For the second batch of five soil samples, the spike recoveries were 122% and 116% for the MS/MSD pair, which indicates acceptable precision and accuracy for the analysis. Technical holding time criteria were met for all analyses.

3.1.2 Organic Analyses

No organic analyses were performed at this site. See Section 4.1.1.2 for a discussion of a previous investigation. See the revised SAP for Aggregate J (LANL 1993, 48849) for a discussion of the rationale.

3.1.3 Radiochemistry Analyses

Soil samples were analyzed for alpha-emitting nuclides by alpha spectrometry at fixed-site laboratories. The following radionuclides were analyzed for alpha activity: ^{241}Am, ^{238}Pu, ^{239,240}Pu, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U, ^{235}U, and ^{238}U. The analytical protocols employed were either Laboratory internal protocols or external protocols that have much in common with the Laboratory radiochemistry methods. It should be noted that the radiochemistry procedures will vary somewhat from laboratory to laboratory because of the lack of

promulgated radiological analyses. Insufficient data are available to assess the interlaboratory bias. No holding time requirements exist for the radiological analyses.

The Aggregate J data set includes some negative values for radionuclide activity measurements. Negative values may result when the measured value for the laboratory background, usually determined by analysis of a blank sample, is subtracted from the measured value for the sample. Both the blank (background) value and the sample value have an associated uncertainty; therefore, a finite probability exists that a negative value may result when the background correction is performed. A negative value has no physical significance for an individual measurement but may be included in a larger data set to establish the distribution of values. In some cases, negative values were simply reported as "zero" activity.

The uncertainties that are reported with the alpha spectrometry results are either 1-sigma or 2-sigma values calculated using Poisson counting statistics and are based on both sample and background or blank counts. Longer count times result in lower uncertainties. The reported uncertainties do not reflect the sources of variability arising from sample collection or sample preparation before analysis. The bias introduced during sample preparation before the alpha spectrometry analyses was monitored by the addition of tracer isotopes. The reported sample results have been corrected for the chemical yield of the tracer isotope to account for matrix effects and losses during sample preparation.

The accuracy of the alpha-isotope counting was monitored by the analysis of single blind performance evaluation samples, which indicated acceptable accuracy for the analysis of isotopic plutonium. Laboratory duplicate samples were also prepared and analyzed to provide an estimate of the precision of the method. The average relative percent difference for the analysis of two duplicate samples indicates good precision for ^{239,240}Pu (18%) but poor precision for ^{238}Pu (105%) and ^{241}Am (58%). The maximum results for the analysis of duplicate samples were 0.377 pCi/g and 0.749 pCi/g for ^{238}Pu and ^{241}Am, respectively. According to the EPA guidelines for data review, sample results are qualified based on the duplicate sample analysis according to the relationship of the sample or duplicate value to the detection limit. The minimum detectable activities (MDAs) for the measurements were not reported; therefore, the quality of the data cannot be adequately evaluated. No duplicate analyses were performed for the isotopic thorium and uranium determinations.

Fast turnaround plutonium analysis of soil samples was conducted by former INC-12 personnel according to an in-house protocol. Samples were air dried and pulverized; 0.3 g to 5 g aliquots were weighed for analysis. The ^{236}Pu tracer isotope was added to each sample before complete digestion with mineral acids. The radiochemical separation of plutonium was accomplished by lanthanum fluoride coprecipitation, followed by two ion-exchange chromatography cleanup steps. The purified plutonium fractions were electroplated onto platinum disks for alpha counting. Samples were counted three times; each count period was set at twenty hours. The errors that are reported with the plutonium isotope activities reflect the counting errors. Reagent blank samples were also counted with each sample batch. The average blank value for ^{239,240}Pu activity was 0.150 (±0.09) pCi, which was subtracted from the sample values. The MDA for ^{239,240}Pu was determined to be 0.42 pCi/g based on the analysis of five blank samples. No activity attributable to ^{238}Pu was observed in the reagent blank samples; therefore, the MDAs were determined on the basis of counting statistics alone. Sample activities that were less than the MDA were reported as "<MDA."

3.1.4 High Explosives Analyses

No high explosives analyses were performed at this site because high explosives were not used at former TA-42.

3.1.5 Field QC Activities

The analytical results for the bottle blanks and equipment rinsate blanks collected during the sampling events at former TA-42 indicate that no contamination was introduced during the sampling procedure.

Six field duplicate samples were collected and analyzed for either elemental lead or alpha-emitting radionuclides. The average relative percent difference in the analysis of two pairs of duplicate samples for elemental lead by GFAA was 6%, which indicates excellent sampling precision. The average relative percent difference in the analysis of four pairs of duplicate samples for alpha isotopes indicated high variability for ^{238}Pu (108%), $^{239,240}Pu$ (61%), and ^{241}Am (65%).

3.2 Screening Assessment Methodology

A screening assessment is performed on the data set for a site to determine whether a release has occurred at the site and to identify whether a site-specific evaluation of human health and ecological risks is justified. The initial data set for the screening assessment is generally the data set for a specific PRS. However, a screening assessment may also be performed for aggregates of several PRSs or for specific exposure units. The area identified as a single unit, with its data set, is referred to as a decision unit.

In the first stage of a screening assessment, the maximum detected concentration of a COPC in a decision unit is compared with a matrix-specific background concentration. If the maximum detected concentration of a COPC does not exceed the background value for any medium, the COPC is eliminated from further consideration. If the detection limit for a COPC is greater than the background concentration, the COPC is retained for further evaluation.

At this point, the screening methodologies for human health and ecological risks diverge. The second stage of the human health screening is to compare the maximum detected concentration of the remaining COPCs with COPC-specific human health SALs. If multiple COPCs are present, this screening incorporates an evaluation of additive effects. COPCs may be designated COCs after additional evaluation if they are not eliminated by comparison with SALs, SALs are unavailable, or the reporting limit exceeds the SAL (see Section 3.2.2). A decision logic diagram for identifying potential COCs in the human health screening assessment is provided in Figure 3.

The second stage of the ecological risk screening methodology differs from the human health screening in that the habitat value of the site is evaluated before maximum detected concentrations of the remaining COPCs are compared with ecotoxicological screening action levels (ESALs). The habitat evaluation is performed to eliminate from further consideration those sites where ongoing human activities are likely to dominate any impact to the environment due to COPCs. The mere existence of ongoing operations at a site may be viewed as tacit approval that environmental impacts of this magnitude are an acceptable risk. Therefore, risk screening, risk assessment, and remediation levels that protect human health are more appropriate in these areas. COPCs that are not eliminated by comparison with ESALs, for which ESALs are unavailable, or for which the reporting limit exceeds the ESAL may be designated as COPCs after additional evaluation (see Section 3.2.3.2). A decision logic diagram for identifying COPCs for ecotoxicological risk assessment is provided in Figure 4. Logic for screening of ecotoxicological risk at the Laboratory assumes that land-use patterns (areas where ongoing human activities are present) will not change. If land-use patterns change, then the risk to ecological receptors should be evaluated for the new land use.

3.2.1 Background Comparison

Comparison of the maximum detected concentration of a COPC with a background concentration value is performed for metals and radionuclides. If no background concentration value is available, the metal or radionuclide is carried forward to the SAL screening. Comparison with background is not performed for organic COPCs in this RFI, although background values for certain widely distributed organic compounds may be identified. Background concentrations for metals and some radionuclides in Laboratory soils were taken from Table 2 of "Statistical Comparisons to Background, Part I" (Environmental Restoration Project Assessments Council 1995, 45753). Additional background values were taken from Laboratory environmental surveillance reports (Purtymun et al. 1987, 6687; ESG 1988, 6877; ESG 1989, 6894;

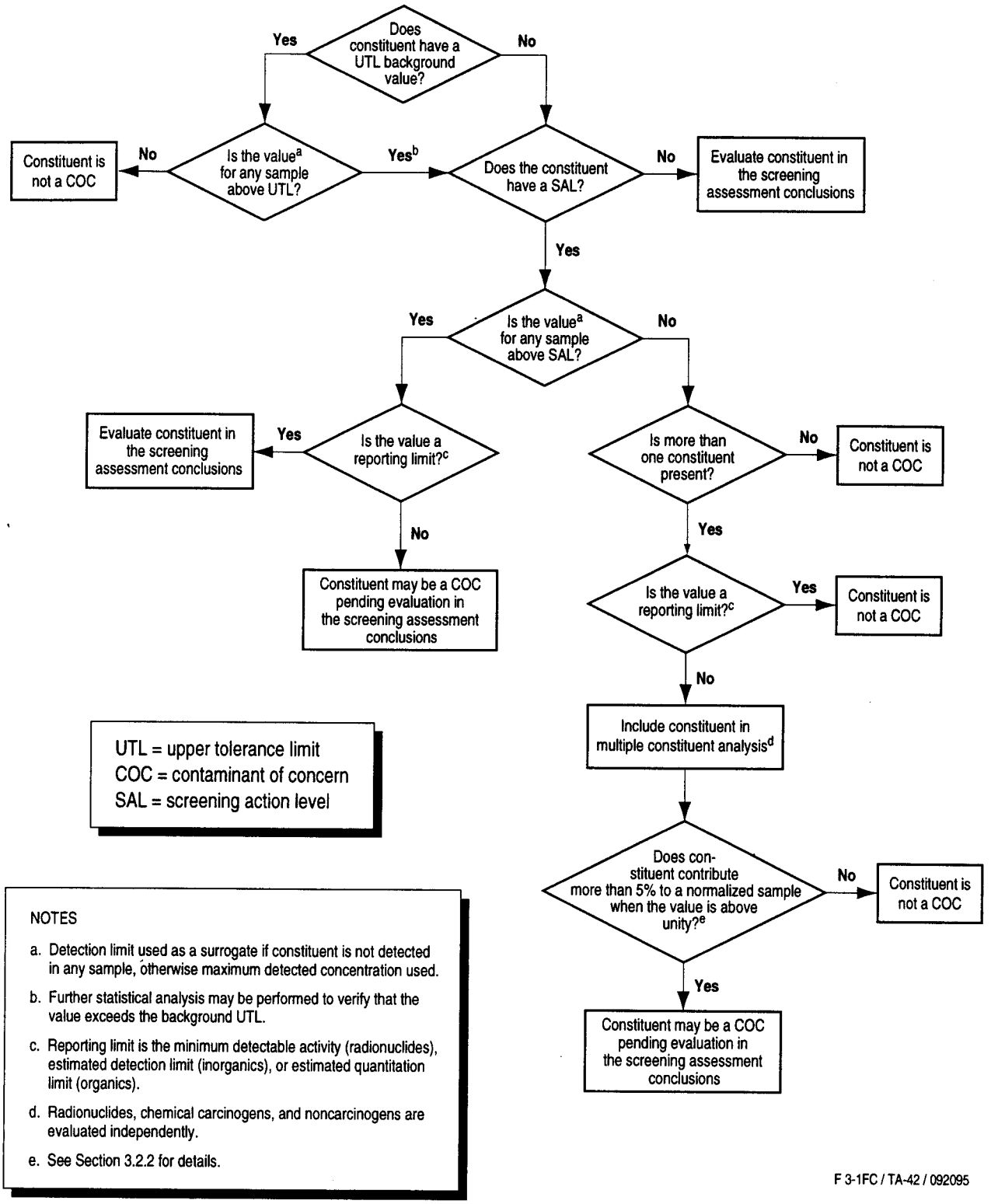
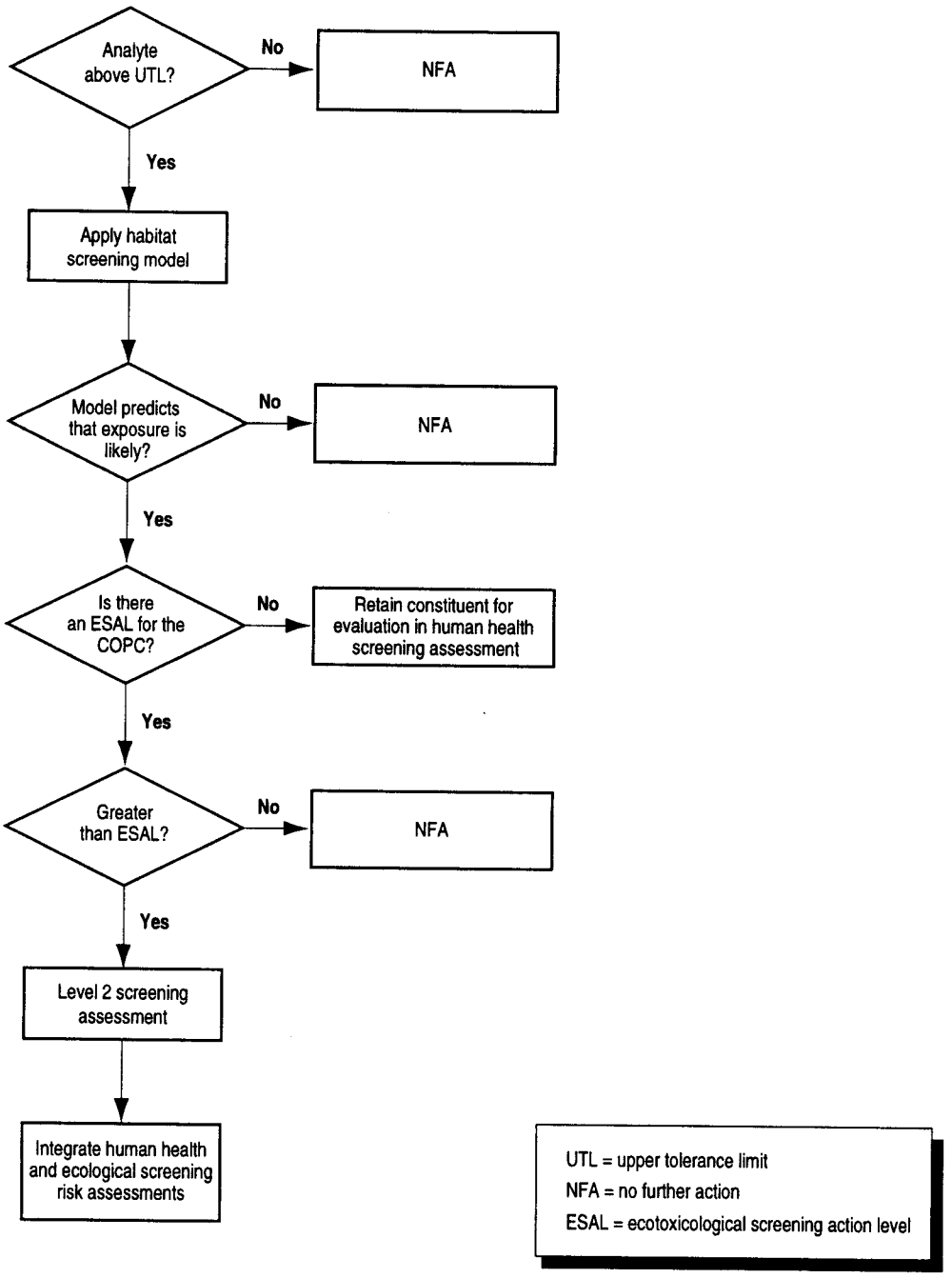


Figure 3. Decision logic for identifying contaminants of concern in the human health screening assessment.



F 04FC / TA-42 RFI RPT / 081495

Figure 4. Decision logic for screening of ecotoxicological risk.

Environmental Protection Group 1990, 6995; Environmental Protection Group 1992, 7004). These reports present regional background soil concentrations of ^{90}Sr, ^{137}Cs, ^{238}Pu, and $^{239,240}Pu$ collected from 1974 to 1990 at seven localities in northern New Mexico. Because these data were collected at different times and cannot be considered a single data set for calculating summary statistics, the maximum observed concentration of these radionuclides was used as a background value in lieu of the UTL.

A background value for ^{228}Th was not available in the references cited above. However, ^{228}Th is a relatively short-lived decay product of the parent radionuclide ^{232}Th, with which it tends to be found in secular equilibrium. In only a few decades, decay results in identical activities of ^{228}Th and ^{232}Th in soil that previously contained only ^{232}Th. After equilibrium has been achieved, it is maintained ad infinitum. Therefore, the natural background concentration (expressed in activity per mass of soil) of ^{228}Th may be assumed to be equal to that of ^{232}Th.

The maximum detected concentration of a COPC is compared with the UTL of the background distribution defined as the 95% upper confidence limit of the 99th percentile of the underlying distribution. As discussed in the "Statistical Comparisons to Background, Part I" (Environmental Restoration Project Assessments Council 1995, 45753), the maximum detected background concentration of a constituent may be used if the data set does not support the calculation of a UTL. If the maximum detected concentration of a COPC (or the reporting limit, if no detects occurred) is equal to or lower than the corresponding background value, it is eliminated as a COPC; if the maximum detected concentration is greater than the corresponding UTL, the COPC is carried forward to the SAL comparison screening.

At the discretion of the project statistician, additional analysis of a background value may be performed before carrying a COPC forward to the SAL comparison. In addition, it is important to determine whether the analytical methods used to generate the background UTL values and the sample values produce data sets that are directly comparable. If the differences in the analytical methods result in comparative bias between the data sets, a correction may need to be applied before performing the background screening.

3.2.2 Screening Action Levels Comparison/Other Standards

SALs are generic, conservative values used as preliminary screening tools before embarking on a site-specific risk assessment. Development of SALs is addressed in the "Screening Assessment Methodology at Los Alamos National Laboratory" (draft), (Environmental Restoration Project Assessments Council 1995, 04-0311). Chemical SALs are calculated using a risk-based approach with an allowable incremental cancer risk level of one excess cancer per one million individuals and a hazard quotient of unity for noncarcinogens. Radionuclide SALs are calculated using a dose-based approach with an allowable dose limit of 10 mrem/yr. See Appendix J of the IWP (LANL 1993, 26078).

Comparison of COPC data with SALs generally proceeds in two steps. In the first step the maximum detected concentration of each remaining COPC in a medium is compared with the medium-specific SAL for that COPC. Any COPC with a maximum detected concentration above the SAL is tentatively designated a COC pending further evaluation. If a COPC in one or more media has no corresponding SAL, the COPC may be evaluated in a risk assessment or eliminated because of process knowledge or toxicological information. Similarly, if the COPC was not detected in any sample but its analytical reporting limit exceeds its SAL, rationale for further action will be discussed.

When multiple COPCs are present at a site, COPCs that do not individually exceed their respective SALs may collectively pose a potential health risk. In accordance with the "Screening Assessment Methodology at Los Alamos National Laboratory" (draft), (Environmental Restoration Project Assessments Council 1995, 04-0311), if multiple COPCs remain following the background screening, they are evaluated assuming additive effects.

In the multiple constituent analysis, COPCs are divided into three classes: radionuclides, carcinogenic constituents, and noncarcinogenic constituents. Additive effects are assumed within each class, but each class is evaluated independently. The maximum values of the COPCs that remain following the background comparison are divided by the SAL for each COPC, and the resulting normalized values are summed for each sample. If duplicate samples are obtained, the maximum single value for a COPC is used for this evaluation in this RFI report. If the sum of the normalized values is less than unity for a COPC for all samples, the COPC is not further evaluated. If the sum of the normalized values exceeds unity at any sample point, constituents contributing greater than 5% of the normalized value are identified as potential COCs and are evaluated further.

The equation for calculating the appropriate normalized sum is

$$M = \sum_{COPCs} \left(C_i / SAL_i \right)_j$$

where

M	=	normalized sum of COPCs at sample point j,
C_i	=	maximum concentration of the ith constituent at sample point j, and
SAL_i	=	medium-specific SAL for the ith constituent at sample point j.

The results of the human health screening assessment are presented in Section 4.1.3.1.

COPCs in the human health screening assessment that exceed SALs or that exceed 5% of the normalized sample value in a multiple constituent analysis are evaluated with regard to data quality, frequency of detection, and process knowledge. A determination for inclusion in a risk assessment is made on an individual basis. In addition, COPCs for which no SALs exist or for which the SALs exceed the reporting limit are evaluated for possible inclusion in a risk assessment. The basis for decision may incorporate process knowledge, the relative magnitudes of the reporting limit and SAL, toxicological information, and other criteria.

The screening process is applied to COPCs in samples collected at any depth in soil or tuff. Potential COCs identified in subsurface samples may also be evaluated based on the likelihood of a complete exposure pathway to a receptor.

A possible conclusion of the screening assessment is the need for additional data at one or more decision units. If more data are needed, a SAP for additional data gathering may be included in an appendix.

COCs identified on the basis of human health or ecotoxicological screening assessments will be presented separately because the risk assessment methodologies for these endpoints differ.

3.2.3 Ecotoxicological Screening Assessment Methodology

Screening for ecotoxicological risk uses a phased approach in which sites that have COPCs above background UTLs are evaluated for habitat quality and then compared with ESALs if the site possesses minimum habitat quality criteria. Development of the habitat screening methodology and ESALs is addressed in the guidance for screening assessment methodology (Environmental Restoration Project Assessments Council 1995, 04-0311). The results of the ecotoxicological risk screening assessment are presented in Chapter 4.0.

3.2.3.1 Ranking of Habitat Condition and Receptor Accessibility to Constituents of Potential Concern

A landscape condition score is given to each PRS. The landscape condition score is an ordinal ranking of the landscape context. A PRS that is located in a highly disturbed landscape receives a lower score than one embedded in a landscape with less extensive disturbances. Sites that are highly impacted by industrial development or regularly disturbed by other human activities receive a landscape condition score of one. Other areas at the Laboratory have been disturbed by human activities, but the density of development and the frequency of disturbance are such that ecological receptors use the areas for portions of their life cycles. These areas, such as the boundaries of technical areas or low-density developments, receive a landscape condition score of two. The final category of landscape condition pertains to areas where there is little or no disturbance caused by humans or where the habitat has high ecological value, such as wetlands or other sensitive habitats. These areas receive a landscape condition score of three.

Each PRS also is given a receptor access score that reflects how accessible the COPCs associated with the PRS are to ecological receptors. Receptor accessibility is judged by the habitat conditions immediately surrounding the PRS; therefore, this measure is not completely independent of the landscape condition ranking. If the potential for access by receptors is zero, then the receptor access score is zero. If only current risk is considered, then contaminants buried below the zone of biological activity are scored as zero. If the PRS or its associated affected media consist of small habitat patches within an industrial context, then the receptor access score is one. These patches are distinguished from those that follow by being completely surrounded by human structures (such as roads, fences, buildings, and parking lots). A PRS receives a receptor access score of two if there is access to open space. These areas are impacted by human activities, but some exposure to ecological receptors is likely. The final receptor access score, three, is reserved for contamination of habitats with high ecological value or high potential for COPC transport to other habitats (for example, outfalls).

The following model is used to facilitate decision-making about individual PRSs. Based on the landscape condition score and the receptor access score, PRSs will be either recommended for NFA or subjected to ESAL-based screening (see Figure 5).

	Landscape Condition Score		
Receptor Access Score	**1**	**2**	**3**
0	**NFA[a]**		
1			
2	**ESAL[b] Comparison**		
3			

a. NFA = no further action
b. ESAL = ecotoxicological screening action level

Figure 5. Habitat evaluation model for identifying PRSs that may be excluded from further consideration.

3.2.3.2 Comparison with Ecotoxicological Screening Action Levels

If the habitat model indicates that ecological exposures are likely, then ESALs are applied to each COPC. Any COPC that has concentrations less than the minimum ESAL may be excluded from further consideration. Additional screening comparisons with the COPC values are required before making decisions about a recommendation of NFA, remedial action, or additional data gathering (see Section 3.3.2).

COPCs in the ecotoxicological screening assessment that exceed the minimum ESAL are evaluated with regard to data quality, frequency of detection, process knowledge, the likelihood of exposures to different ecological receptors, likely remediation impacts, and the amount that COPCs exceed ESALs. COPCs for which no ESAL exists or for which the reporting limit exceeds the ESAL are evaluated for possible inclusion in a risk assessment. The basis for the decision may incorporate process knowledge, the relative magnitudes of the ESALs and the reporting limits, toxicological information, site-specific ecological data, likely remediation impacts, or other criteria.

3.3 Risk Assessment Methodology

No human health or ecological risk assessment was performed for Aggregate J.

3.4 Development of Conclusions and Recommendations

Recommendations for future action are generally offered for each individual aggregate area. However, recommendations might be offered for individual PRSs or for associations of PRSs across two or more aggregates if warranted by circumstances.

Four possible outcomes exist for PRSs evaluated in this RFI: NFA, accelerated cleanup, additional data gathering, and initiation of a corrective measures study.

Final decision analysis for all PRSs in this RFI report were made based on the results of the screening assessment.

4.0 SITE-SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

Because the results of all the PRSs are so closely related, each set of PRS results, conclusions, and recommendations will be grouped together unless a specific concern needs to be addressed. The results of the investigation are shown in Table 1.

TABLE 1

RESULTS OF THE INVESTIGATION

PRS	HSWA[a]		Proposed Action					
			NFA[b]	Accelerated Cleanup		Further Investigation		Rationale
	Yes	No		VCA[c]	EC[d]	Phase II	CMS[e]	
42-001(a)	X		X					Contamination below SALs[f] or UTLs[g]
42-001 (b and c)	X		X					Contamination below SALs or UTLs
42-002(b)	X		X					Contamination below SALs or UTLs
42-003	X		X					Contamination below SALs or UTLs
42-002(a)		X	X					Contamination below SALs or UTLs

a. HSWA = Hazardous and Solid Waste Amendments
b. NFA = no further action
c. VCA = voluntary corrective action
d. EC = expedited cleanup
e. CMS = corrective measures study
f. SAL = screening action level
g. UTL = upper tolerance limit (for soil background data)

4.1 Aggregate J

A detailed description of the location, site activities, and history of these PRSs is found in Section 3.4 of the work plan. The following summaries have been taken from the revised SAP for Aggregate J (LANL 1993, 48849).

Former TA-42, the incinerator site, was designed to reduce the volume of radionuclide-contaminated waste produced throughout the Laboratory (Emelity et al. 1975, 324; Harper and Garde 1981, 6286; LANL 1990, 7511). Construction of the site was completed in 1951. The incinerator was intended to burn radionuclide-contaminated wastes generated at the Laboratory. However, because of the poor performance of the incinerator and operational problems associated with the off-gas cleanup system, very little waste was actually incinerated. The incinerator operated for little more than one year (1951 to 1952) (Harper and Garde 1981, 6286).

Between 1957 and 1969 the main floor area of the incinerator/control building was used by the former Group H-1 as an area for storage and decontamination of equipment (such as dry boxes and vehicles) (Roy F. Weston, Inc., 1989, 11907). In the decontamination process a "vacublaster" was used to remove radionuclides and possibly other contaminants including grease and oil from various laboratory equipment. This process generated wastes probably consisting of fine solid residues and liquids containing radionuclides and possibly including acids and solvents. Waste liquids apparently went to the septic system that served this building. It is believed that fine solid residues were bagged and sent to a material disposal area (Roy F. Weston, Inc., 1989, 11907).

TABLE 3

RESULTS OF ENVIRONMENTAL SURVEILLANCE GROUP STUDY AFTER D&D

Location	Number of Samples with Gross-Alpha Activity Less than 25 pCi/g	Number of Samples with Gross-Alpha Activity Greater than 25 pCi/g	Values (pCi/g) for Samples with Gross-Alpha Activity Greater than 25 pCi/g
Former building area	60	1	29
Septic tank area	Unknown	None	—
Tile drain field	12	5	31 35 44 99 45
Excavation under the tile drain field	3	5	65 78 87 310 418
Canyon wall below the tile drain field outfall	14	5	29 36 40

4.1.1.2 Environmental Protection Group Reconnaissance Study

At the request of the construction leader from the former Project Management Group (ENG-1), personnel from the former Environmental Protection Group (EM-8) performed a reconnaissance study in January 1991. The OU 1129 technical team used the analytical results from EM-8 as Phase I results to design the SAP for this accelerated characterization. Table 4 contains the levels of ^{238}Pu, ^{239,240}Pu, and toxicity characteristic leaching procedure (TCLP) lead in the near-surface samples (surface to 5-ft depth). The near-surface fill materials and soils were important because construction activities would impact them and because, if contamination were found, the path to receptors would originate there. Table 5 contains the analytical results for all samples (near-surface and subsurface) that EM-8 personnel collected. Figure 6 shows the location of the reconnaissance samples, which have the prefix "PF."

During the 1991 reconnaissance study conducted by EM-8, soil samples were analyzed for the following constituents: ^{238}Pu, ^{239,240}Pu, total uranium, ^{137}Cs, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). The following trace metals were analyzed by TCLP: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Based on the analytical results, which are presented in Tables 4 and 5, the alpha-emitting plutonium isotopes and elemental lead were the only COPCs identified. See the revised SAP for Aggregate J (LANL 1993, 48849). The measured activities of the gamma-emitting ^{137}Cs isotope were well below the background UTL value of 1.4 pCi/g. No VOC or SVOC constituents were detected above the estimated quantitation limits for the respective methods. PCBs were detected in 6 of 18 soil samples at levels of 1 ppm or less, which are well below the action level for PCBs of 10 mg/kg (Environmental Restoration Project Assessments Council 1995, 45378).

The septic tank received radioactive liquid waste that contained plutonium, uranium, associated fission products, tritium, solvents, acids, and greases. Most of these contaminants are believed not to be associated with incinerator operations but entered the septic system from decontamination operations between 1957 and 1969. During this time, wastewater containing $^{239,240}Pu$, ^{235}U, tritium, and fission products passed through the septic system and was discharged into Mortandad Canyon (Meyer 1977, 875).

Because of the specialized nature of the incinerator facility and the extensive contamination of the control building and other structures at the site, the decision was made in the mid-1970s to decommission and decontaminate former TA-42. Most of the contamination present, excluding the contents of the ash storage tanks, was attributed to the decontamination operations that were conducted between 1957 and 1969 (Harper and Garde 1981, 6286).

Decommissioning work began in January 1978 with the removal of the incinerator and associated equipment in the control building. After dismantling and removing the structure, the drain pipes under the building foundation were filled with hot asphalt to immobilize the contamination (Harper and Garde 1981, 6286). The uncontaminated foundation was crushed with a crane and steel ball and removed. The ash storage tanks contained 2,000 L (473 gal.) of dry sludge and 2,600 L (615 gal.) of wet sludge. The sludges were removed, mixed with cement and taken to area G, TA-54, for storage in accordance with the DOE's 20-yr retrievable storage criteria. The tanks were excavated and taken to TA-54 for disposal. It is not known if the drain lines were removed or left in place (Ahlquist 1987, 752).

The supernatant liquid from the 4,000-L concrete septic tank was pumped into a tank and transported to the Laboratory's radioactive liquid waste treatment facility (TA-50). Cement was added to solidify 35 gal. of sludge in the tank. An attempt to remove the tank intact failed when the walls collapsed. The remaining rubble was loaded onto a dump truck with a backhoe (Harper and Garde 1981, 6286).

This operation generated wastes, which were all buried or stored at the Laboratory's TA-54 radioactive solid waste disposal/storage site located 2.5 km from the decommissioning site. Six hundred cubic meters (m^3) of building debris and equipment and 1,200 m^3 of soil contaminated with less than 10 nCi $^{239,240}Pu$ per gram of waste were buried in trenches at TA-54. Former TA-42 was then contoured to conform with the surrounding terrain, and native grasses were planted (Harper and Garde 1981, 6286).

4.1.1 Previous Investigations

Data collected at the site before this accelerated characterization came from two sources: a study performed in 1978 by the former Environmental Surveillance Group after D&D activities and a reconnaissance study performed in 1991 by the former Environmental Protection Group (EM-8). These data were used to develop the revised SAP for Aggregate J, which is contained in Appendix E of the work plan (LANL 1993, 48849). The discussion of the previous investigations at former TA-42 is divided into two subsections: Environmental Surveillance Group Study and Environmental Protection Group Reconnaissance Study.

4.1.1.1 Environmental Surveillance Group Study

Final gross-alpha activity in soil samples taken after the D&D activities in 1978 (Harper and Garde 1981, 6286) are shown in Table 3.

Harper and Garde (1981, 6286) report that "Because of the low levels of contamination and the safety hazards associated with any further excavation, the Environmental Surveillance Group considered the area decontaminated to as low as reasonably achievable (ALARA). After concurrence from the Laboratory's Health Division Office and the Los Alamos, New Mexico, Area Office of the U.S. Department of Energy, the area was contoured and revegetated to minimize erosion."

TABLE 4

1991 EM-8 RECONNAISSANCE RESULTS FOR NEAR-SURFACE SAMPLING AT FORMER TA-42

Borehole	Sample Depth (ft)	^{238}Pu (pCi/g)	Unc[a]	$^{239,240}Pu$ (pCi/g)	Unc	Pb TCLP[b] (mg/L)	Unc
PF-IB1	0–5	0.0004	0.0009	0.015	0.026	11.4	1.1
PF-IB2	0–5	0.003	0.001	0.0554	0.0047	0.05	0.01
PF-HT2	0–5	0.002	0.002	0.0179	0.0033	< 0.01	
PF-HT3	0–5	0.0012	0.0007	0.0205	0.0031	0.04	0.01
PF-CDA	0–5	0.0036	0.0009	0.0014	0.0006	0.17	0.02
PF-PLN	0–5	0.0012	0.0008	0.006	0.001	0.01	0.01
PF-PLM	0–5	0.009	0.002	0.0148	0.0021	< 0.01	
PF-PLS	0–5	0.006	0.001	0.0151	0.0018	0.34	0.03

a. Unc = uncertainty
b. TCLP = toxicity characteristic leaching procedure

4.1.2 Field Investigation

Figure 6 shows the locations of both the samples taken during the 1991 EM-8 reconnaissance study (designated by the prefix "PF") and the samples collected during this investigation (designated by the prefix "42").

The OU 1129 field team collected near-surface samples with a hand auger. They used the auger to collect unconsolidated materials in 6- to 12-in. intervals. They pulled the auger when it was full and placed the samples in a decontaminated pan. Augering continued until the top 3 ft of soil was collected or until the soil-tuff interface was encountered (Table 6 shows the actual sample depths). When they reached the soil-tuff interface, the field team collected samples, homogenized the samples, and divided the composite material into splits for analysis by the former Isotope and Nuclear Chemistry Group (INC-12) (125 g); for alpha, beta, and gamma screening by the former Health and Environmental Chemistry Group (EM-9 now CST-9) mobile laboratory (500 g); and for EM-9 analysis (125 g). For each sample collected, OU 1129 personnel completed the Chain of Custody/Request for Analysis form, affixed a label to the sample container, and entered a complete description of the sample on the Sample Collection Log.

The field team also used a hand auger to collect subsurface samples in the interval below the soil-tuff interface. After they encountered the interface and collected the near-surface samples, the field team decontaminated the equipment. They continued augering in the nonwelded tuff below the interface until they could no longer turn the auger or until they collected samples from a 3-ft interval. They handled these samples in the same manner as the near-surface samples.

The field team used a power-assisted hand auger to collect samples near the tile drain field. The targeted depths were surface to 5 ft, 5 ft to 10 ft, and 10 ft to 15 ft; however, the actual depths were surface to 5 ft, 5 ft to 7 ft, and 7 ft to 11 ft. The field team collected samples from the first 5-ft interval with a hand auger. They attempted to drill the second interval with the hand auger, but when they reached the depth of 7 ft, they could no longer turn the hand auger. They collected samples from that 2-ft interval before using the power-assisted hand auger to collect samples from the 7- to 11-ft interval. By turning the auger bit, they brought the samples up to the surface for collection.

TABLE 5

ANALYTICAL RESULTS FROM 1991 EM-8 RECONNAISSANCE SAMPLING AT FORMER TA-42

Sample No.[a, b]	PCBs[c] (µg/g)	Unc[d]	Pb[e] (mg/L)	Unc	VOCs[f]	SVOCs[f]
PF-IB1-0	< 0.05		11.4	1.1	NTCF[f]	NTCF
PF-IB1-5	< 0.05		0.29	0.03	NTCF	NTCF
PF-IB2-0	< 0.05		0.05	0.01	NTCF	NTCF
PF-IB2-5	< 0.05		0.03	0.01	NTCF	NTCF
PF-HT2-0	1.02	0.2	< 0.01		NTCF	NTCF
PF-HT-2-5	0.4	0.08	0.04	0.01	NTCF	NTCF
PF-HT2-10	< 0.05		< 0.01		NTCF	NTCF
PF-HT3-0	0.08	0.02	0.04	0.01	NTCF	NTCF
PF-HT3-5	0.11	0.02	< 0.01		NTCF	NTCF
PF-HT3-10	< 0.05		0.04	0.01	NTCF	NTCF
PF-CDA-0	< 0.05		0.17	0.02	NTCF	NTCF
PF-ST-10	< 0.05		2.2	0.2	NTCF	NTCF
PF-ST-15	< 0.05		0.45	0.04	NTCF	(see note g)
PF-ST-20	< 0.05		< 0.01		NTCF	NTCF
PF-ST-25	< 0.05		< 0.01		NTCF	NTCF
PF-PLN-0	0.52	0.1	0.01	0.01	NTCF	(see note h)
PF-PLM-0	0.12	0.02	< 0.01		NTCF	NTCF
PF-PLS-0	< 0.05		0.34	0.03	NTCF	NTCF

Sample No.	^{238}Pu (pCi/g)	Unc	$^{239,240}Pu$ (pCi/g)	Unc	Total U (µg/g)	Unc	^{137}Cs (pCi/g)	Unc
PF-IB1-0	0.0004	0.0009	0.015	0.026	3.58	0.4	0.0883	0.0996
PF-IB1-5	0.007	0.001	0.0002	0.0004	3.44	0.3	0.176	0.151
PF-IB2-0	0.003	0.001	0.0554	0.0047	3.5	0.3	0.0944	0.0941
PF-IB2-5	0.0003	0.0006	0.000	0.0005	3.76	0.4	0.193	0.171
PF-HT2-0	0.002	0.002	0.0179	0.0033	3.85	0.4	0.169	0.111
PF-HT-2-5	0.009	0.004	0.0628	0.0085	3.76	0.4	0.0643	0.16
PF-HT2-10	0.0006	0.0004	0.0013	0.0006	3.7	0.4	0.236	0.111
PF-HT3-0	0.0012	0.0007	0.0205	0.0031	3.65	0.4	0.245	0.143
PF-HT3-5	0.0035	0.0009	0.0086	0.0014	3.13	0.3	0.241	0.109
PF-HT3-10	0.0016	0.0006	0.0292	0.0027	3.6	0.4	0.238	0.153
PF-CDA-0	0.0036	0.0009	0.0014	0.0006	1.86	0.2	0.0643	0.156
PF-ST-10	0.015	0.002	0.151	0.0077	4.17	0.4	0.143	0.104
PF-ST-15	2.48	0.15	4.77	0.26	5.2	0.5	0.0579	0.17
PF-ST-20	0.155	0.016	0.40	0.03	3.34	0.3	0.0239	0.101
PF-ST-25	0.016	0.002	0.0032	0.0008	3.9	0.4	0.463	0.173
PF-PLN-0	0.0012	0.0008	0.006	0.001	3.7	0.4	0.0662	0.106
PF-PLM-0	0.009	0.002	0.0148	0.0021	3.44	0.3	0.272	0.146
PF-PLS-0	0.006	0.001	0.0151	0.0018	2.47	0.2	0.16	0.109

a. Last digit on sample number indicates the depth of sampling in feet.

b. PF = Philip Fresquez (sample collector), IB = incinerator building, HT = holding tank, CDA = canyon disposal area, ST = septic tank, PLN = parking lot north, PLM = parking lot middle, PLS = parking lot south

c. Cleanup level for polychlorinated biphenyls (PCBs) is 10 mg/kg (or ppm) for industrial sites with other constituents of potential concern (Environmental Restoration Project Assessments Council 1995, 45378).

d. Unc = uncertainty

e. Toxicity characteristic leaching procedure (TCLP) metals analyzed for included Hg, As, Se, Ag, Ba, Cd, Cr, and Pb. All other TCLP metals were below action levels except for a sample that contained Pb above the background upper tolerance limit (39 mg/kg) when converted from TCLP to total Pb (see Section 4.1.3.2); therefore, only Pb results are shown.

f. VOCs = volatile organic compounds, SVOCs = semivolatile organic compounds, NTCF = no target compound found

g. Eight SVOCs were detected in this sample. Seven of the eight were polycyclic aromatic hydrocarbons (PAHs). Although these hydrocarbon compounds are carcinogen hazards in volatile forms (Sax and Lewis 1987, 34770), they are all common constituents in paving (asphalt) and roofing tar (coal tar pitch) materials (Windholz 1983, 34771). The soil sample collected at the 15-ft level was fill material, thus the PAHs detected in this soil sample were probably from a piece of asphalt or paving tar, a nonhazardous material (nonsoluble and nonvolatile) in its present form. The other SVOC detected is bis-2-ethyl-hexylphthalate, but at trace amounts (400 ppb).

h. This sample contained a trace amount of bis-2-ethyl-hexylphthalate (400 ppb). This amount is below the Environmental Protection Agency action-level guideline of 83 ppm.

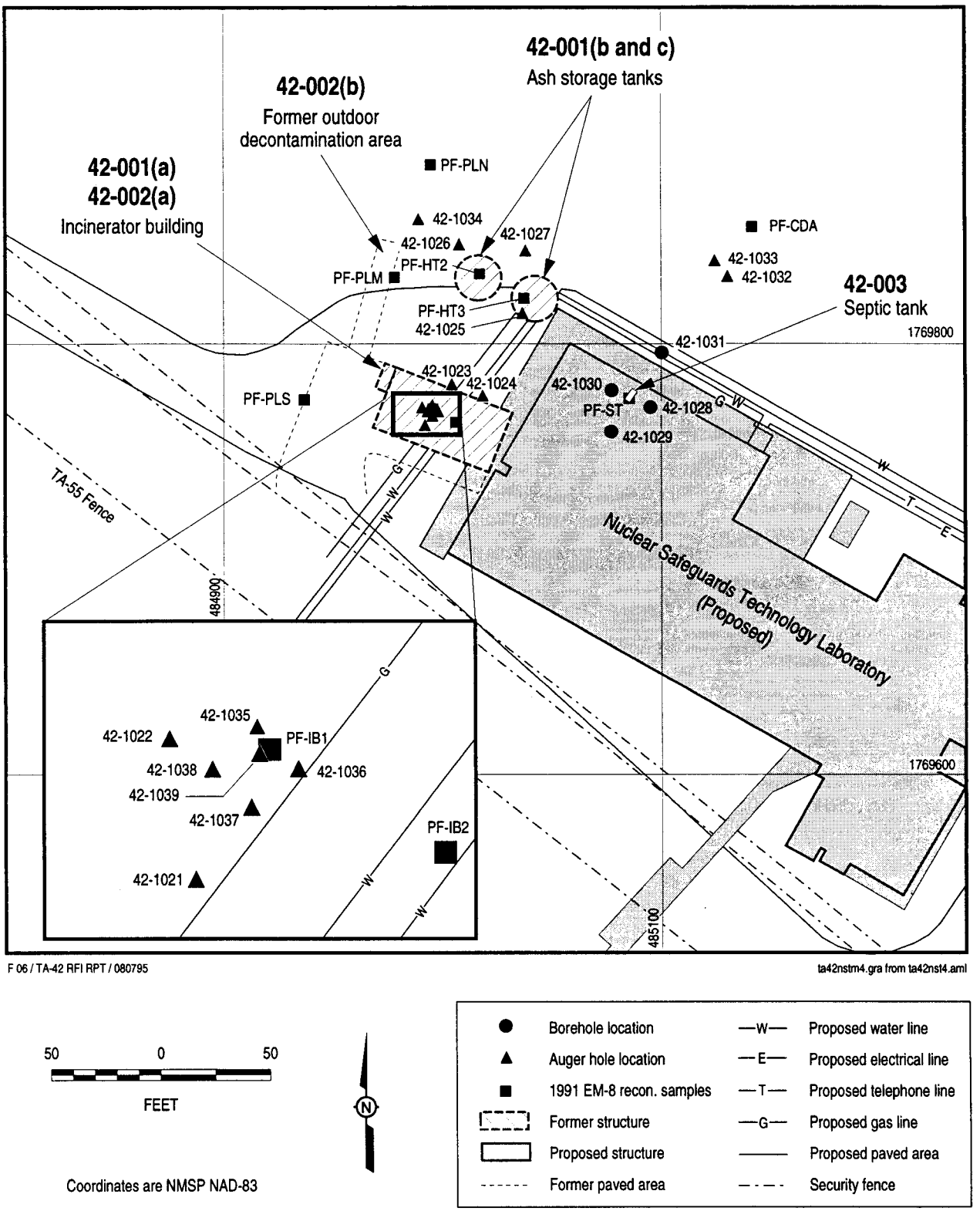


Figure 6. Potential realease sites and sampling locations at former TA-42.

TABLE 6

SUMMARY OF OU 1129 SAMPLES COLLECTED AT FORMER TA-42

PRS	Sample Type	Location ID No.	Bar Code Number	Sample No.*	Sample Interval (ft)	Date Collected
42–001(a) 42–002(a)	Auger	42-1021	AAA0951	B-1-1	0–1.5	7/16/92
			AAA0953	B-1-2	1.5–2.4	7/16/92
	Auger	42-1022	AAA0954	B-2-1	0–2.6	7/16/92
			AAA0955	B-2-2	2.6–3.5	7/16/92
	Auger	42-1023	AAA0956	B-3-1	0–3	7/16/92
			AAA0957	B-3-2	3–4.75	7/16/92
	Auger	42-1024	AAA0969	B-12-1	0–3	7/16/92
			AAA0970	B-12-2	3–5	7/16/92
	Auger	42-1035		B-14-1	0–1	9/22/92
				B-14-2	1–2	9/22/92
				B-14-3	2–3	9/22/92
	Auger	42-1036		B-15-1	0–1	9/22/92
				B-15-2	1–2	9/22/92
				B-15-3	2–3	9/22/92
	Auger	42-1037		B-16-1	0–1	9/22/92
			AAA1691	B-16-2	1–2	9/22/92
				B-16-3	2–3	9/22/92
	Auger	42-1038		B-17-1	0–1	9/22/92
				B-17-2	1–2	9/22/92
				B-17-3	2–3	9/22/92
	Auger	42-1039	AAA1692	B-18-1	0–1	9/22/92
			AAA1693	B-18-2	1–2	9/22/92
			AAA1695	B-18-3	2–3	9/22/92
42–001 (b and c)	Auger	42-1025	AAA0960	B-4-1	0–2.2	7/16/92
			AAA0961	B-4-2	2.2–5.25	7/16/92
	Auger	42-1027	AAA0962	B-5-1	0–3	7/16/92
			AAA0963	B-5-2	3–6	7/16/92
	Auger	42-1026	AAA0967	B-11-1	0–3	7/16/92
			AAA0968	B-11-2	3–6	7/16/92
42–002(b)	Auger	42-1034	AAA0992	B-13-1	0–3	7/22/92
			AAA0993	B-13-2	3–6	7/22/92
42–003	Borehole	42-1028	AAA0973	B-6-1	10–15	7/21/92
			AAA0974	B-6-1D	10–15	7/21/92
			AAA0975	B-6-2	15–20	7/21/92
			AAA0976	B-6-3	20–25	7/21/92
			AAA0990	B-6-C-2	25–28	7/21/92
	Borehole	42-1029	AAA0977	B-7-1	10–15	7/21/92
			AAA0978	B-7-2	15–20	7/21/92
			AAA0979	B-7-3	20–25	7/21/92
	Borehole	42-1030	AAA0980	B-8-1	10–15	7/21/92
			AAA0981	B-8-1D	10–15	7/21/92
			AAA0982	B-8-2	15–20	7/21/92
			AAA0983	B-8-3	20–25	7/21/92
			AAA0991	B-8-C-3	25–28	7/21/92
	Borehole	42-1031	AAA0984	B-9-1	10–17	7/21/92
			AAA0985	B-9-2	17–22	7/21/92
			AAA0986	B-9-3	22–27	7/21/92
	Power-Assisted Auger	42-1032	AAA0964	B-10-1	0–5	7/16/92
			AAA0965	B-10-2	5–7	7/16/92
			AAA0966	B-10-3	7–11	7/22/92
	Auger	42-1033	AAA0989	C-1-1	0–3.5	7/16/92

* as assigned in the revised SAP for Aggregate J (LANL 1993, 48849)

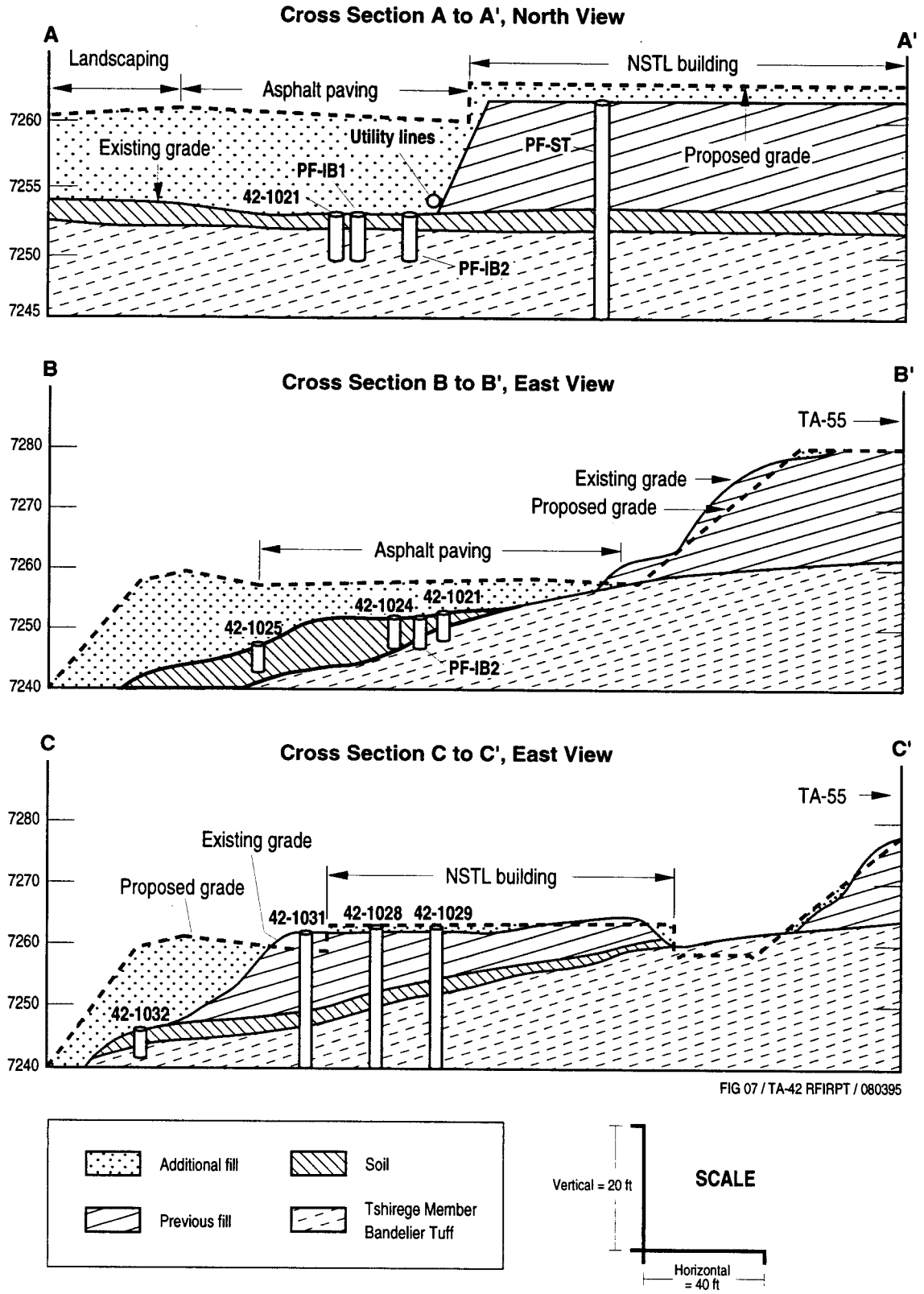


Figure 7. Schematic cross section through former TA-42; (A) north view, (B) east view, and (C) east view.

The field team used a hollow-stem auger and a split spoon to collect subsurface samples between 10 ft and 30 ft. The split spoon is a 5-ft core barrel that can be opened to remove the sample. The field team did not sample the top 10 ft of fill material because it postdated the contamination and was assumed to be clean. They started sampling at a depth of 10 ft and collected samples at every 5-ft interval.

Sampling locations were selected to bound the extent of contaminants detected during the reconnaissance study and to include locations where construction activities might impact residual contamination around the NSTL structures or utility lines (Figure 6). Sample locations were surveyed after the samples were collected so that the exact coordinates (XYZ) would be documented.

The sample at Location ID No. 42-1032 was moved from the original location that was designated in the SAP because the tile drain field was not found. A second auger hole was drilled to find the location of the former structure. The soil from the abandoned auger hole was collected as a contingency sample (Location ID No. 42-1033) (Figure 6).

4.1.2.1 Results of Field Surveys

Engineering Survey

An engineering survey was performed to locate the former incinerator building, the ash holding tanks, the septic tank and associated tile drain field and outfall, the outdoor decontamination area, and the utility lines associated with the NSTL to be constructed on this site. As-built drawings, survey data, and engineering drawings for the NSTL provided the information on the former buildings, facility locations, and future construction activities at the site. The following engineering drawings were used during the engineering survey to locate former TA-42 structures: ENG-C12002 (LASL 1950, 25392) and ENG-R2476 (LASL 1969, 48884). The following engineering drawings were used during the engineering survey to locate future structures and utilities of the NSTL: C45894 sheet numbers C1, C2, C3, C6, and C18 (LANL, 1991, 48896; LANL, 1991, 48902; LANL, 1991, 48897; LANL, 1991, 48899; LANL, 1991, 48901). The information from the engineering drawings was converted to New Mexico State Plane coordinates and submitted to the Facility for Information Management, Analysis, and Display. Sample locations were chosen based on the findings of the engineering survey and previous data collected at the site. All sample points were surveyed, and the results were registered on the site map (see Figure 6).

Geologic Survey

A geologic survey was performed to understand the relationship between existing soil and bedrock, to understand the impact of future construction activities on the current topography, and to help recognize transport and exposure pathways. The results of the geologic survey (site cross sections) are illustrated in Figure 7. Figure 7 shows the existing grade, which was present during the RFI, and the proposed grade, which would be present after the construction of the NSTL building. The locations of the cross sections are shown in Figure 8. In addition, detailed geological logs of the samples collected using a hollow-stem auger are shown in Appendix C. These logs include a detailed lithologic description of each core, sections of core not recovered, qualitative moisture content, and the analyses requested for each interval.

4.1.2.2 Results of Field Screening

Radiation and organic screening were conducted concurrently with the sampling effort. The auger holes and the breathing zones around the sample locations were tested for organic vapors every time the auger advanced an interval. Organic screening was performed with a Century OVA 128 GC and an HNu photo-ionizing detector. The following materials were monitored for radiation: the soil removed by the hand augers, the drill rig cuttings, the cores after the split spoons were opened, and the equipment after the auger or drill rig advanced an interval. In addition, shoes and coveralls were checked before personnel left the site. Beta and gamma radiation were monitored with an Eberline ESP; alpha radiation was monitored with an Alpha Instrument Model 139.

The samples were analyzed for lead using a Spectrace 9000 that provides portable field EDXRF analysis. Splits were collected from each 1-ft interval, placed in special 32-mm sample cups, and sealed with 4-µm polypropylene x-ray film windows.

Field monitoring of fugitive dust at the site was conducted in conjunction with the drilling operation. Two HVASs were set up at the site, one upwind and one downwind from the drill rig. The filter samples were submitted to CST-9 for analysis of gross-alpha, -beta, and -gamma activity; ^{238}Pu; ^{239,240}Pu; and ^{241}Am. Results from the HVASs are shown in Table 7. Negative values are a result of counting statistics; activity in those filters was at background level.

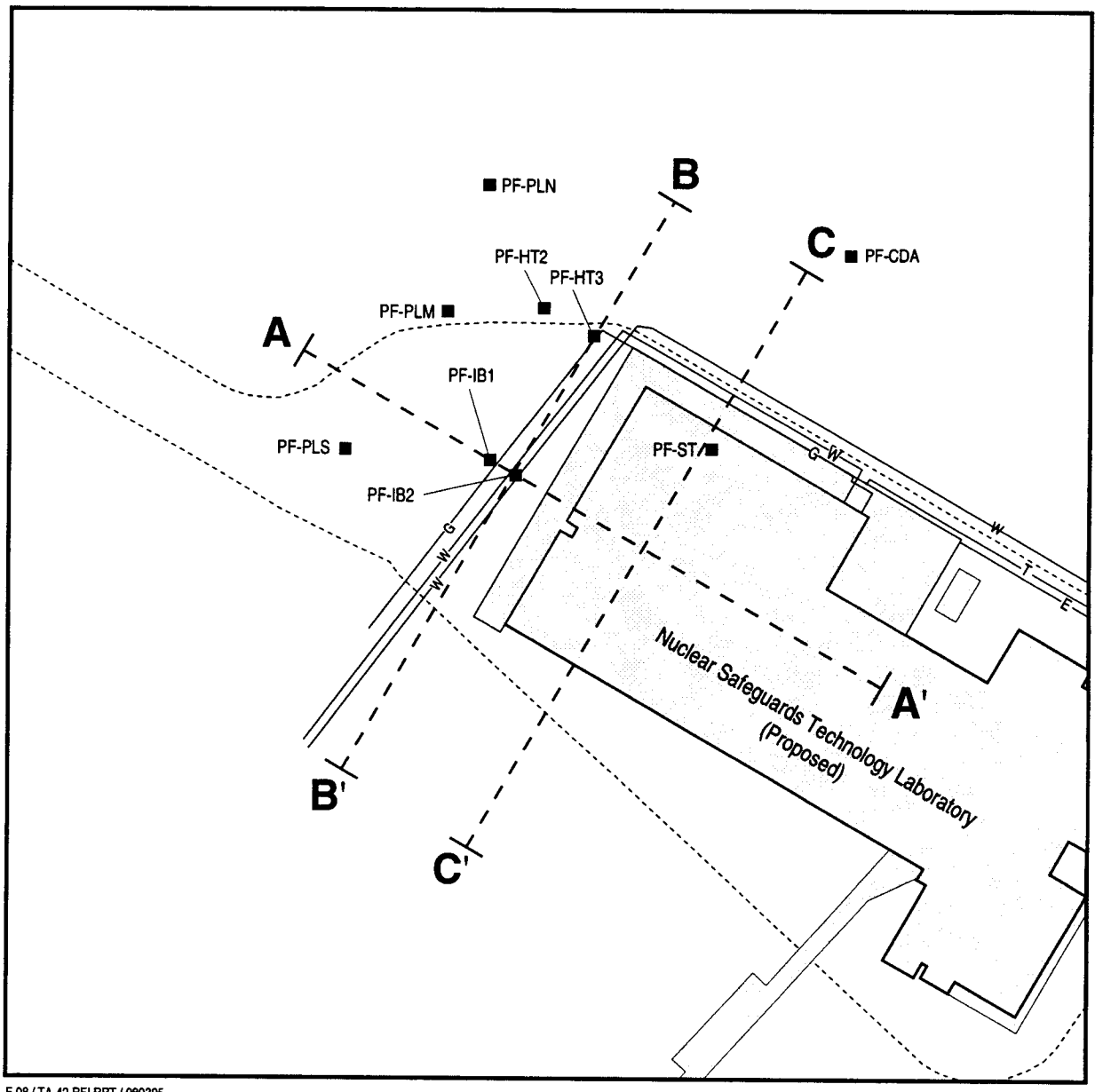
The apparent concentrations of ^{238}Pu and ^{239,240}Pu in air filter samples collected downwind from the drilling operation were higher than those collected upwind. However, because of uncertainty in the analytical results, no statistical difference exists between samples collected upwind and downwind. The ^{241}Am concentrations in air filter samples collected downwind from the drilling operation were similar to those collected upwind.

No radiation above background was detected by the monitoring instruments during sampling. Organic vapors were detected up to 2 ppm in the borehole and in several sections in the split-spoon sampler for the auger drill, but the vapors were not detected in the breathing zone. The industrial hygienist indicated that the reading was probably the result of the high moisture content of the sample or fumes from the drill rig, which was located upwind from the sample location. The samples were high in moisture content but were not saturated. Previous samples collected at the site and analyzed for VOCs and SVOCs had no hits (see Table 5).

4.1.3 Screening Assessment

The screening assessment of the analytical results for samples collected at former TA-42 was conducted according to the methodology outlined in Section 3.2. The screening assessment data tables are found in Appendix D. The results of the screening assessment should not be interpreted independently of an evaluation of the analytical data quality and the revised SAP for Aggregate J (LANL 1993, 48849). As discussed previously, the sample locations were chosen based on knowledge gained from the results of the 1991 EM-8 reconnaissance study and on construction project plans. Samples were collected at the locations of the PRSs in the areas where the reconnaissance indicated the presence of radionuclides or metals and in areas where excavation for future activities is planned. Sample locations are indicated in Figure 6.

The suite of analytes was determined based on the analytical results of the 1991 EM-8 reconnaissance study (LANL 1993, 48849). Consequently, soil samples collected for the current investigation were analyzed for isotopic plutonium and elemental lead. A few selected samples from the vicinity of the ash storage tanks, PRS Nos. 42-001(b and c), were also analyzed for the following alpha-emitting radionuclides: ^{241}Am, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U, ^{235}U, and ^{238}U.



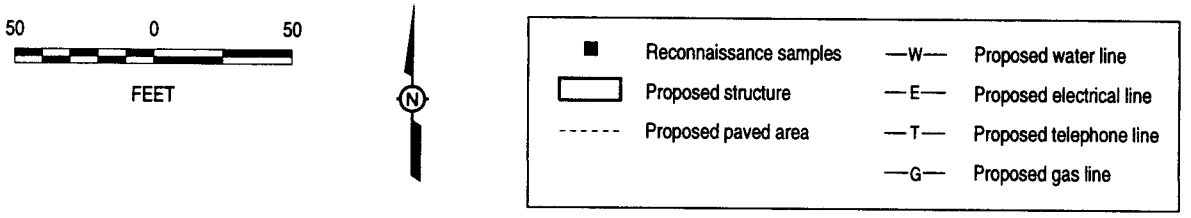


Figure 8. Former TA-42 site map showing reconnaissance sample locations, cross sections, and proposed Nuclear Safeguards Technology Laboratory.

TABLE 7

RESULTS FROM HIGH-VOLUME AIR SAMPLERS

Analyte	Upwind HVAS (pCi/filter)		Downwind HVAS (pCi/filter)	
	Analytical Result	Analytical Unc*	Analytical Result	Analytical Unc
Alpha	0.9	0.2	0.8	0.2
Beta	1.9	0.3	2.0	0.3
Gamma	−80	80	−100	80
^{238}Pu	0.002	0.011	0.015	0.016
$^{239,240}Pu$	0.006	0.01	0.026	0.016
^{241}Am	0.0	0.23	−0.01	0.04

* Unc = uncertainty

For the screening assessment, results for isotopic plutonium were considered from the following samples:

- those collected for the 1991 EM-8 reconnaissance study, which were analyzed by a fixed-site laboratory;
- those collected during the RFI for quick turnaround analysis by the former INC-12; and
- those collected during the RFI for fixed-site laboratory analysis.

The INC-12 results for isotopic plutonium analysis can be found in Table B-1, Appendix B. The INC-12 results for ICPMS analysis of elemental lead, which are also found in Table B-1, were included in the screening assessment. The EM-8 results for elemental lead could not be included in the screening assessment because the results of the TCLP analysis cannot be directly compared with either the UTL or SAL values. Samples submitted to INC-12 for analysis were collected from the area of the incinerator and the ash storage tanks, critical depths at the septic tank, locations of planned excavations for utility lines, and the former outdoor decontamination area.

Elemental lead was analyzed by either GFAA, ICPMS, or field portable EDXRF methods. As discussed in Section 3.1, the EDXRF data set, which is summarized in Table B-2, Appendix B, could not be screened against the site-specific background UTL values because the background measurements were performed using SW-846 methods. However, the EDXRF data has been included in the screening assessment against the SAL value for elemental lead in soil. The analytical data quality evaluation for Aggregate J, which is found in Appendix A, indicated that the GFAA results for elemental lead are potentially biased low by as much as 60% for Location ID No. 42-1021 (surface to1.5 ft and 1.5 ft to 2.4 ft), Location ID No. 42-1022 (surface to 2.6 ft and 2.6 ft to 3.5 ft), and Location ID No. 42-1023 (surface to 3 ft and 3 ft to 4.75 ft). Because of the impact of the significant low bias on the UTL comparison, the GFAA results should be carried forward to the SAL comparison.

The data set for the analyses performed at fixed-site laboratories is summarized in Table B-3. For sample locations and depths where there was more than one result for a particular constituent, such as plutonium measured by the former INC-12 and the fixed-site laboratory, the maximum value was chosen for the purposes of the screening assessment. Choosing the maximum value yields conservative screening results.

Gross-alpha, -beta, and -gamma screening of all samples was performed at a mobile laboratory before analysis. The MDAs for soil samples were 63 pCi/g alpha, 24 pCi/g beta, and 4 pCi/g gamma. A background sample of the Bandelier Tuff was also counted, and the sample activity was corrected by subtracting the background activity. Gross-alpha, -beta, and -gamma activity was not detected above the MDA in any of the samples collected.

4.1.3.1 Comparison with Background/SALs

Comparison with Background Levels

The radionuclide and elemental lead analytical results for Aggregate J were compared with background UTL values as an initial step in the screening assessment (see Section 3.2.1). Elemental lead is considered to be a noncarcinogenic constituent because the SAL value is based solely on a noncarcinogenic endpoint. A distributional shift test was not performed because the data sets were too small. The data tables for the background UTL comparisons, identifying COPCs present above the UTL values for each sample, are provided in Tables D-1 (radionuclides) and D-2 (lead), Appendix D. The COPCs that were identified as a result of the background UTL values comparison are listed in Table 8. Included in the list of COPCs are those constituents for which a background UTL value is not available.

TABLE 8

CONSTITUENTS OF POTENTIAL CONCERN CARRIED FORWARD TO THE SAL COMPARISON FOR AGGREGATE J

Radionuclides	Noncarcinogenic Constituents
^{241}Am[a]	Lead[b]
^{238}Pu	
$^{239,240}Pu$	
^{230}Th[a]	
^{235}U	

a. COPC is carried forward because the UTL value is not available.
b. COPC is carried forward because the lead UTL value cannot be directly compared with EDXRF results.

During the current accelerated characterization study, soil samples collected from 14 locations at depths ranging from surface to 28 ft were analyzed for alpha-emitting radionuclides. At all 14 sample locations ^{238}Pu and $^{239,240}Pu$ were present at levels exceeding the background UTL values of 0.014 pCi/g and 0.052 pCi/g, respectively. The radionuclides ^{238}Pu and $^{239,240}Pu$ were also present at levels exceeding background in Sample No. PF-ST, which was collected at the septic tank site during the 1991 EM-8 reconnaissance study. The radionuclides $^{239,240}Pu$ were also detected above the UTL value in Sample No. PF-IB2 (the incinerator site) and Sample No. PF-HT2 (the ash storage tanks site). The radionuclide ^{235}U was present above its background UTL value of 0.088 pCi/g at one location only, Location ID No. 42-1027, which is near the ash storage tanks site.

The radionuclides ^{241}Am and ^{230}Th are carried forward to the SAL comparison because background UTL values are not available for these radionuclides. The radionuclides ^{228}Th, ^{232}Th, ^{234}U, and ^{238}U were eliminated from further consideration because these radionuclides were present at levels that were less than their respective UTL values.

The ICPMS and GFAA results for elemental lead were screened against the soil UTL value of 39 mg/kg. The UTL value for lead was not exceeded at any of the five sample locations from which samples were analyzed by GFAA. However, lead is carried forward to the SAL comparison because of the potentially large negative bias noted for some of the GFAA results. Also, the EDXRF results for lead could not be directly compared with the UTL value and hence are carried forward to the SAL comparison.

Comparison with Human Health Screening Action Levels

COPCs that were not eliminated in the background comparison were evaluated by a comparison with the human health SALs. The radionuclide data set underwent a multiple constituent analysis. The data set for elemental lead, including the EDXRF results, underwent the SAL comparison but not the multiple constituent analysis since no other noncarcinogenic inorganic constituents were analyzed for in Aggregate J. Measurements for lead were made using EDXRF at five sample locations near the incinerator site at depths ranging from surface to 3 ft.

The results of the screening comparison with SAL values indicate that no potential COCs were identified at any of the sample locations in Aggregate J. No COPC identified in the background comparison was present above its SAL value. Furthermore, the SAL-normalized sum did not exceed unity at any sample location in the multiple constituent analysis for radionuclides.

Screening Assessment Conclusions

As a result of the screening assessment conducted for the samples collected in Aggregate J, no COCs were identified that pose a potential risk to human health. In Figure 9 the maximum detected amount of each constituent is compared with its SAL and UTL value, which are given in Table 9. As illustrated in Figure 3, constituents for which a SAL value is not available or for which the SAL value is lower than the reporting limit are evaluated separately for inclusion in a risk assessment. None of the constituents analyzed for in Aggregate J fall into this category.

TABLE 9

COMPARISON OF BACKGROUND LEVELS AND SCREENING ACTION LEVELS WITH CONSTITUENTS OF POTENTIAL CONCERN IN AGGREGATE J

COPC	UTLs[a] for LANL Soil Background Data	Soil Screening Action Level[b]	Maximum Result in Aggregate J
Lead	39 mg/kg	400 mg/kg	28.1 mg/kg
^{241}Am	N/A	17 pCi/g	0.933 pCi/g
^{238}Pu	0.014 pCi/g[c]	20 pCi/g	2.48 pCi/g
$^{239,240}Pu$	0.052 pCi/g[c]	18 pCi/g	10.3 pCi/g
^{228}Th	2.67 pCi/g	1.5 pCi/g	2.59 pCi/g
^{230}Th	N/A	5 pCi/g[d]	1.55 pCi/g
^{232}Th	2.68 pCi/g	5 pCi/g[d]	1.53 pCi/g
^{234}U	2.03 pCi/g	86 pCi/g	1. pCi/g
^{235}U	0.088 pCi/g	18 pCi/g	0.0999 pCi/g
^{238}U	1.90 pCi/g	59 pCi/g	0.815 pCi/g

a. UTL = upper tolerance limit
b. Installation Work Plan (LANL 1993, 26077; LANL 1993, 26078)
c. Maximum value is reported rather than the UTL.
d. Generic limits for ^{230}Th and ^{232}Th are set in DOE Order 5400.5 (DOE 1990, 0080) at 5 pCi/g averaged over each additional 15-cm interval.

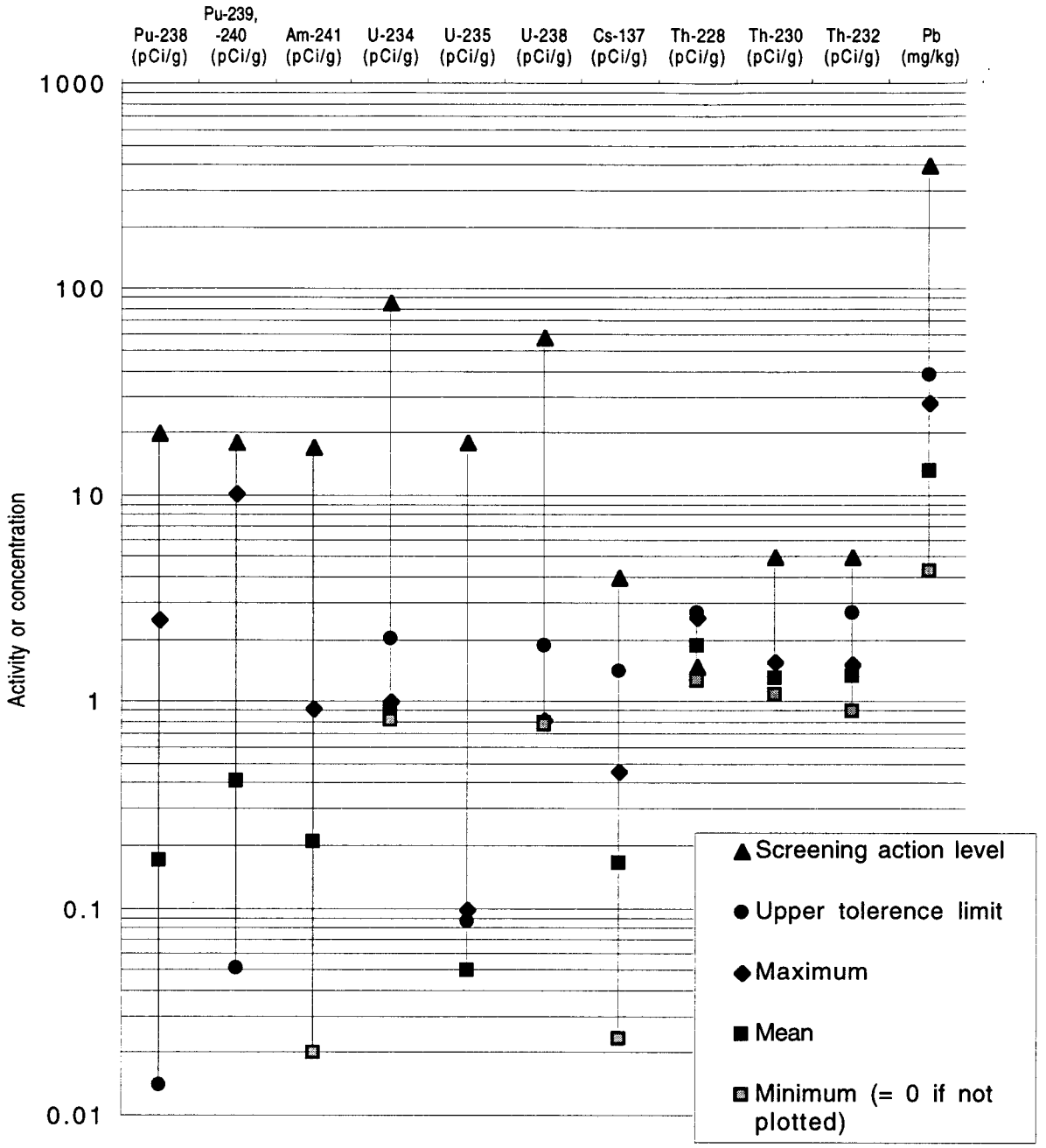


Figure 9. Data summary for Aggregate J.

4.1.3.2 Data Interpretation

Alpha-emitting isotopes of plutonium were present above background UTL values at the sites of the former incinerator, PRS No. 42-001(a) and PRS No. 42-002(a); the former ash storage tanks, PRS Nos. 42-001(b and c); the former septic tank, PRS No. 42-003; and the former outdoor decontamination area, PRS No. 42-002(b). The maximum activity of ^{238}Pu detected was 2.48 (±0.15) pCi/g at the site of the former septic tank (Sample No. PF-ST-15). The maximum activity of ^{239,240}Pu detected was 10.3 (±1.7) pCi/g, also at the site of the former septic tank (Location ID No. 42-1030 [10 ft to15 ft]). The radionuclide ^{235}U was present above its background UTL value at sample Location ID No. 42-1027 near the former ash storage tanks. None of the alpha-emitting isotopes were present above their respective SALs.

The radionuclide ^{228}Th was present above its SAL value of 1.5 pCi/g at three sample locations: Location ID No. 42-1026 and Location ID No. 42-1027, which are in the vicinity of the former ash storage tanks, and Location ID No. 42-1034, which is in the vicinity of the parking lot. However, none of the sample results exceeded the background value of 2.67 pCi/g for ^{228}Th; consequently ^{228}Th was eliminated from consideration as a COC.

The results of the INC-12 ICPMS analyses for lead (the maximum value was 17 mg/kg) were inconsistent with the level of lead in Sample No. PF-IB1 (11.4 mg/L by TCLP, which is approximately 228 mg/kg total lead) that was collected during the 1991 EM-8 reconnaissance study (see Table 5). The calculation to convert TCLP concentration to total lead assumes that lead is 100% leachable from the soil. If TCLP analyses for lead were actually performed on these samples, the values would be expected to be less than the calculated maximum. The calculation is based on the analytical methodology given in 40 CFR 261, Appendix II, Method 1311 (EPA 1993, 40099) in which the solid phase is extracted with an amount of extraction fluid equal to 20 times the weight of the solid phase. More information was needed to assess the extent of lead contamination at Sample No. PF-IB1 (site of the former incinerator). For this purpose, EDXRF field screening was conducted. Four locations (Location ID Nos. 42-1035 through 42-1038) were sampled at a 2-ft radius from Sample No. PF-IB1 in cardinal directions (N, S, E, and W). In addition, one location (Location ID No. 42-1039] was sampled immediately adjacent to Sample No. PF-IB1 to determine if the 228 mg/kg equivalent total lead in Sample No. PF-IB1 was due to a point source of contamination.

The EDXRF results for elemental lead are given in Appendix B.

EDXRF analyses did not show lead concentrations equivalent to or greater than the background UTL of 39 mg/kg or the human health SAL of 400 mg/kg; therefore, only five of the splits collected from each 1-ft interval were submitted for confirmatory analysis by GFAA. The results of the GFAA analyses confirmed the results of the EDXRF screening, which indicate that lead is not a COC at the site. The most plausible explanation for the 228 mg/kg equivalent total lead result is that the contamination detected in Sample No. PF-IB1 was due to either a very localized point source or an analytical error.

4.1.3.3 Risk Assessment

No human health risk assessment was performed for this PRS aggregate because no COCs were identified.

4.1.3.4 Ecotoxicological Screening Assessment

Ranking of Habitat Condition and Receptor Accessibility to COPCs

Ecological characteristics of the site were reviewed to estimate the likelihood that ecological receptors could come in contact with COPCs to a significant degree. The location of former TA-42 and the effects of past disturbances warrant a landscape condition score of one. See Figure 10, which is an aerial photograph of the site that shows the current conditions. Continuing disturbances will limit the amount of contact ecological receptors would have with COPCs; therefore, the site is given a receptor access score of one. Application of these scores to the decision model in Figure 5 produces a recommendation of NFA at this site with respect to ecological risk; therefore, no comparisons of COPCs with ESALs are required.

4.1.4 Conclusions and Recommendations

The COPCs in Aggregate J were ^{238}Pu, ^{239,240}Pu, lead, ^{241}Am, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U, ^{235}U, and ^{238}U. No COCs were identified in the screening assessment. The available data indicate that the COPCs are either not present or are present in concentrations that would not pose a risk to human health or the environment based on results of the screening assessment.

DOE/AL gave the former Facilities Engineering Division and the former Nuclear Technology and Engineering Division approval for construction validation in October 1992 because they found that most of the NSTL building foundation would not overlap the footprint of the former incinerator facility (see Figure 6) and all COPC concentrations were well below the SALs.

All the PRSs in Aggregate J are recommended for NFA. Based on criterion number 4, a Class III permit modification will be requested to remove this site from the Hazardous and Solid Waste Amendments Module of the Laboratory's RCRA operating permit.

4.1.5 Further Investigations

Further investigations are not recommended for any of the PRSs in Aggregate J.

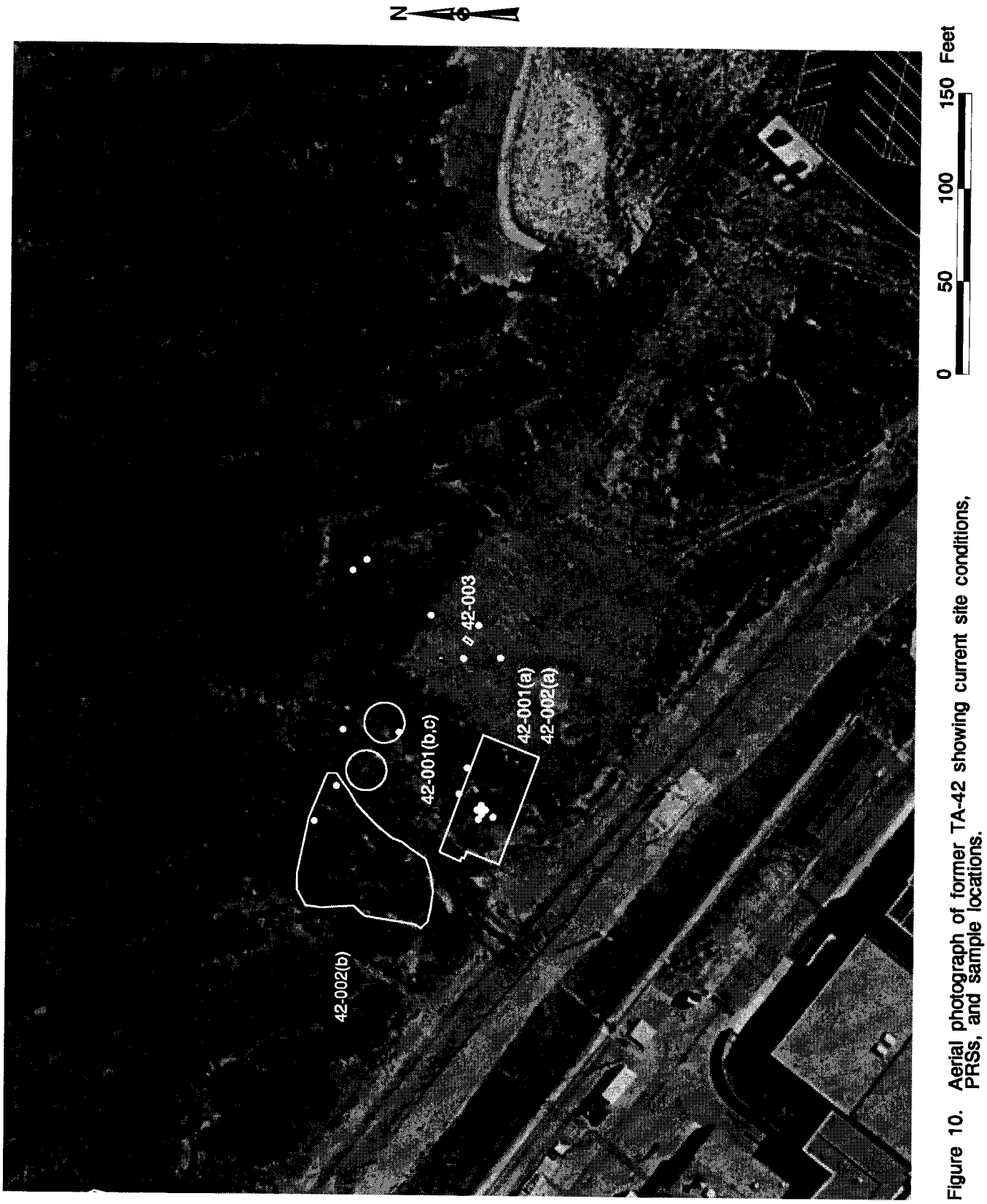


Figure 10. Aerial photograph of former TA-42 showing current site conditions, PRSs, and sample locations.

This page intentionally left blank

REFERENCES

Ahlquist, A. J., May 9, 1978. "Final Soil Sampling at TA-42," Los Alamos Scientific Laboratory Memorandum H8-78-237 to Ray Garde (H-1) from A. John Ahlquist (H-8), Los Alamos, New Mexico. **(Ahlquist 1978, ER ID Number 746)**

Ahlquist, A. J., August 12, 1987. "CEARP Report—Comments," Los Alamos National Laboratory Memorandum ECMO-87-186 to Doris B. Garvey (ECMO) from A. John Ahlquist, Los Alamos, New Mexico. **(Ahlquist 1987, ER ID Number 752)**

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

Bradshaw, R., March 9, 1977. "Ten-Year Decontamination and Decommissioning Plan, ES 3843-0," Los Alamos Scientific Laboratory Memorandum ENG-728 to Distribution from R. Bradshaw, Los Alamos, New Mexico. **(Bradshaw 1977, ER ID Number 765)**

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

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

DOE (US Department of Energy), June 5,1990. "Radiation Protection of the Public and the Environment," DOE Order 5400.5 (Change 1), Washington, DC. **(DOE 1990, 0080)**

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

Dunham, D. A., December 17, 1992. "Biological and Floodplain/Wetlands Assessment for Environmental Restoration Program, Operable Unit 1129, TA-4, -5, -35, -42, -48, -52, -55, -63, -66 and Operable Unit 1147, TA-50" (draft), Environmental Protection Group (EM-8), Los Alamos National Laboratory, Los Alamos, New Mexico. **(Dunham 1992, ER ID Number 31276)**

Emelity, L. A., J. R. Buchholz, A. M. Valentine, W. R. Goldsmith, L. C. Borduin, M. E. Muller, and R. A. Hemphill, January 1975. "A Survey of Liquid Waste Management Problems at the LASL," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. **(Emelity et al. 1975, ER ID Number 324)**

Enders, J., March 30, 1965. "Request for additional pit space and disposal wells," Los Alamos Scientific Laboratory Memorandum to Charles Reynolds (Eng-4) from John Enders (H-1), Los Alamos, New Mexico. **(Enders 1965, ER ID Number 801)**

Environmental Protection Group, December 1990. "Environmental Surveillance at Los Alamos During 1989," Los Alamos National Laboratory Report LA-12000-ENV, Los Alamos, New Mexico. **(Environmental Protection Group 1990, ER ID Number 6995)**

Environmental Protection Group, March 1992. "Environmental Surveillance at Los Alamos During 1990," Los Alamos National Laboratory Report LA-12271-MS, Los Alamos, New Mexico. **(Environmental Protection Group 1992, ER ID Number 7004)**

Environmental Restoration Project Assessments Council, January 18, 1995. "Screening Assessment Methodology at Los Alamos National Laboratory" (draft), Los Alamos National Laboratory, Los Alamos, New Mexico. **(Environmental Restoration Project Assessments Council 1995, 04-0311)**

Environmental Restoration Project Assessments Council, February 6, 1995. "Guidance for Evaluation and Cleanup of PCBs in Soil" (final draft), Los Alamos National Laboratory, Los Alamos, New Mexico. **(Environmental Restoration Project Assessments Council 1995, ER ID Number 45378)**

Environmental Restoration Project Assessments Council, March 28, 1995. "Statistical Comparisons to Background, Part I," Los Alamos National Laboratory Report LA-UR-95-1217, Los Alamos, New Mexico. **(Environmental Restoration Project Assessments Council 1995, ER ID Number 45753)**

EPA (US Environmental Protection Agency), November 1986. "Test Methods for Evaluating Solid Waste, Volume IA: Laboratory Manual, Physical/Chemical Methods," SW-846, Revision 0, Third Edition, Washington, DC. **(EPA 1986, ER ID Number 31732)**

EPA (US Environmental Protection Agency), July 1990. "PCB Spill Cleanup Policy," *Code of Federal Regulations, Protection of Environment*, Title 40, Part 761, Subpart G, Washington, DC. **(EPA 1990, ER ID Number 39994)**

EPA (US Environmental Protection Agency), July 1993. "Identification and Listing of Hazardous Waste," *Code of Federal Regulations, Protection of Environment*, Title 40, Part 261, Appendix II, Method 1311, Washington, DC. **(EPA 1993, ER ID Number 40099)**

ESG (Environmental Surveillance Group), May 1988. "Environmental Surveillance at Los Alamos During 1987," Los Alamos National Laboratory Report LA-11306-ENV, Los Alamos, New Mexico. **(ESG 1988, ER ID Number 6877)**

ESG (Environmental Surveillance Group), June 1989. "Environmental Surveillance at Los Alamos During 1988," Los Alamos National Laboratory Report LA-11628-ENV, Los Alamos, New Mexico. **(ESG 1989, ER ID Number 6894)**

Fresquez, P., March 1, 1991. "Results of an Environmental Restoration Interim Action (ERIA) Reconnaissance Survey at the Site of the Proposed Nuclear Safeguard Technology Laboratory (NSTL) Near TA-55," Los Alamos National Laboratory Memorandum HSE-8:91-340 to Henry Nunes (EES-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. **(Fresquez 1991, ER ID Number 817)**

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

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

Harper, J. R., and R. Garde, November 1981. "The Decommissioning of the TA-42 Plutonium Contaminated Incinerator Facility," Los Alamos National Laboratory Report LA-9077-MS, Los Alamos, New Mexico. **(Harper and Garde 1981, ER ID Number 6286)**

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

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

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

LANL (Los Alamos National Laboratory), March 1, 1991. Engineering Drawing C45894, sheet number C1, Los Alamos, New Mexico. **(LANL 1991, ER ID Number 48896)**

LANL (Los Alamos National Laboratory), March 1, 1991. Engineering Drawing C45894, sheet number C2, Los Alamos, New Mexico. **(LANL 1991, ER ID Number 48902)**

LANL (Los Alamos National Laboratory), March 1, 1991. Engineering Drawing C45894, sheet number C3, Los Alamos, New Mexico. **(LANL 1991, ER ID Number 48897)**

LANL (Los Alamos National Laboratory), March 1, 1991. Engineering Drawing C45894, sheet number C6, Los Alamos, New Mexico. **(LANL 1991, ER ID Number 48899)**

LANL (Los Alamos National Laboratory), March 1, 1991. Engineering Drawing C45894, sheet number C18, Los Alamos, New Mexico. **(LANL 1991, ER ID Number 48901)**

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

LANL (Los Alamos National Laboratory), November 1993. "Installation Work Plan for Environmental Restoration," Revision 3, Vol. I, Los Alamos National Laboratory Report LA-UR-93-3987, Los Alamos, New Mexico. **(LANL 1993, ER ID Number 26077)**

LANL (Los Alamos National Laboratory), November 1993. "Installation Work Plan for Environmental Restoration," Revision 3, Vol. II, Los Alamos National Laboratory Report LA-UR-93-3987, Los Alamos, New Mexico. **(LANL 1993, ER ID Number 26078)**

LANL (Los Alamos National Laboratory), November 8, 1993. "Revised Sampling and Analysis Plan for OU 1129 Aggregate J," Revision 1, Los Alamos National Laboratory Report LA-UR-92-2120, Los Alamos, New Mexico. **(LANL 1993, ER ID Number 48849)**

LANL (Los Alamos National Laboratory), February 1995. "Installation Work Plan for Environmental Restoration," Revision 4, Los Alamos National Laboratory Report LA-UR-95-740, Chapter 2, Los Alamos, New Mexico. **(LANL 1995, ER ID Number 48637)**

LASL (Los Alamos Scientific Laboratory), May 26, 1950. Engineering Drawing ENG-C12002, sheet number 2, Los Alamos, New Mexico. **(LASL 1950, ER ID Number 25392)**

LASL (Los Alamos Scientific Laboratory), November 21, 1969. Engineering Drawing ENG-R2476, sheet number 1, Los Alamos, New Mexico. **(LASL 1969, ER ID Number 48884)**

LASL (Los Alamos Scientific Laboratory), circa 1977. "Material Disposal Areas at LASL," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. **(LASL circa 1977, ER ID Number 21560)**

Manz, K. L., M. D. Hannaford, E. D. McGehee, and T. L. Binzen, June 1994. "Environmental Restoration Program Operable Units (OUs) 1129 and 1147: Cultural Resource Survey Report," Cultural Resource Management Team Report No. 72, Los Alamos National Laboratory, Los Alamos, New Mexico. **(Manz et al. 1994, ER ID Number 49508)**

Meyer, D. D., December 28, 1977. "Other Sites of Interest," Los Alamos Scientific Laboratory Report, attached to Los Alamos Scientific Laboratory Memorandum H12-78-1 to Margaret A. Rogers (H-12) from Dean D. Meyer, Los Alamos, New Mexico. **(Meyer 1977, ER ID Number 875)**

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

Pratt, A. R., G. M. Gainer, C. N. Thomson, and R. D. Hutton, September 1994. "Fast-Turnaround RCRA Site Characterization of Former TA-42 at Los Alamos National Laboratory," Los Alamos National Laboratory Report LA-UR-94-3260, Los Alamos, New Mexico. **(Pratt et al. 1994, ER ID Number 41204)**

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

Purtymun, W. D., R. J. Peters, T. E. Buhl, M. N. Maes, and F. H. Brown, November 1987. "Background Concentrations of Radionuclides in Soils and River Sediments in Northern New Mexico, 1974–1986," Los Alamos National Laboratory Report LA-11134-MS, Los Alamos, New Mexico. **(Purtymun et al. 1987, ER ID Number 6687)**

Roy F. Weston, Inc., August 1989. "Site Database, Task 6, TA-42, 48, and 55," Los Alamos National Laboratory Report (working draft), Los Alamos, New Mexico. **(Roy F. Weston, Inc., 1989, ER ID Number 11907)**

Sax, I. N., and R. J. Lewis, Sr., 1987. "Hawley's Condensed Chemical Dictionary," 11th Ed., Van Nostrand Reinhold Company, New York, New York. **(Sax and Lewis 1987, ER ID Number 34770)**

Vaniman, D. and K Wohletz, November 16, 1993. "Reconnaissance Geology of North-Central LANL," Facility for Information Management, Analysis, and Display Map G101599, Los Alamos National Laboratory, Los Alamos, New Mexico. **(Vaniman and Wohletz 1993, 48809)**

Windholz, M. (Editor), 1983. "The Merck Index: An Encyclopedia of Chemicals, Drugs, and Biologicals," 10th Ed., Merck and Co., Inc., Rahway, New Jersey. **(Windholz 1983, ER ID Number 34771)**

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

Appendix A
Data Quality Evaluation

This page intentionally left blank

TABLE A-1

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE J

Location ID No.	PRS[a]	Sample ID No.	Matrix	Sample Type	Analysis Type	Request No.	QC[b] Parameter	Comments
Part I. Regular Field Samples								
42-1021-B-1	42-001(a) 42-002(a)	AAA0951	Soil	Reg	GFAA[c]	13188	Accuracy	Due to poor recovery from matrix spike samples, the results for lead should be regarded as estimated and potentially biased low.
42-1021-B-2	42-001(a) 42-002(a)	AAA0953	Soil	Reg	GFAA	13188	Accuracy	Due to poor recovery from matrix spike samples, the results for lead should be regarded as estimated and potentially biased low.
42-1022-B-1	42-001(a) 42-002(a)	AAA0954	Soil	Reg	GFAA	13188	Accuracy	Due to poor recovery from matrix spike samples, the results for lead should be regarded as estimated and potentially biased low.
42-1022-B-2	42-001(a) 42-002(a)	AAA0955	Soil	Reg	GFAA	13188	Accuracy	Due to poor recovery from matrix spike samples, the results for lead should be regarded as estimated and potentially biased low.
42-1023-B-1	42-001(a) 42-002(a)	AAA0956	Soil	Reg	GFAA	13188	Accuracy	Due to poor recovery from matrix spike samples, the results for lead should be regarded as estimated and potentially biased low.
42-1023-B-2	42-001(a) 42-002(a)	AAA0957	Soil	Reg	GFAA	13188	Accuracy	Due to poor recovery from matrix spike samples, the results for lead should be regarded as estimated and potentially biased low.
42-1035-B-1	42-001(a) 42-002(a)	N/A[d]	Soil	Reg	EDXRF[e]	N/A	Precision	Sample result for lead is less than the estimated detection limit and should be regarded as estimated.
42-1036-B-1	42-001(a) 42-002(a)	N/A	Soil	Reg	EDXRF	N/A	Precision	Sample result for lead is less than the estimated detection limit and should be regarded as estimated.
42-1036-B-2	42-001(a) 42-002(a)	N/A	Soil	Reg	EDXRF	N/A	Precision	Sample result for lead is less than the estimated detection limit and should be regarded as estimated.
42-1036-B-3	42-001(a) 42-002(a)	N/A	Soil	Reg	EDXRF	N/A	Precision	Sample result for lead is less than the estimated detection limit and should be regarded as estimated.
42-1037-B-1	42-001(a) 42-002(a)	N/A	Soil	Reg	EDXRF	N/A	Precision	Sample result for lead is less than the estimated detection limit and should be regarded as estimated.
42-1038-B-2	42-001(a) 42-002(a)	N/A	Soil	Reg	EDXRF	N/A	Precision	Sample result for lead is less than the estimated detection limit and should be regarded as estimated.
42-1039-B-3	42-001(a) 42-002(a)	N/A	Soil	Reg	EDXRF	N/A	Precision	Sample result for lead is less than the estimated detection limit and should be regarded as estimated.
Part II. Field QC Samples								
42-1021-B-1D	42-001(a) 42-002(a)	AAA0952	Soil	Dup	GFAA	13188	Accuracy	Due to poor recovery from matrix spike samples, the results for lead should be regarded as estimated and potentially biased low.
42-1028-B-1D	42-003	AAA0974	Soil	Dup	Isotopic Pu	13189	Precision	Poor relative percent differences (>50%) for field duplicate samples for following analyte(s): Pu-238 and Pu-239, -240.
					Am241	13189	Precision	Poor relative percent difference (>50%) for field duplicate sample for following analyte(s): Am-241.
42-1030-B-1D	42-003	AAA0981	Soil	Dup	Isotopic Pu	13189	Precision	Poor relative percent differences (>50%) for field duplicate samples for following analyte(s): Pu-238 and Pu-239, -240.
					Am-241	13189	Precision	Poor relative percent difference (>50%) for field duplicate sample for following analyte(s): Am-241.
42-1031-B-1D	42-003	AAA0984	Soil	Dup	Isotopic Pu	13189	Precision	Poor relative percent differences (>50%) for field duplicate samples for following analyte(s): Pu-238.
					Am-241	13189	Precision	Poor relative percent difference (>50%) for field duplicate sample for following analyte(s): Am-241.
42-1032-B-1D	42-003	AAA0965	Soil	Dup	Isotopic Pu	13189	Precision	Poor relative percent differences (>50%) for field duplicate samples for following analyte(s): 238Pu and Pu-239, -240.
					Am-241	13189	Precision	Poor relative percent difference (>50%) for field duplicate sample for following analyte(s): Am-241.

a. PRS = potential release site
b. QC = quality control
c. GFAA = graphite furnace atomic absorption
d. N/A = not applicable
e. EDXRF = energy dispersive x-ray fluorescence

This page intentionally left blank

Appendix B
Analytical Data Set for Aggregate J

This page intentionally left blank

TABLE B-1

INC-12 ANALYTICAL RESULTS OF SAMPLING AT FORMER TA-42

Location ID No.	Depth (ft)	^{238}Pu (pCi/g)	Error %[a]	$^{239,240}Pu$ (pCi/g)	Error %	Total Pb (mg/kg)
42-1021	0–1.5	0.036	8	1.28	6.5	17
42-1022	0–2.6	< 0.02	12	0.094	15	< 5
42-1022	2.6–3.5	< 0.004	1	0.044	11	< 5
42-1023	3–4.75	0.016	25	1.05	4.8	< 5
42-1025	0–2.2	0.0067	24	0.110	20	NM[b]
42-1025	2.2–5.25	< 0.002	2	0.144	0.9	NM
42-1027	3–6	< 0.004	9	0.165	13	NM
42-1028	15–20	< 0.06	17	< 0.406	18	NM
42-1028	25–28	< 0.06	9	< 0.29	79	NM
42-1029	15–20	< 0.01	6	< 0.006	45	NM
42-1030	15–20	0.067	7	< 0.002	28	NM
42-1030	25–28	< 0.03	9	< 0.17	13	NM
42-1031	10–17	0.010	20	0.176	12	NM
42-1031	17–22	< 0.01	3	< 0.003	28	NM
42-1032	0–5	0.022	19	0.639	14	NM
42-1032	7–11	0.009	44	< 0.006	24	NM
42-1026	0–3	0.012	30	0.149	2.9	NM
42-1024	0–3	< 0.003	5	0.043	11	NM
42-1024	3–5	0.029	18	0.877	3.0	NM
42-1034	0–3	< 0.01	2	< 0.002	23	NM

a. The percent error is calculated from the standard error (1-sigma) of the measurement.
b. NM = not measured

TABLE B-2

EDXRF ANALYSIS RESULTS OF LEAD INVESTIGATION AT FORMER TA-42

Location ID No.	Depth (ft)	Total Pb by EDXRF[a] (mg/kg)	Contract Laboratory Total Pb (mg/kg)
42-1035	0–1	8	
42-1035	1–2	19	
42-1035	2–3	19	
42-1036	0–1	12	
42-1036	1–2	6	
42-1036	2–3	10	
42-1037	0–1	12	
42-1037	1–2	25	10.4
42-1037	2–3	19	
42-1038	0–1	19	
42-1038	1–2	7	
42-1038	2–3	16	
42-1039	0–1	19	12.5
42-1039	1–2	15	15.3
42-1039	1–2	15	17.1
42-1039	2–3	13	12.4

a. EDXRF = energy dispersive x-ray fluorescence

TABLE B-3

CONTRACT LABORATORY ANALYTICAL RESULTS

Location ID No.	Depth (ft)	^{238}Pu (pCi/g)	Unc[a]	$^{239,240}Pu$ (pCi/g)	Unc	Pb (mg/kg)	Unc	^{241}Am (pCi/g)	Unc
42-1021	0–1.5	0.0739	0.0244	0.0523	0.0208	14.4	2.88	0.0491	0.0352
42-1021	0–1.5					14.5	2.9		
42-1021	1.5–2.4	0.2	0.062	0.0839	0.0395	4.3	0.86	0.0657	0.0568
42-1022	0–2.6	0.02	0.02	0.11	0.03	12	2.4	0.17	0.03
42-1022	2.6–3.5	–0.01	0.02	0.03	0.02	6.6	1.32	0.02	0.025
42-1023	0–3	0.0	0.025	0.0	0.015	11.7	2.34	0.02	0.015
42-1023	3–4.75	1.75	0.24	2.24	0.31	28.1	5.62	0.332	0.107
42-1025	0–2.2	0.438	0.149	0.125	0.08			0.121	0.055
42-1025	2.2–5.25	0.289	0.107	0.231	0.096			0.0818	0.0477
42-1027	0–3	0.36	0.146	0.216	0.112			0.0958	0.0558
42-1027	3–6	0.139	0.075	0.511	0.155			0.138	0.061
42-1028	10–15	0.101	0.096	0.151	0.114			0.061	0.211
42-1028	10–15	0.36	0.153	0.666	0.0712			0.0249	0.0499
42-1028	15–20	0.0319	0.0371	0.0212	0.0302			0.0862	0.0529
42-1028	20–25	0.052	0.0606	0.0	0.0028			0.138	0.062
42-1028	25–28	0.138	0.09	0.0964	0.0743			0.135	0.057
42-1029	10–15	0.0	0.0018	0.0722	0.0599			0.0707	0.0584
42-1029	15–20	0.168	0.09	0.0112	0.0225			0.0388	0.0778
42-1029	20–25	0.0393	0.0788	0.0	0.06			0.0413	0.034
42-1030	10–15	1.95	0.44	10.3	1.7			0.152	0.074
42-1030	10–15	0.565	0.2	1.46	0.36			0.292	0.107
42-1030	15–20	0.0836	0.0727	0.0119	0.024			0.327	0.098
42-1030	20–25	0.269	0.105	0.0179	0.0254			0.358	0.112
42-1030	25–28	0.147	0.09	0.0793	0.061			0.332	0.097
42-1031	10–17	0.0492	0.0738	0.312	0.159			0.463	0.116
42-1031	10–17	0.132	0.07	0.29	0.111			0.749	0.171
42-1031	17–22	0.0283	0.0424	0.0189	0.0378			0.529	0.127
42-1031	22–27	0.332	0.144	0.0553	0.0559			0.342	0.102
42-1032	0–5	0.377	0.171	0.298	0.151			0.103	0.046
42-1032	0–5	0.0973	0.0783	0.401	0.152			0.209	0.069
42-1032	5–7	0.0992	0.0765	0.0142	0.0491			0.157	0.075
42-1032	7–11	0.0806	0.062	0.229	0.125			0.057	0.114
42-1026	0–3	0.389	0.165	0.135	0.102			0.107	0.055
42-1026	3–6	0.214	0.108	0.485	0.167			0.227	0.071
42-1024	0–3	0.154	0.091	0.0441	0.0543			0.0804	0.0455
42-1024	3–5	0.07	0.0504	0.963	0.225			0.38	0.12
42-1034	0–3	0.0827	0.0719	0.0591	0.0535			0.933	0.194
42-1034	3–6	0.0771	0.07	0.0	0.0024			0.309	0.09
42-1037	1–2					10.4	NR[b]		
42-1039	0–1					12.5	NR		
42-1039	1–2					15.3	NR		
42-1039	1–2					17.1	NR		
42-1039	2–3					12.4	NR		
42-1033	0–3.5	0.156	0.102	0.296	0.144			0.105	0.052

a. Unc = uncertainty
b. NR = not reported

TABLE B-3 (continued)

CONTRACT LABORATORY ANALYTICAL RESULTS

Location ID No.	Depth (ft)	^{228}Th (pCi/g)	Unc[a]	^{230}Th (pCi/g)	Unc	^{232}Th (pCi/g)	Unc	^{234}U (pCi/g)	Unc	^{235}U (pCi/g)	Unc	^{238}U (pCi/g)	Unc
42-1021	0–1.5												
42-1021	0–1.5												
42-1021	1.5–2.4												
42-1022	0–2.6												
42-1022	2.6–3.5												
42-1023	0–3												
42-1023	3–4.75												
42-1025	0–2.2												
42-1025	2.2–5.25												
42-1027	0–3												
42-1027	3–6	1.9	0.49	1.55	0.41	1.53	0.41	0.819	0.28	0.0999	0.0901	0.779	0.226
42-1028	10–15												
42-1028	10–15												
42-1028	15–20												
42-1028	20–25												
42-1028	25–28												
42-1029	10–15												
42-1029	15–20												
42-1029	20–25												
42-1030	10–15												
42-1030	10–15												
42-1030	15–20												
42-1030	20–25												
42-1030	25–28												
42-1031	10–17												
42-1031	10–17												
42-1031	17–22												
42-1031	22–27												
42-1032	0–5												
42-1032	0–5												
42-1032	5–7												
42-1032	7–11												
42-1026	0–3	1.27	0.29	1.1	0.26	1.39	0.3	1	0.43	0.0	0.105	0.815	0.365
42-1026	3–6												
42-1024	0–3												
42-1024	3–5												
42-1034	0–3	2.59	0.81	1.52	0.55	0.91	0.395						
42-1034	3–6	1.83	0.69	1.1	0.44	1.46	0.53						
42-1037	1–2												
42-1039	0–1												
42-1039	1–2												
42-1039	1–2												
42-1039	2–3												
42-1033	0–3.5												

a. Unc = uncertainty

Appendix C
Geological Logs for Aggregate J

This page intentionally left blank

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	42	SAP:	Aggregate J	Date Logged:	07-21-92
Borehole:	B6	Collar Elevation:	7262 ft	Page:	1 of 1
Location ID:	42-1028	Total Depth:	28 ft	Field Team Leader:	Gabriela Gainer
Core Size:	2-1/2 in.	Coordinates:	N 1769770.86 E 485077.53	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. Hollow-Stem Auger				

NOTE: Borehole is located 10 ft northeast of the septic tank

Depth in Feet	Sample Interval	Analysis Requested: Gross-α, β, γ	Isotopic Pu	Am-241	Sample Number	Qualitative Moisture Content: Dry	Low Moisture	Moist	Very Moist	Profile	Lithologic Description and Remarks (Tuff refers to Tshirege Member, Bandelier Tuff)
0											Sandy soil/tuff pebbles mix; gray; depth 0 to 2 ft
											Soil/clay/tuff mix; gray to reddish brown; depth 2 to 3 ft
											No recovery between 3 and 4.5 ft
5											Soil/tuff mix; tan to gray; depth 4 to 6 ft
											Soil/clay/tuff; moderate clay horizon; dark brown; depth 6 to 8 ft
											No recovery between 8 and 8.5 ft
10											Soil/tuff mix; trace to moderate clay; tan to brown; depth 8.5 to 10 ft
											Tuff contact in this zone; difficult to identify actual contact; soft; depth 10 to 12 ft
		X	–	X	B-6-1 B-6-1D						Clay and roots; orange; depth 12 to 12.5 ft
											Tuff, soft; tan to brown; depth 12.5 to 15 ft (no competence at 12.5 and 13 ft)
15											Clay, reddish brown with ≤30% tuff (soft gray to brown); depth 15 to 18 ft; 1/4-in. root running down axis of core barrel in clay zone; white clay at contact with tuff
		X	X	X	B-6-2						
											Clay, same as above but without organics; depth 18 to 20 ft
20											50% clay and 50% soft tuff; tuff is drying out but is still very soft and fragile; clay is very moist at contact with tuff; depth 20 to 22 ft
		X		X	B-6-3						Tuff, fragile; pumice is visible; gray; depth 22 to 23 ft
25											Tuff, edges are dusty; beginning to be competent and welded; up to 1-in. pumice crystals; gray; depth 23 to 28 ft
		X		X	B-6-C-2						
30											Total depth: 28 ft

NOTE: No dust was visible at collar or during drilling; interval from 23 to 28 ft was dry; small amount of dust was visible during trip out; fill material from approximately 0 to 11 ft.

FIG 09 / TA-42 RFI RPT / 082495

Figure C-1. Geological log of borehole at Location ID No. 42-1028.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log
RCRA Site Characterization

Technical Area:	42	SA P:	Aggregate J	Date Logged:	07-21-92
Borehole:	B7	Collar Elevation:	7263 ft	Page:	1 of 1
Location ID:	42-1029	Total Depth:	28.5 ft	Field Team Leader:	Gabriela Gainer
Core Size:	2-1/2 in.	Cordinates:	N 1769759.13 E 485077.53	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. Hollow-Stem Auger				

NOTE: Borehole is located at the septic line cleanout 15 ft south of the septic tank

Depth in Feet	Sample Interval	Analysis Requested: Gross-α, β, γ	Analysis Requested: Isotopic Pu	Analysis Requested: Am-241	Sample Number	Qualitative Moisture Content: Dry	Qualitative Moisture Content: Low Moisture	Qualitative Moisture Content: Moist	Qualitative Moisture Content: Very Moist	Profile	Lithologic Description and Remarks (Tuff refers to Tshirege Member, Bandelier Tuff)
0											Tuff/soil mix (60% tuff gravels, 40% silty sand of tuff origin); gray to brown; trace of clay; depth 0 to 3.5 ft
											No recovery between 3.5 and 4.5 ft
5											Tuff/soil mix as noted in 0 to 3.5-ft depth; slight increase in brown clay; depth 4.5 to 6.5 ft
											Clayey soil; brown; depth 6.5 to 8.5 ft
											Clay with weathered tuff gravels and soils; brown; depth 8.5 to 10 ft (NOTE: Tuff contact at 10 ft)
10		X	X	X	B-7-1						Tuff, weathered but firm core; pumice is evident; "rocky"; gray; depth 10 to 13.5 ft
15		X	X	X	B-7-2						Tuff, competent; not quite dusty, but getting very dry with depth; gray; pumice and quartz crystals; depth 13.5 to 18.5 ft (NOTE: Possible PID hit at approximate depth of 14.0 to 16.0 ft)
20		X	X	X	B-7-3						Tuff, competent; gray; drying out with depth; depth 18.5 to 23.5 ft
											Tuff, competent; gray; depth 23.5 to 25.0 ft
25											Tuff, competent; gray; dusty; depth 25 to 28.5 ft (NOTE: Sample not taken between 25 and 28 ft)
30											Total depth: 28.5 ft

NOTE: The interval from 14 to 28.5 ft contained competent tuff; wind was blowing 10 to 15 mph and swirling around vehicles; dust was also blowing off auger during trip out; fill material from approximately 0 to 10 ft.

FIG C-2 / TA-42 RFI RPT / 082495

Figure C-2. Geological log of borehole at Location ID No. 42-1029.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log
RCRA Site Characterization

Technical Area:	42	SAP:	Aggregate J	Date Logged:	07-21-92
Borehole:	B8	Collar Elevation:	7262 ft	Page:	1 of 1
Location ID:	42-1030	Total Depth:	28 ft	Field Team Leader:	Gabriela Gainer
Core Size:	2-1/2 in.	Coordinates:	N 1769778.96 E 485076.86	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. Hollow-Stem Auger				

NOTE: Borehole is located 10 ft northwest of the septic tank

Depth in Feet	Sample Interval	Analysis Requested: Gross-α, β, γ	Isotopic Pu	Am-241	Sample Number	Qualitative Moisture Content: Dry	Low Moisture	Moist	Very Moist	Profile	Lithologic Description and Remarks (Tuff refers to Tshirege Member, Bandelier Tuff)
0											Fill, soil/tuff mix predominantly fine to medium silty sand with tuff gravels; trace clay, gray; depth 0 to 2 ft
											Clayey soil with tuff gravels; brown; depth 2 to 3 ft
											No recovery between 3 and 4 ft
5											70% clay, 30% purple tuff gravels with pumice; brown; pieces of asphalt (small pebbles) found at 5.5 ft; depth 4 to 8 ft
											Soil/tuff mix; depth 8 to 10 ft
10											Brown clay zone at tuff contact; depth 10 to 11.5 ft
		X	X	X	B-8-1 B-8-1D						Tuff, weathered, not competent, visible pumice; gray; depth 11.5 to 13 ft.
											Tuff, rocky, not quite competent; gray to tan; depth 13 to 15 ft
15											Tuff, competent, almost dusty but still holding moisture; pumice evident; gray to tan; depth 15 to 18 ft
		X	X	X	B-8-2						
20											Tuff, competent, drying out with depth; gray to tan; depth 18 to 23 ft
		X	X	X	B-8-3						
											Tuff, same as above; depth 23 to 24 ft
25											Tuff, competent, dusty, lightly welded; gray; depth 24 to 28 ft
		X	X	X	B-8-C-3						
30											

Total depth: 28 ft

NOTE: No dust was visible during drilling; swirling winds were blowing 10 to 15 mph; dust was blowing during trip out; fill material from approximately 0 to 11 ft.

FIG C-3 / TA-42 RFI RPT / 082495

Figure C-3. Geological log of borehole at Location ID No. 42-1030.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log
RCRA Site Characterization

Technical Area:	42	SAP:	Aggregate J	Date Logged:	07-21-92
Borehole:	B9	Collar Elevation:	7260 ft	Page:	1 of 1
Location ID:	42-1031	Total Depth:	27 ft	Field Team Leader:	Gabriela Gainer
Core Size:	2-1/2 in.	Cordinates:	N 1769796.48 E 485100.34	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. Hollow-Stem Auger				

NOTE: Collared hole at northwest edge of antihelicopter pad where proposed utility lines will run. Will also check the tile field. Pad consists of 70% soil (tuff orgin) and 30% tuff blocks (pebbles to 6-in. diameter). Light gray to brown, dusty at surface.

Depth in Feet	Sample Interval	Analysis Requested: Gross-α, β, γ	Isotopic Pu	Am-241	Sample Number	Qualitative Moisture Content: Dry	Low Moisture	Moist	Very Moist	Profile	Lithologic Description and Remarks (Tuff refers to Tshirege Member, Bandelier Tuff)
0											Tuff/soil mix; gray; no dust during collaring; depth 0 to 1 ft
											Tan block of tuff; depth 1 to 2 ft
5											Soil (70%)/tuff (30%) mix; increase in brown clay visible with depth; gray to reddish-brown with increase in clay content; moisture increasing with clay content; depth 2 to 6 ft
											No recovery between 6 and 7 ft
10											Clayey soil; reddish brown; tuff pebbles smaller and less prevalent; high moisture content in clay; depth 7 to 12 ft (NOTE: Zone of asphalt rubble evident between 10.3 ft and 10.5 ft; it is included in the first sample)
		X	X	X	B-9-1						No recovery between 12 and 15 ft
15											100% recovery; tuff contact at approximately 16 ft (actual contact is unknown because of recovery problems between 12 and 15 ft); strong clay horizon at contact; soft weathered tuff very moist; light brown to gray; pumice evident; depth 15 to 17 ft
											Tuff continues; depth 17 to 18 ft
20		X	X	X	B-9-2						Reddish brown clay seam at a depth of 18 to 20 ft
											Soft tuff; gray; depth 20 to 21 ft
											Clay seam at a depth of 21 to 21.5 ft
											Nonwelded tuff; gray; drier as tuff turns from gray to flesh color; depth 21.5 to 22 ft
											Same as above; 22–22.5-ft depth.
		X	X	X	B-9-3						Reddish brown clay fracture fill (50% tuff, 50% clay); gray tuff; depth 22.5 to 23 ft
25											Nonwelded tuff; very fragile; noncohesive; light gray to flesh color; increase in pumice content; depth 23 to 27 ft (NOTE: Tuff will probably be dry within the next 10 ft)
30											

Total depth: 27 ft

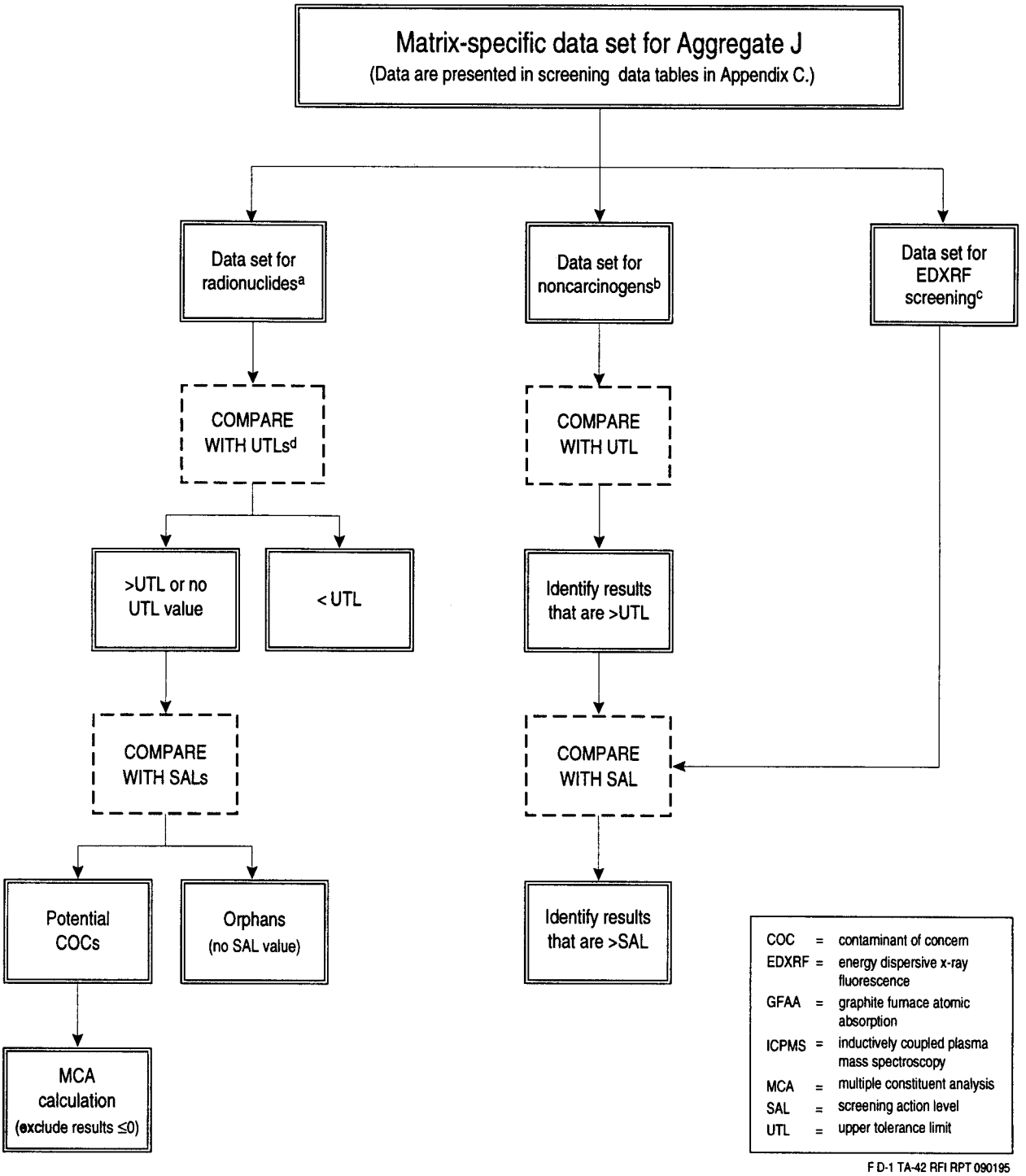
NOTE: No dust was visible during drilling or trip out; fill material from approximately 0 to 16 ft.

FIG 12 / TA-42 RFI RPT / 082495

Figure C-4. Geological log of borehole at Location ID No. 42-1031.

Appendix D
Human Health Screening Assessment

This page intentionally left blank



a. Data set for radionuclides consists of results for radionuclide analyses at fixed-site laboratories.
b. Data set for noncarcinogens consists of results for lead analyzed by GFAA or ICPMS. (SAL for lead is based solely on noncarcinogenic endpoint.)
c. Data set for EDXRF screening consists of results for lead analyzed by EDXRF.
d. UTL values are not available for water samples. Screening assessment for water samples proceeds directly to SAL comparison.

Figure D-1. Organization of data tables for screening assessment purposes.

This page intentionally left blank

TABLE D-1

SCREENING ASSESSMENT FOR RADIONUCLIDES IN AGGREGATE J[a]

Greater than background or no background value:

Location ID No.	Matrix	Depth (ft)	^{241}Am	^{238}Pu	$^{239,240}Pu$	^{230}Th	^{235}U
42-1021	Soil	0–1.5	0.0491	0.0739	0.0523		
42-1021	Soil	1.5–2.4	0.0657	0.2	0.0839		
42-1022	Soil	0–2.6	0.17	0.02	0.11		
42-1022	Soil	2.6–3.5	0.02	–0.01	0.03		
42-1023	Soil	0–3	0.02	0	0		
42-1023	Soil	3–4.75	0.332	1.75	2.24		
42-1024	Soil	0–3	0.0804	0.154	0.0441		
42-1024	Soil	3–5	0.38	0.07	0.963		
42-1025	Soil	0–2.2	0.121	0.438	0.125		
42-1025	Soil	2.2–5.25	0.0818	0.289	0.231		
42-1026	Soil	0–3	0.107	0.389	0.135	1.1	0
42-1026	Soil	3–6	0.227	0.214	0.485		
42-1027	Soil	0–3	0.0958	0.36	0.216		
42-1027	Soil	3–6	0.138	0.139	0.511	1.55	0.0999
42-1028	Soil	10–15	0.061	0.36	0.666		
42-1028	Soil	15–20	0.0862	0.0319	0.0212		
42-1028	Soil	20–25	0.138	0.052	0		
42-1028	Soil	25–28	0.135	0.138	0.0964		
42-1029	Soil	10–15	0.0707	0	0.0722		
42-1029	Soil	15–20	0.0388	0.168	0.0112		
42-1029	Soil	20–25	0.0413	0.0393	0		
42-1030	Soil	10–15	0.292	1.95	10.3		
42-1030	Soil	15–20	0.327	0.0836	0.0119		
42-1030	Soil	20–25	0.358	0.269	0.0179		
42-1030	Soil	25–28	0.332	0.147	0.0793		
42-1031	Soil	10–17	0.749	0.132	0.312		
42-1031	Soil	17–22	0.529	0.0283	0.0189		
42-1031	Soil	22–27	0.342	0.332	0.0553		
42-1032	Soil	0–5	0.209	0.377	0.401		
42-1032	Soil	5–7	0.157	0.0992	0.0142		
42-1032	Soil	7–11	0.057	0.0806	0.299		
42-1033	Soil	0–3.5	0.105	0.156	0.296		
42-1034	Soil	0–3	0.933	0.0827	0.0591	1.52	
42-1034	Soil	3–6	0.309	0.0771	0	1.1	
PF-IB1-0	Soil	Surface		0.0004	0.015		
PF-IB1-5	Soil	5		0.007	0.0002		
PF-IB2-0	Soil	Surface		0.003	0.0554		
PF-IB2-5	Soil	5		0.0003	0		
PF-HT2-0	Soil	Surface		0.002	0.0179		
PF-HT2-5	Soil	5		0.009	0.0628		
PF-HT2-10	Soil	10		0.0006	0.0013		
PF-HT3-0	Soil	Surface		0.0012	0.0205		
PF-HT3-5	Soil	5		0.0035	0.0086		
PF-HT3-10	Soil	10		0.0016	0.0292		
PF-CDA-0	Soil	Surface		0.0036	0.0014		
PF-ST-10	Soil	10		0.015	0.151		
PF-ST-15	Soil	15		2.48	4.77		
PF-ST-20	Soil	20		0.155	0.4		
PF-ST-25	Soil	25		0.016	0.0032		
PF-PLN-0	Soil	Surface		0.0012	0.006		
PF-PLM-0	Soil	Surface		0.009	0.0148		
PF-PLS-0	Soil	Surface		0.006	0.0151		
SOIL SAL[b]			17	20	18	5	18
BACKGROUND UTL[c]				0.014	0.052		0.088

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All results are reported in pCi/g. Shaded boxes indicate results that exceed the UTL value.

b. SAL = screening action level

c. UTL = upper tolerance limit

TABLE D-1 (continued)
SCREENING ASSESSMENT FOR RADIONUCLIDES IN AGGREGATE J[a]

Less than background:

Location ID No.	Matrix	Depth (ft)	^{228}Th	^{232}Th	^{234}U	^{238}U
42-1021	Soil	0–1.5				
42-1021	Soil	1.5–2.4				
42-1022	Soil	0–2.6				
42-1022	Soil	2.6–3.5				
42-1023	Soil	0–3				
42-1023	Soil	3–4.75				
42-1024	Soil	0–3				
42-1024	Soil	3–5				
42-1025	Soil	0–2.2				
42-1025	Soil	2.2–5.25				
42-1026	Soil	0–3	1.27	1.39	1	0.815
42-1026	Soil	3–6				
42-1027	Soil	0–3				
42-1027	Soil	3–6	1.9	1.53	0.819	0.779
42-1028	Soil	10–15				
42-1028	Soil	15–20				
42-1028	Soil	20–25				
42-1028	Soil	25–28				
42-1029	Soil	10–15				
42-1029	Soil	15–20				
42-1029	Soil	20–25				
42-1030	Soil	10–15				
42-1030	Soil	15–20				
42-1030	Soil	20–25				
42-1030	Soil	25–28				
42-1031	Soil	10–17				
42-1031	Soil	17–22				
42-1031	Soil	22–27				
42-1032	Soil	0–5				
42-1032	Soil	5–7				
42-1032	Soil	7–11				
42-1033	Soil	0–3.5				
42-1034	Soil	0–3	2.59	0.91		
42-1034	Soil	3–6	1.83	1.46		
SOIL SAL[b]			1.5	5	86	59
BACKGROUND UTL[c]			2.67	2.68	2.03	1.9

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All results are reported in pCi/g.
b. SAL = screening action level
c. UTL = upper tolerance limit

TABLE D-1 (continued)
SCREENING ASSESSMENT FOR RADIONUCLIDES IN AGGREGATE J[a]

Orphans[b]:

Location ID No.	Matrix	Depth (ft)	Alpha	Beta	Gamma
42-1021	Soil	0-1.5	<63.1	<23.8	<4.37
42-1021	Soil	1.5-2.4	<63.1	<23.8	<4.37
42-1022	Soil	0-2.6	<63.1	<23.8	<4.37
42-1022	Soil	2.6-3.5	<63.1	<23.8	<4.37
42-1023	Soil	0-3	<63.1	<23.8	<4.37
42-1023	Soil	3-4.75	<63.1	<23.8	<4.37
42-1024	Soil	0-3	<63.1	<23.8	<4.37
42-1024	Soil	3-5	<63.1	<23.8	<4.37
42-1025	Soil	0-2.2	<63.1	<23.8	<4.37
42-1025	Soil	2.2-5.25	<63.1	<23.8	<4.37
42-1026	Soil	0-3	<63.1	<23.8	<4.37
42-1026	Soil	3-6	<63.1	<23.8	<4.37
42-1027	Soil	0-3	<63.1	<23.8	<4.37
42-1027	Soil	3-6	<63.1	<23.8	<4.37
42-1028	Soil	10-15	<63.1	<23.8	<4.37
42-1028	Soil	15-20	<63.1	<23.8	<4.37
42-1028	Soil	20-25	<63.1	<23.8	<4.37
42-1028	Soil	25-28	<63.1	<23.8	<4.37
42-1029	Soil	10-15	<63.1	<23.8	<4.37
42-1029	Soil	15-20	<63.1	<23.8	<4.37
42-1029	Soil	20-25	<63.1	<23.8	<4.37
42-1030	Soil	10-15	<63.1	<23.8	<4.37
42-1030	Soil	15-20	<63.1	<23.8	<4.37
42-1030	Soil	20-25	<63.1	<23.8	<4.37
42-1030	Soil	25-28	<63.1	<23.8	<4.37
42-1031	Soil	10-17	<63.1	<23.8	<4.37
42-1031	Soil	17-22	<63.1	<23.8	<4.37
42-1031	Soil	22-27	<63.1	<23.8	<4.37
42-1032	Soil	0-5	<63.1	<23.8	<4.37
42-1032	Soil	5-7	<63.1	<23.8	<4.37
42-1032	Soil	7-11	<63.1	<23.8	<4.37
42-1033	Soil	0-3.5	<63.1	<23.8	<4.37
42-1034	Soil	0-3	<63.1	<23.8	<4.37
42-1034	Soil	3-6	<63.1	<23.8	<4.37
	SOIL SAL[c]				
	BACKGROUND UTL[d]				

a Reported results are the maximum results from the analysis of duplicate samples, where applicable. All results are reported in pCi/g.
b. Orphan = constituent for which a screening action level value is not available.
c SAL = screening action level (Values are not available for blank entries.)
d. UTL = upper tolerance limit (Values are not available for blank entries.)

TABLE D-1 (continued)
SCREENING ASSESSMENT FOR RADIONUCLIDES IN AGGREGATE J[a]

Comparison with SALs[b] and multiple constituent analysis:

Location ID No.	Matrix	Depth (ft)	^{241}Am	^{238}Pu	^{239,240}Pu	^{230}Th	^{235}U	MCA[c]
42-1021	Soil	0–1.5	0.0491	0.0739	0.0523			0.009
42-1021	Soil	1.5–2.4	0.0657	0.2	0.0839			0.019
42-1022	Soil	0–2.6	0.17	0.02	0.11			0.017
42-1022	Soil	2.6–3.5	0.02	–0.01	0.03			0.002
42-1023	Soil	0–3	0.02	0	0			0.001
42-1023	Soil	3–4.75	0.332	1.75	2.24			0.231
42-1024	Soil	0–3	0.0804	0.154	0.0441			0.015
42-1024	Soil	3–5	0.38	0.07	0.963			0.079
42-1025	Soil	0–2.2	0.121	0.438	0.125			0.036
42-1025	Soil	2.2–5.25	0.0818	0.289	0.231			0.032
42-1026	Soil	0–3	0.107	0.389	0.135	1.1	0	0.253
42-1026	Soil	3–6	0.227	0.214	0.485			0.051
42-1027	Soil	0–3	0.0958	0.36	0.216			0.036
42-1027	Soil	3–6	0.138	0.139	0.511	1.55	0.0999	0.359
42-1028	Soil	10–15	0.061	0.36	0.666			0.059
42-1028	Soil	15–20	0.0862	0.0319	0.0212			0.008
42-1028	Soil	20–25	0.138	0.052	0			0.011
42-1028	Soil	25–28	0.135	0.138	0.0964			0.020
42-1029	Soil	10–15	0.0707	0	0.0722			0.008
42-1029	Soil	15–20	0.0388	0.168	0.0112			0.011
42-1029	Soil	20–25	0.0413	0.0393	0			0.004
42-1030	Soil	10–15	0.292	1.95	10.3			0.685
42-1030	Soil	15–20	0.327	0.0836	0.0119			0.024
42-1030	Soil	20–25	0.358	0.269	0.0179			0.036
42-1030	Soil	25–28	0.332	0.147	0.0793			0.031
42-1031	Soil	10–17	0.749	0.132	0.312			0.068
42-1031	Soil	17–22	0.529	0.0283	0.0189			0.034
42-1031	Soil	22–27	0.342	0.332	0.0553			0.040
42-1032	Soil	0–5	0.209	0.377	0.401			0.053
42-1032	Soil	5–7	0.157	0.0992	0.0142			0.015
42-1032	Soil	7–11	0.057	0.0806	0.299			0.024
42-1033	Soil	0–3.5	0.105	0.156	0.296			0.030
42-1034	Soil	0–3	0.933	0.0827	0.0591	1.52		0.366
42-1034	Soil	3–6	0.309	0.0771	0	1.1		0.242
PF-IB1-0	Soil	Surface		0.0004	0.015			0.001
PF-IB1-5	Soil	5		0.007	0.0002			0.000
PF-IB2-0	Soil	Surface		0.003	0.0554			0.003
PF-IB2-5	Soil	5		0.0003	0			0.000
PF-HT2-0	Soil	Surface		0.002	0.0179			0.001
PF-HT2-5	Soil	5		0.009	0.0628			0.004
PF-HT2-10	Soil	10		0.0006	0.0013			0.000
PF-HT3-0	Soil	Surface		0.0012	0.0205			0.001
PF-HT3-5	Soil	5		0.0035	0.0086			0.001
PF-HT3-10	Soil	10		0.0016	0.0292			0.002
PF-CDA-0	Soil	Surface		0.0036	0.0014			0.000
PF-ST-10	Soil	10		0.015	0.151			0.009
PF-ST-15	Soil	15		2.48	4.77			0.389
PF-ST-20	Soil	20		0.155	0.4			0.030
PF-ST-25	Soil	25		0.016	0.0032			0.001
PF-PLN-0	Soil	Surface		0.0012	0.006			0.000
PF-PLM-0	Soil	Surface		0.009	0.0148			0.001
PF-PLS-0	Soil	Surface		0.006	0.0151			0.001
SOIL SAL			17	20	18	5	18	
BACKGROUND UTL[d]				0.014	0.052		0.088	

a. Reported results are the maximum results from the analysis of duplicate samples. All values are reported in pCi/g. No potential contaminants of concern were identified in the comparison with the SAL.

b. SAL = screening action level

c. MCA = multiple constituent analysis (value is the sum of the normalized values)

d. UTL = upper tolerance limit

TABLE D-2

SCREENING ASSESSMENT FOR LEAD IN AGGREGATE J[a]

Less than background [b]:

Location ID No.	Matrix	Depth (ft)	Lead
42-1021	Soil	0–1.5	17
42-1021	Soil	1.5–2.4	4.3[c]
42-1022	Soil	0–2.6	12[c]
42-1022	Soil	2.6–3.5	6.6[c]
42-1023	Soil	0–3	11.7[c]
42-1023	Soil	3–4.75	28.1[c]
42-1037	Soil	1–2	10.4
42-1039	Soil	0–1	12.5
42-1039	Soil	1–2	17.1
42-1039	Soil	2–3	12.4
SOIL SAL[d]			400
BACKGROUND UTL[e]			39

Comparison with SAL[f]:

Location ID No.	Matrix	Depth (ft)	Lead
42-1021	Soil	0–1.5	17
42-1021	Soil	1.5–2.4	4.3
42-1022	Soil	0–2.6	12
42-1022	Soil	2.6–3.5	6.6
42-1023	Soil	0–3	11.7
42-1023	Soil	3–4.75	28.1
42-1035	Soil	0–1	8[c]
42-1035	Soil	1–2	19
42-1035	Soil	2–3	19
42-1036	Soil	0–1	12[c]
42-1036	Soil	1–2	6[c]
42-1036	Soil	2–3	10[c]
42-1037	Soil	0–1	12[c]
42-1037	Soil	1–2	25
42-1037	Soil	2–3	19
42-1038	Soil	0–1	19
42-1038	Soil	1–2	7[c]
42-1038	Soil	2–3	16
42-1039	Soil	0–1	19
42-1039	Soil	1–2	17.1
42-1039	Soil	2–3	13[c]
SOIL SAL[d]			400
BACKGROUND UTL[e]			39

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg.

b. Reported results are for analysis by graphite furnace atomic absorption (GFAA) or inductively coupled plasma mass spectrometry (ICPMS).

c. Estimated value

d. SAL = screening action level

e. UTL = upper tolerance limit

f. Reported results are for analysis by GFAA, ICPMS, or energy dispersive x-ray fluorescence (EDXRF). No results exceeded the SAL value.

This page intentionally left blank