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rec'd 11/3/95

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Date: November 1, 1995
Refer to: EM/ER:95-576

Mr. David Neleigh
NM Federal Facilities Section
Multimedia Planning and Permitting Division
EPA, Region 6, 6PD-N
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SUBJECT: SUBMITTAL OF THE RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION (RFI) REPORT FOR POTENTIAL RELEASE SITES (PRSs) IN TECHNICAL AREA (TA) 48

Dear Mr. Neleigh:

Enclosed are two copies of the Los Alamos National Laboratory's RFI Report concerning PRSs 48-001, 48-002(e), 48-003, 48-005, 48-007(a), 48-007(b), 48-007(c), 48-007(d), 48-007(f), and 48-010 in TA-48. The report documents field work performed as detailed in the approved RFI Work Plan for Operable Unit 1129 and the results of the sampling.

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

Sincerely,

Jorg Jansen, Program Manager
Environmental Restoration

Sincerely,

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

Enclosures: 2 RFI Reports for PRSs in TA-48

Environmental Restoration

2580

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Document Title: RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT FOR POTENTIAL RELEASE SITES IN TECHNICAL AREA 48

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LOOK BOOKSHELF

CANCER OU 1129 XXRL11243

RFI Report for Potential Release Sites

48-001
48-002(e)
48-003
48-005
48-007(a)
48-007(b)
48-007(c)
48-007(d)
48-007(f)
48-010

(located in former Operable Unit 1129)

Field Unit 4

Environmental Restoration Project

September 1995

A Department of Energy Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

LA-UR-95-3328

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ACRONYMS AND ABBREVIATIONS

AOC	area of concern
BB	bottle blank
CMS	corrective measures study
COC	contaminant of concern
COPC	constituent of potential concern
CVAA	cold vapor atomic absorption
DOE	Department of Energy
EC	expedited cleanup
EDL	estimated detection limit
EDXRF	energy dispersive x-ray fluorescence
EPA	Environmental Protection Agency
EQL	estimated quantitation limit
ER	Environmental Restoration
ERB	equipment rinsate blank
ESAL	ecotoxicological screening action level
FIMAD	Facility for Information Management, Analysis, and Display
GFAA	graphite furnace atomic absorption
HSWA	Hazardous and Solid Waste Amendments
ICPES	inductively coupled plasma emission spectroscopy
ICPMS	inductively coupled plasma mass spectroscopy
IDL	instrument detection limit
IWP	Installation Work Plan
LANL	Los Alamos National Laboratory
LCS	laboratory control sample
LIA	lost in analysis
MCA	multiple constituent analysis
MDA	minimum detectable activity
Myr	million years
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFA	no further action
NPDES	National Pollutant Discharge Elimination System
OU	Operable Unit
OVA	organic vapor analyzer
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl (also known as Aroclors)
PE	performance evaluation
PRS	potential release site
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
SAL	screening action level
SVOC	semivolatile organic compound
TA	Technical Area
TCLP	toxicity characteristic leaching procedure
UTL	upper tolerance limit
VCA	voluntary corrective action
VOC	volatile organic compound

EXECUTIVE SUMMARY

This report describes the Phase I results of the Resource Conservation and Recovery Act facility investigation (RFI) for Operable Unit 1129 to evaluate the existence of contamination at Technical Area (TA) -48 at Los Alamos National Laboratory. Sampling activities for TA-48 Aggregates K, L, M, N, X, and Y were conducted under the guidelines described in the May 1992 *RFI Work Plan for Operable Unit 1129*. There were only minor deviations from the sampling and analysis plan for each aggregate. Included in this report are the results of investigations for all aggregates except Aggregate L. The results for Aggregate L will not be presented in this report because the two potential release sites (PRSs) in this aggregate were selected for expedited cleanup (EC), and Phase I results for Aggregate L are presented in the EC plan.

TA-48, the radiochemistry site, is currently used for chemical and radiochemical analyses, radioactive waste disposal research, and radioisotope production for nuclear medicine. It was established in 1957 and is the site of current and former operational structures built to house radiochemistry and nuclear medicine research work. Activities in the main radiochemistry building (TA-48-1) include processing of high-level alpha and/or beta-gamma emitters, radiochemical analyses on spallation products from the Clinton P. Anderson Meson Physics Facility, and dissolution and radiochemical studies on samples from underground shot cavities at the Nevada Test Site. Additionally, TA-48 facilities are used to study the nuclear properties of radioactive materials using analytical and physical chemistry.

The data in this report are presented by PRS aggregate. These aggregates are the same groupings of PRSs that are described in the work plan. The PRSs are grouped together because of their geographical proximity or because they are related to the same laboratory operations. See Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of this report for more detail about each Aggregate.

The following PRSs, which resulted from operations at TA-48, are included in this report.

Aggregate K

- 48-001, air exhaust system of nine stacks

Aggregate M

- 48-003, location of inactive septic system

Aggregate N

- 48-005, location of industrial waste lines

Aggregate X

- 48-002(e), location of storage area for solvents
- 48-007(a), outfall for chemically treated water from cooling towers
- 48-007(d), outfall for noncontact cooling water from vacuum pump
- 48-010, unlined pond that received industrial, treated cooling water

Aggregate Y

- 48-007(b), outfall for noncontact cooling water from vacuum pump
- 48-007(c), outfall for noncontact cooling water from vacuum pump
- 48-007(f), outfall for noncontact cooling water from x-ray machines

The following PRSs are recommended for no further action: PRS No. 48-001 in Aggregate K; PRS No. 48-003 in Aggregate M; PRS No. 48-005 in Aggregate N; PRS Nos. 48-002(e), 48-007(a and d), and 48-010 in Aggregate X; and PRS Nos. 48-007(b, c, and f) in Aggregate Y. The results of the investigation for each PRS are shown in Table ES-1.

TABLE ES-1
RESULTS OF THE INVESTIGATION

PRS	HSWA[a]		NFA[b]	Accelerated Cleanup		Further Investigation		Rationale
	Yes	No		VCA[c]	EC[d]	Phase II	CMS[e]	
48-003	X		X					The PRS has only radionuclide components; RCRA[f] constituents were below SALs[g] or UTLs[h]
48-005	X		X					The PRS has only radionuclide components; RCRA constituents were below SALs or UTLs
48-007(a)	X		X					The PRS has only radionuclide components; RCRA constituents were below SALs or UTLs
48-007(b)	X		X					The PRS has radionuclide components; RCRA constituents above the SAL do not pose a risk to human health.
48-007(c)	X		X					The PRS has radionuclide components; RCRA constituents above the SAL do not pose a risk to human health.
48-007(d)	X		X					The PRS has only radionuclide components; RCRA constituents were below SALs or UTLs
48-007(f)	X		X					The PRS has radionuclide components; RCRA constituents above the SAL do not pose a risk to human health.
48-010	X		X					The PRS has only radionuclide components; RCRA constituents were below SALs or UTLs
48-001		X	X					Contamination below SALs or UTLs
48-002(e)		X	X					Contamination below SALs or UTLs or not present at levels that pose risk based on the anticipated future land use

a. Hazardous and Solid Waste Amendments
b. No further action
c. Voluntary corrective action
d. Expedited cleanup
e. Corrective measures study
f. Resource Conservation and Recovery Act
g. Screening action level
h. Upper tolerance limit (for soil background data)

1.0 INTRODUCTION

This report describes the Phase I results of the Resource Conservation and Recovery Act facility investigation (RFI) to evaluate contamination for Operable Unit 1129 at Technical Area (TA) -48 at Los Alamos National Laboratory (hereafter referred to as "the Laboratory"). Sampling activities were conducted under the guidelines described in the *RFI Work Plan for Operable Unit 1129* (LANL 1992, 7666) (hereafter referred to as "the work plan"), which was approved by the Environmental Protection Agency (EPA) on November 3, 1993. Included in this report are the results of investigations for Aggregates K, M, N, X, and Y at TA-48.

1.1 General Site History

TA-48, the radiochemistry site, is currently used for chemical and radiochemical analyses, radioactive waste disposal research, and radioisotope production for nuclear medicine. It was established in 1957 and is the site of current and former operational structures built to house radiochemistry and nuclear medicine research work (DOE 1987, 8663). Activities in the main radiochemistry building (TA-48-1) have included processing of high-level alpha and/or beta-gamma emitters, radiochemical analyses on spallation products from the Clinton P. Anderson Meson Physics Facility, and dissolution and radiochemical studies of samples from underground shot cavities at the Nevada Test Site. Additionally, TA-48 facilities are used to study the nuclear properties of radioactive materials using analytical and physical chemistry. Figure 1-1 shows the location of TA-48.

Effluent routes from TA-48 included ventilation stacks, a sanitary sewer line, storm sewer lines, and industrial waste lines. Waste was also removed by tank truck, special burial, and dumpster (Sattizahn 1971, 890). Figure 1-2 shows the facility structures at TA-48. For more detailed information on the structures at TA-48 and related waste management activities, please see Chapter 3 of the work plan (LANL 1992, 7666). Chemicals and other constituents that contributed to the list of contaminants of potential concern include metals, volatile organic compounds (VOCs), semivolatile organic compounds, and radionuclides.

The data in this report are presented by aggregate. TA-48 includes Aggregates K, L, M, N, X, and Y. Results from the Phase I site characterization of Aggregate L will not be presented in this report because the two potential release sites (PRSs) in Aggregate L were selected for expedited cleanup (EC). Phase I results for those PRSs are presented in the EC plan (LANL 1995, 46092). The aggregates consist of the same groupings of PRSs that were described in the work plan (see Section 1.2 of this report for details). Aggregates K, M, and N consist of only one PRS each. Aggregate X consists of four PRSs that were grouped because of close proximity and because runoff from three of the PRSs accumulates in the wetland east of TA-48 (the fourth PRS in this aggregate). Aggregate Y consists of three PRSs that were grouped because of close proximity and because all three PRSs are outfalls. Figure 1-3 shows the locations of the PRSs in TA-48.

1.2 RFI Overview

Phase I of the RFI site characterization of TA-48 started in July 1993. The original purpose of the site characterization was to confirm the presence or absence of contamination in 10 PRSs within the five aggregates designated as K, M, N, X, and Y. Table 1-1 contains a description of the PRSs within each aggregate. The field team's approach to the TA-48 site characterization was to sample on an aggregate-by-aggregate basis. For more detailed information on each PRS, see Chapter 3 of the work plan (LANL 1992, 7666).

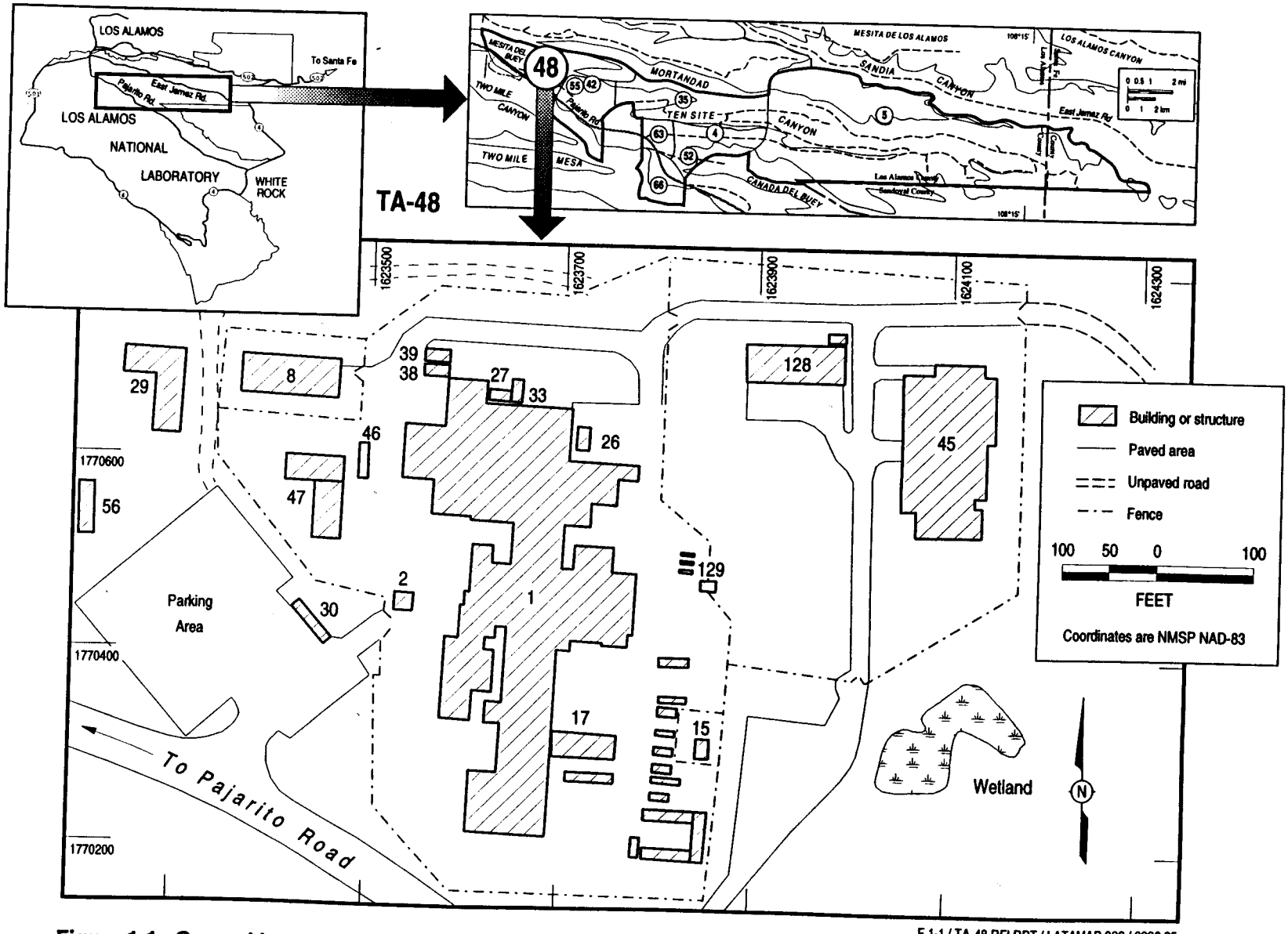


Figure 1-1. General location map for TA-48.

F 1-1 / TA-48 RFI RPT / LATAMAP 232 / 0926 95

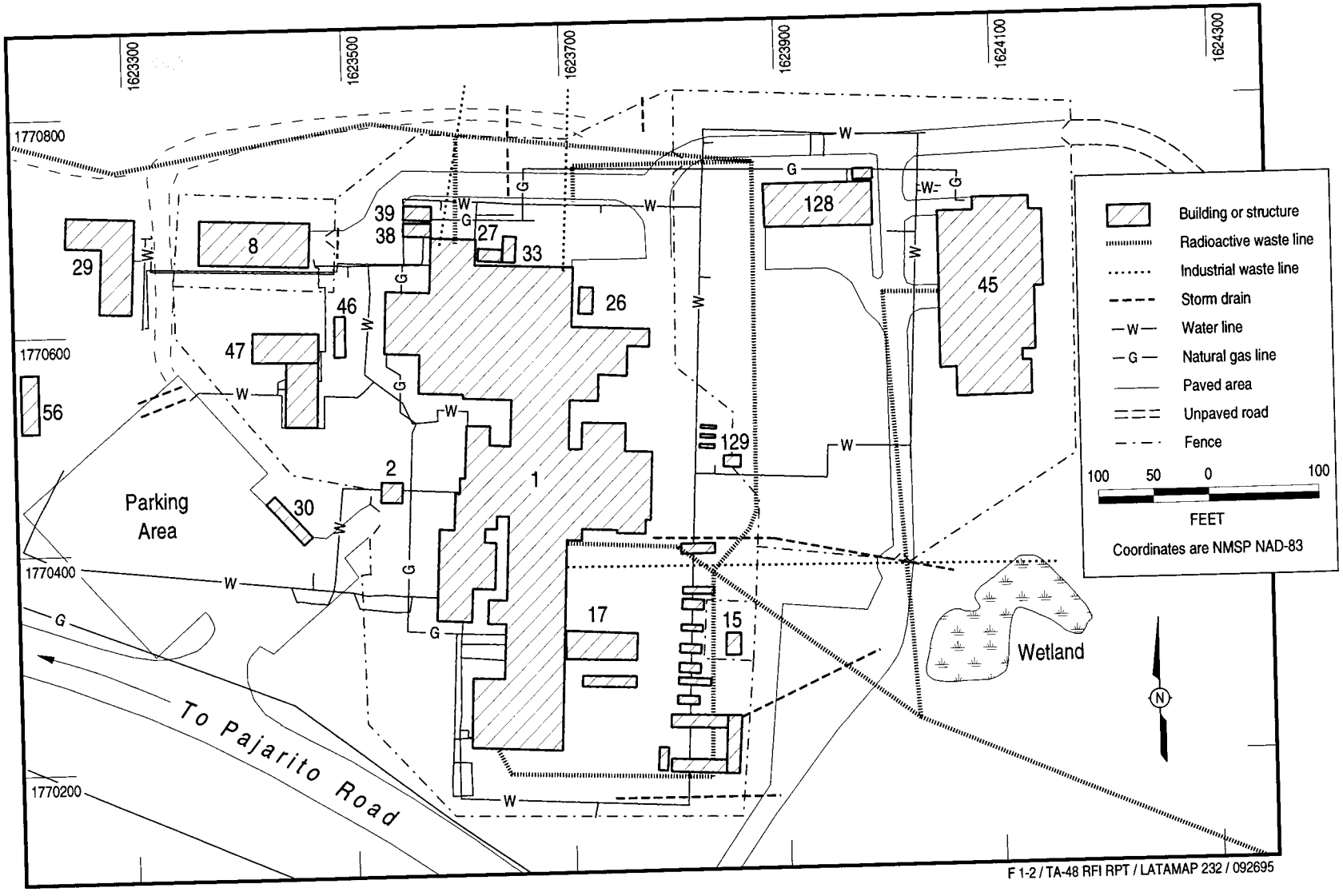
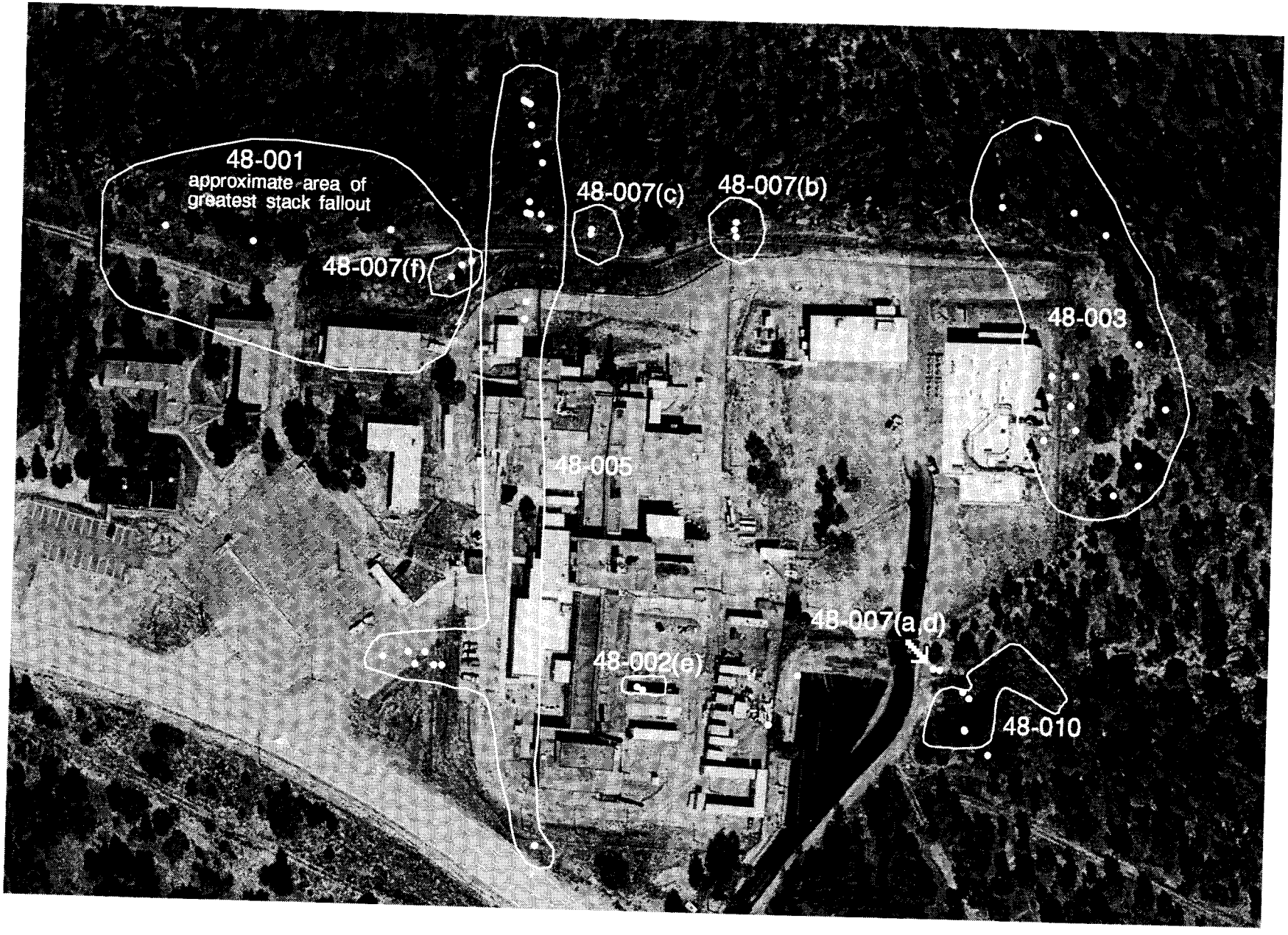


Figure 1-2. TA-48 facility site map.



0 180 360 Feet

Figure 1-3. Aerial photograph of TA-48 showing the location of PRSs and samples collected.

TABLE 1-1

TA-48 POTENTIAL RELEASE SITE DESCRIPTIONS

PRS[a] No.	PRS Type	Agg.	Description
48-001	AOC[b]	K	An air exhaust system consisting of nine stacks. Three stacks carry exhaust from chemical fume hoods, three carry exhaust from combustion boilers, one carries filtered exhaust from glove boxes, one carries filtered exhaust from hot cell laboratories, and one carries exhaust from a welding and degreasing booth.
48-003	HSWA[c]	M	Inactive septic system for TA-48-1. This PRS consists of a septic tank (TA-48-5), a filter bed (TA-48-6), and an outfall that discharged sanitary wastes, hazardous chemicals, and radionuclides into Mortandad Canyon.
48-005	HSWA	N	Three industrial waste lines (Line 34, Line 37, and Line 38) used to transport radionuclides and chemicals from TA-48 to the waste treatment plant at TA-45 and later to TA-50. Portions of the old lines outside the TA-48 security fence were removed.
48-002(e)	AOC	X	Satellite storage area for solvents located on the east side of TA-48-1. Solvent containers left rust stains on the pavement.
48-007(a)	HSWA	X	Outfall for chemically treated water from two cooling towers located on the TA-48-1 roof. The outfall is open to evaporation and discharges into PRS No. 48-010, an unlined pond.
48-007(d)	HSWA	X	Outfall for noncontact cooling water for vacuum pump in the south end of TA-48-1. It discharges its effluent into the surface impoundment/wetlands area.
48-010	HSWA	X	Unlined pond located about 500 ft southeast of TA-48-1. Industrial, noncontact, treated cooling water (from the TA-48-1 roof) that has been discharged into PRS Nos. 48-007(a and d) flows into this pond.
48-007(b)	HSWA	Y	Outfall for noncontact cooling water for a vacuum pump in the northeast corner of TA-48-1. It discharges into Mortandad Canyon on the north side of TA-48-1.
48-007(c)	HSWA	Y	Outfall for noncontact cooling water for vacuum pump system in basement on north end of TA-48-1. It discharges into Mortandad Canyon northeast of TA-48-1.
48-007(f)	HSWA	Y	Outfall for noncontact cooling water (for cooling x-ray machines) from office building TA-48-46. There may have been releases from this outfall into Mortandad Canyon.

a. Potential release site
b. Area of concern
c. Hazardous and Solid Waste Amendments

1.3 Field Activities

Engineering surveys and environmental surveys were completed for each aggregate before Phase I sampling activities began. The engineering surveys, which were based on engineering drawings provided by the Facility Project Delivery Group (FSS-6), archival aerial photographs and drawings, and field observations, were conducted by the field team geologist with support from the field team sampling technicians.

The environmental surveys were conducted by the field team health and safety officer using field screening instrumentation, including an organic vapor analyzer (such as a flame ionization detector) for VOCs and a Bicron Surveyor 2000 (also called a pancake probe) for gross-alpha, -beta, and -gamma radiation. Using the *Solid Waste Management Units Report* (LANL 1990, 7511), the work plan, and the presampling surveys, the field team identified each PRS and its associated features, sampling locations within each PRS, and potential physical and environmental concerns.

Field sampling activities at TA-48 began on July 12, 1993, and ended on July 30, 1993. Additional samples were taken at Aggregate N on October 28, 1993, and at Aggregate X on May 15, 1995.

Soil samples were collected using a scoop (LANL-ER-SOP-06.09, R0) for surface soil samples, a hand auger (LANL-ER-SOP-06.10, R0) for near-surface soil samples, and hollow-stem augers with split-spoon methods (LANL-ER-SOP-06.24, R0) for drilling. Surface water samples were collected as grab samples (LANL-ER-SOP-06.13, R0) and acidified. The types and number of samples collected in each aggregate were 5 hand augers (7 samples taken) and 1 soil scoop in Aggregate K; 6 soil borings (3 samples each) and 5 soil scoops in Aggregate M; 9 soil borings (25 samples taken) and 10 soil scoops in Aggregate N; and 1 hand auger (3 samples taken), 7 soil scoops, and 5 surface water samples in Aggregate X.

The two PRSs in Aggregate L were chosen for EC, which is the final remedy. The EC activities were conducted from August 10 to August 31, 1995. The closure report for the EC is a separate document, which will be submitted to the EPA by September 25, 1995.

Deviations from field work in accordance with the work plan are discussed in further detail in Chapter 4 under the respective aggregate or PRS.

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2.0 ENVIRONMENTAL SETTING

Technical Area (TA) -48 is located off Pajarito Road in the north-central part of the Laboratory on the Mesita del Buey. It is bounded by Mortandad Canyon to the north and east and Two Mile Canyon to the south (see Figure 1-1). The elevation of TA-48 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-48 and has an approximate thickness of 650 ft. Surface waters from heavy thunderstorms, spring snowmelt, and effluent from the cooling towers of the main radiochemistry building (TA-48-1) 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-48 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-48 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.

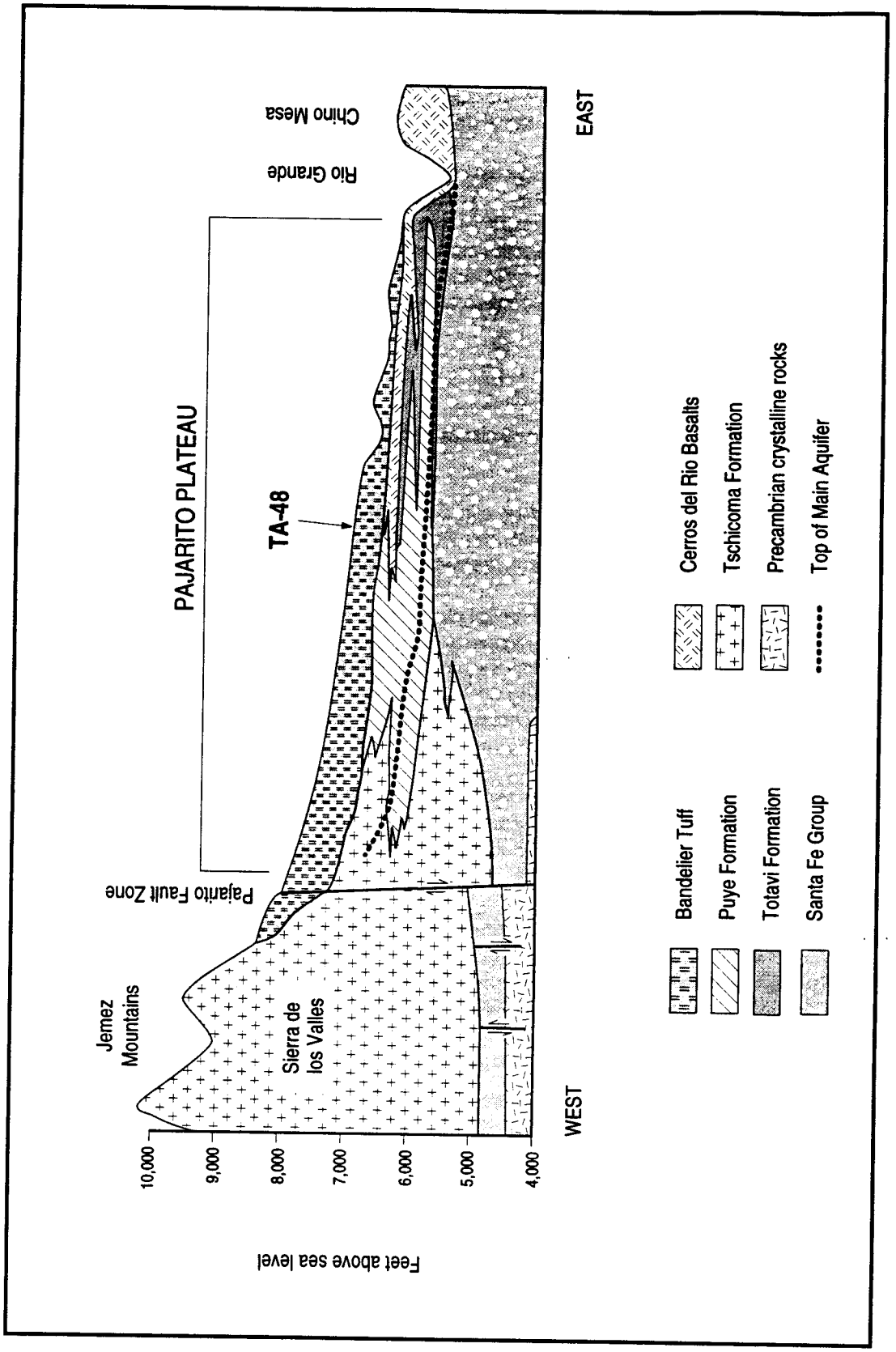
Winds are usually light and blow predominantly from the southwest to the northeast. However, strong winds are common in early spring, and winds can gust to more than 60 mph. Strong dust devils can develop on the tops of mesas in summer and can cause brief gusts of 75 mph or greater in the immediate area 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-48. For a more complete discussion of the geology of the TA-48 area, please refer to Chapter 2 of the work plan for Operable Unit (OU) 1129 (LANL 1992, 7666) and Chapter 2 of the Installation Work Plan (IWP) for Environmental Restoration, Revision 4 (LANL 1995, 48637).

2.2.1 Geologic Setting

Figure 2-1 depicts a generalized cross section of the geologic setting described in this section.



F 2-2 / TA-48 RFI RPT / 092696

Figure 2-1. Generalized cross section of Pajarito Plateau with approximate location of TA-48.

2.2.1.1 Stratigraphy

TA-48 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 east of TA-48. The units below 700 ft are described by Purtymun (1995, 45344).

Bandelier Tuff

The Pajarito Plateau in the area of TA-48 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-48.

Underlying the Tshirege Member is the Otowi Member of the Bandelier Tuff. The Otowi Member is composed of multiple flow units of soft, unwelded ash-flow tuffs that were formed by eruptions about 1.61 Myr ago (Izett and Obradovich 1994, 48817). This unit is approximately 320 ft thick in the area of TA-48.

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-48. 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-48 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-48 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-48, 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-48 indicates that the Totavi Formation is 60 to 80 ft thick in the area of TA-48.

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-48, and some may be present in the subsurface near TA-48.

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-48 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 2-1).

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-48 is bounded on the east and west by branches of the Rendija Canyon segment. (Vaniman and Wohletz 1993, 48822). Although little or no vertical offset has been documented in the area of TA-48, the fault system is expressed as an area of greatly increased fracturing and brecciation of the Bandelier Tuff.

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-48 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 soils at TA-48 are the Carjo loam and the Tocal very fine sandy loam, with lesser amounts of Hackroy sandy loam. The Carjo series is described as moderately deep, well-drained soils that formed from weathered tuff on slightly sloping mesa tops. Soil thickness ranges from 20 to 40 in. The Tocal series is described as shallow, well-drained soils that formed from weathered tuff on slightly sloping mesa tops. Soil thickness ranges from 8 to 20 in. The Hackroy series, very similar in nature and thickness to the Tocal series, is generally associated with small interspersed areas of tuff outcrop and is highly subject to erosion.

2.3 Hydrology

Presented below is a brief description of the surface and subsurface hydrology at TA-48. For a more complete discussion of the hydrology of the TA-48 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 generally 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-48 flows directly into Mortandad Canyon, immediately north and east of TA-48, 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-48.

2.3.2 Vadose Zone Hydrology

TA-48 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-48; however, no shallow perched aquifers are known to be present beneath TA-48. 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-48 have not indicated the presence of any shallow or perched aquifers (Devaurs and Purtymun 1985, 7415); therefore, the saturated zone under TA-48 appears to be restricted to the deep main aquifer. The top of the main aquifer at TA-48 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-48.

Ground water in the main aquifer flows to the east toward the Rio Grande. The hydraulic gradient in the area of TA-48 is 60 to 80 ft per mile, and the rate of movement varies from 20 ft per year to more than 300 ft per year, depending on the permeability of the Puye Formation and the underlying Santa Fe Group rocks.

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 Environmental Restoration (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).

A small wetland on the east side of TA-48 receives runoff from the site (see Figure 1-2). The wetland supports a rank stand of cattails and contains four standing ponderosa pine snags, which provide a nesting habitat for violet-green swallows. Recent evidence of fill activities exists, and an upper portion was apparently filled for a parking lot. During a site inspection in May 1995, signs of use by mule deer and coyotes were observed. Bird species detected included the Virginia warbler, chipping sparrow, rufous-sided towhee, common raven, violet-green swallow, pygmy nuthatch, and western wood pewee. Also, a number of reptiles and amphibians may use the area for breeding, foraging, or overwintering: plateau whiptail, eastern fence lizard, many-lined skink, chorus frog, woodhouse's toad, western terrestrial garter snake, prairie rattler, short-horned lizard, and possibly the canyon tree frog (Dunham 1992, 31276).

Although the wetland is small, it provides habitats for the species listed above and potentially for other species not detected during limited surveys. The wetland probably improves the water quality of runoff from the site. However, the wetland also may cause some ecological receptors to be exposed to constituents of potential concern (COPCs).

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.

Level 2 habitat evaluations indicated that at TA-48 habitat conditions exist for only 1 of the 24 species of threatened, endangered, or sensitive plants and animals that were identified as potential species of concern (Dunham 1992, 31276).That species is the spotted bat, which uses 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 that enter Mortandad Canyon or the wetland area (Aggregate X). 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.

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3.0 APPROACH TO DATA ASSESSMENT AND ANALYSIS

3.1 Summary of Quality Control Activities

The objective of the Phase I investigation at Technical Area (TA) -48 was to confirm the presence or absence of contamination in the 10 potential release sites (PRSs) in the 5 aggregates designated as K, M, N, X, and Y. To meet this objective, appropriate analytical methods and protocols were applied.

Quality control (QC) procedures were implemented in the analytical laboratory to provide estimates of the bias and precision of the analytical measurements. The specific QC samples and procedures used to assess bias were as follows: laboratory blank samples, system monitoring compound (surrogate) recovery, matrix spike compound recovery, isotope tracer recovery, laboratory control samples (LCSs), and single-blind performance evaluation (PE) samples. The specific QC samples and procedures used to assess precision were as follows: laboratory duplicate samples, matrix spike duplicate samples, and surrogate recovery variability.

In addition, technical holding time criteria were applied to ensure that the analytical results were not biased because of sample degradation or loss.

QC samples were also collected in the field to provide information regarding sampling procedure bias and to evaluate sampling precision. Field QC samples included the following: bottle blanks, equipment rinsate blanks, trip blanks (volatile organic compound [VOC] analysis only), and field duplicate samples.

In the following sections, estimates of the precision and bias of the main analyte suites are presented by evaluating the specific quality indicators listed above. The effectiveness of the analytical methods for detecting constituents of potential concern (COPCs) in soil and water matrices is also assessed. Potential limitations in the analytical data that may impact their intended use are noted. The results for field QC samples are also presented and interpreted with regard to bias and uncertainty introduced by the sampling procedures. The results for individual samples were qualified by evaluation of the above listed QC parameters, following Environmental Protection Agency (EPA) guidelines for inorganic data review (EPA 1994, 48639) and for organic data review (EPA 1994, 48640), where applicable.

Details regarding the qualification of analytical results for individual samples are given in Appendix A. The results for specific analytes were qualified as unusable for only a few samples. Some field samples that were submitted for radiochemical analyses were reported as "lost in analysis" by the analytical laboratory, usually because recovery of the tracer isotope was less than 10%. The impact of missing or unusable analytical data on the overall quality of the data set is discussed in the site-specific result sections for each individual aggregate.

Sections 3.1.1 through 3.1.4 focus on analytical laboratory QC activities, whereas Section 3.1.5 describes field QC activities.

3.1.1 Inorganic Analyses

Trace metals in soil samples taken at TA-48 were analyzed by either SW-846 methods (EPA 1986, 31732; EPA 1986, 31733) or energy dispersive x-ray fluorescence (EDXRF), as shown in Table 3-1. The four SW-846 methods chosen were inductively coupled plasma emission spectroscopy (ICPES), inductively coupled plasma mass spectroscopy (ICPMS), graphite furnace atomic absorption (GFAA), and cold vapor atomic absorption (CVAA). All water samples were analyzed by SW-846 methods. The EDXRF protocol chosen is described in the Laboratory internal method EI-732 (LANL 1993, 31794). All EDXRF analyses were carried out in-house. All SW-846 analyses were performed by the same fixed-site laboratory.

TABLE 3-1

ANALYTICAL METHODS FOR TRACE METAL ANALYSES

Analytical Protocol	Analytical Method	Analyte Suite
LANL EI-732	EDXRF[a]	As, Ba, Ca, Cd, Cr, Cu, Fe, Hg, K, Mn, Ni, Pb, Sb, Se, Th, Ti, U, and Zn
SW-846 Method 6010	ICPES[b]	Al, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Mg, Mn, Ni, K, Ag, Na, Sr, V, and Zn
SW-846 Method 6020	ICPMS[c]	Pb, Sb, and Tl
SW-846 Method 7060	GFAA[d]	As
SW-846 Method 7741	GFAA	Se
SW-846 Methods 7470 and 7471	CVAA[e]	Hg

a. Energy dispersive x-ray fluorescence
b. Inductively coupled plasma emission spectroscopy
c. Inductively coupled plasma mass spectroscopy
d. Graphite furnace atomic absorption
e. Cold vapor atomic absorption

Technical holding times for the EDXRF analyses were met. Technical holding times for trace metal analysis by ICPES were exceeded for three soil samples. Since the six-month holding time was exceeded by only 11 days, the trace metal results for the impacted samples are usable for Phase I decision-making purposes. Technical holding times for GFAA analysis were exceeded by one month, and holding times for ICPMS analysis were exceeded by two months for two field QC water samples; therefore, the reported results for arsenic, selenium, lead, antimony, and thallium should be regarded as estimated.

Of the 140 soil samples that were analyzed for trace metals, 127 (91%) were analyzed by EDXRF; the remaining 13 (9%) were analyzed by SW-846 methods. Fourteen soil samples were analyzed for mercury by CVAA. To provide confirmation of the EDXRF results, 17% of the soil samples (21 of 127) that were analyzed by EDXRF were also submitted for SW-846 analysis. In all cases, the SW-846 analytical results were able to confirm the conclusions of screening assessments that were based on the EDXRF results.

3.1.1.1 Comparison of SW-846 and EDXRF Methods

The SW-846 methods were performed at fixed-site laboratories and required acid digestion of the sample before the instrumental analysis. In contrast, the EDXRF method could be implemented at either a fixed-site or mobile laboratory facility and, because of the nature of the physical phenomenon on which the x-ray fluorescence measurement is based, did not require sample digestion. The only sample preparation required for soils using the EDXRF method is drying, followed by milling and sieving. Therefore, trace metal analysis of soils using this method is faster, less labor-intensive, and less expensive than using the SW-846 methods. For these reasons, the use of EDXRF for Phase I sample analysis was an attractive alternative to the SW-846 methods.

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

less, so detecting beryllium or sodium by the EDXRF method is not possible. No historical evidence exists to indicate that either silver or thallium was used at any of the TA-48 PRSs, and neither analyte was detected at elevated levels in any of the soil samples that underwent analysis by SW-846 methods. The ER Project has not established screening action levels (SALs) for the analytes beryllium, cobalt, magnesium, or sodium. Concentrations of these metals found in samples taken from PRSs are compared to natural background concentrations in the data assessment methodology (Glatzmaier 1995, 45362). No historical evidence exists to indicate that beryllium, cobalt, magnesium, or sodium were used at any TA-48 PRS, and none of these four analytes were detected at levels exceeding the background upper tolerance limits (UTLs) in the soil samples that underwent analysis by SW-846 methods.

The analytes thorium, titanium, and uranium were not determined by ICPES but were determined by EDXRF. Isotopic uranium and isotopic thorium analyses by alpha spectrometry were performed on soil samples; therefore, total uranium and thorium analyses were not required for screening assessment purposes. Titanium was not considered to be a COPC at the TA-48 site because no archival evidence of its use exists, and neither a SAL value nor a UTL background level has been established for titanium.

The estimated detection limits (EDLs) for both SW-846 and EDXRF methods are compared to the analyte-specific UTLs (Glatzmaier 1995, 45362, Table 2) and SALs (LANL 1993, 26078, Appendix J) for soil samples in Table 3-2. The SW-846 analyte EDLs are element-dependent, ranging from 0.1 mg/kg to 1,000 mg/kg. The EDL for the Laboratory EDXRF method is approximately 10 mg/kg for all the target analytes. For those analytes for which background levels have been established, the EDL for either set of protocols is sufficiently below the UTL to provide data of the required quality for data screening assessment, with the exception of the following seven analytes: antimony, arsenic, beryllium, cadmium, mercury, selenium, and thallium. Four of these seven analytes have SAL values that are well above the EDLs of either set of protocols: antimony, cadmium, mercury, and selenium. Arsenic, beryllium, and thallium are the remaining three analytes for which the method sensitivity may be insufficient for either EDXRF or SW-846 methods. As discussed above, beryllium and thallium were not considered to be COPCs at any TA-48 PRS. In the case of arsenic, any sample containing elevated levels (greater than twice background) of the analyte should be readily identified using the EDXRF method.

3.1.1.2 Comparison of SW-846 and EDXRF Sample Results

Comparison of the analytical results obtained for soil samples that underwent analysis by both EDXRF and SW-846 (specifically ICPES) methods, as shown in Table 3-3, indicates that the EDXRF results were significantly higher than the SW-846 results for the following analytes: barium, calcium, chromium, copper, iron, lead, manganese, and potassium. The results for zinc were approximately equivalent by either method. For the analytes antimony, arsenic, cadmium, mercury, nickel, and selenium, no meaningful comparison of the results can be made because, for most soil samples, the concentrations of these analytes were less than the EDLs.

The higher levels measured for certain analytes by EDXRF are a consequence of the penetrating nature of x-rays. Fluorescence is observed from soil matrix analytes, such as mineral crystals, as well as surface-adsorbed analytes. The acid digestion procedure used in sample preparation for SW-846 methods dissolves surface-adsorbed inorganic compounds but does not efficiently dissolve the mineral compounds that 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 EDXRF results.)

Some discrepancy between the analytical results for the different methods is to be expected, given the heterogeneity of the soil samples that were submitted for analysis. Because of this sample heterogeneity, establishing a correlation between ICPES and EDXRF results would not have been meaningful. However, in no case did the observed discrepancies affect the screening decision that was made based on the analytical results, and, in all cases, the ICPES results were able to confirm the conclusions that were reached, based on the EDXRF data.

TABLE 3-2

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

Analyte	Estimated Detection Limit (mg/kg)		Soil SAL[a] (mg/kg)	UTL[b] (mg/kg)
	SW-846 Method	EDXRF[c] Method		
Aluminum	40	ND[d]	NA[e]	58,900
Antimony	12	10	32	2.5
Arsenic	2.0	10	NA	11.6
Barium	40	10	5,600	1,140
Beryllium	1	ND	NA	3.31
Cadmium	1	10	80	2.7
Calcium	1000	10	NA	54,400
Chromium	2	10	80,000/400[f]	34.2
Cobalt	10	ND	NA	51.1
Copper	5	10	3,000	15.7
Iron	20	10	NA	35,600
Lead	0.2	10	400	39.0
Magnesium	1000	ND	NA	16,100
Manganese	3	10	11,000	1,030
Mercury	0.1	10	24	0.1
Nickel	8	10	1,600	26.7
Potassium	1000	10	NA	6,180
Selenium	1.0	10	400	1.7
Silver	2	ND	400	NA
Sodium	1000	ND	NA	1,880
Thallium	2.0	ND	6.4	0.9
Thorium	ND	10	NA	NA
Titanium	ND	10	NA	NA
Uranium	ND	10	NA	NA
Vanadium	10	ND	560	66
Zinc	4	10	24,000	101

a. Screening action level
b. Upper tolerance limit
c. Energy dispersive x-ray fluorescence
d. Not determined
e. Not available
f. Chromium (III)/chromium (VI)

TABLE 3-3

COMPARISON OF EDXRF[a] AND ICPES[b] RESULTS FOR INORGANIC ANALYTES

Analyte	Number of Analyses	Ratio: EDXRF/ICPES[c]
Barium	21	6.2 ± 3.3
Calcium	21	3.8 ± 1.7
Chromium	7	3.3 ± 1.8
Copper	8	3.4 ± 1.3
Iron	21	2.2 ± 0.9
Lead	18	2.6 ± 1.4
Manganese	21	2.1 ± 1.0
Potassium	21	75.1 ± 49.9
Zinc	21	1.1 ± 0.4

a. Energy dispersive x-ray fluorescence
b. Inductively coupled plasma emission spectroscopy
c. Average ratio of EDXRF result to ICPES result. Uncertainty is the 1-sigma uncertainty of the average ratio.

Discrepancies were noted for several of the confirmatory soil samples when results obtained by both methods were compared. For two soil samples collected in Aggregate Y at Location ID No. 48-2048 (0 to 0.5 ft and 0.5 to 1.5 ft), the EDXRF result for chromium was less than the EDL of 10 mg/kg, whereas the ICPES results for chromium were 25 mg/kg and 26 mg/kg. In one of the two samples, the ICPES result for calcium was an order of magnitude greater than the EDXRF result. The ICPES analysis of a PE sample yielded outside criteria recoveries for both calcium (207%) and chromium (474%); therefore, the ICPES results for these two analytes should be regarded as estimates. Discrepancies were also noted for particular analytes in two confirmatory samples collected from Aggregate M. In the soil sample from Location ID No. 48-2010 (4 to 5 ft), chromium was reported as <10 mg/kg by EDXRF and 23 mg/kg by ICPES. The chromium results by either method were regarded as estimates because of the poor recovery from LCS and/or PE samples. Similarly, in the soil sample from Location ID No. 48-2014 (7 to 7.2 ft), chromium and nickel were reported as <10 mg/kg by EDXRF and 180 mg/kg for chromium and 52 mg/kg for nickel by ICPES. Both ICPES values are regarded as estimates because of poor precision in the analysis of laboratory duplicate samples.

3.1.1.3 Evaluation of Quality Control Data for SW-846 and EDXRF Analyses

The pooled results obtained for EDXRF analysis of soil LCS and single-blind soil PE samples in the time period corresponding to the analysis of the TA-48 soil samples are reported in Table 3-4. The data for the LCS analyses clearly indicate that the instrument control status of arsenic, cadmium, mercury, antimony, selenium, and uranium was not adequately monitored during sample measurement. Therefore, the method performance for these analytes, as determined from the measurement of the PE samples, was poor. The recovery of arsenic exhibited low bias (41%); the recoveries of cadmium, mercury, antimony, and uranium exhibited significantly high bias. The PE sample analyses for arsenic had a 60% false negative rate (based on five analyses); a single selenium-containing sample was analyzed and had a false negative result. The results for nickel in both the LCS and PE samples indicated a low bias of 20% to 40% for this analyte. Therefore, the EDXRF results for arsenic, nickel, and selenium should be regarded as estimates, and the apparent low bias for these analytes should be considered when assessing sample results. In particular, the EDXRF data quality for arsenic is insufficient for screening assessment purposes. The EDXRF results for cadmium, mercury, antimony, and uranium should be regarded as estimates because of inadequate monitoring of the control status of these analytes during sample measurement.

Because analyses of PE samples indicated a high bias for these analytes, the sample results are adequate for screening assessment. The EDXRF results for thorium should be regarded as estimates because of a strong high bias of approximately 40% for this analyte.

TABLE 3-4

EDXRF[a] RESULTS FOR SOLID LABORATORY CONTROL SAMPLES AND PERFORMANCE EVALUATION SAMPLES

Analyte	Laboratory Control Samples[b]	Performance Evaluation Samples[b]
Arsenic	<EDL[c] (13)	41% ± 11% (2)
Barium	117% ± 9% (13)	122% ± 19% (10)
Calcium	104% ± 13% (13)	111% ± 19%(10)
Cadmium	<EDL (13)	130% (1)
Chromium	109% ± 21% (10)	151% ± 191% (9)
Copper	116% ± 39% (10)	86% ± 17% (9)
Iron	107% ± 16% (13)	99% ± 14% (10)
Mercury	<EDL (13)	1266% (1)
Potassium	96% ± 7% (13)	105% ± 44% (10)
Manganese	108% ± 19% (13)	104% ± 16% (10)
Nickel	60% ± 24% (6)	80% ± 16% (4)
Lead	90% ± 24% (13)	96% ± 25% (8)
Antimony	<EDL (13)	177% ± 22% (3)
Selenium	<EDL (13)	False negative (1)
Thorium	144% ± 45% (5)	136% ± 83% (5)
Titanium	96% ± 12% (13)	88% ± 37% (10)
Uranium	<EDL (13)	281% ± 153% (3)
Zinc	81% ± 5% (13)	82% ± 10% (10)

a. Energy dispersive x-ray fluorescence
b. Numbers in parentheses indicate the number of measurements for that particular analyte.
c. Estimated detection limit

Six duplicate samples—three water and three soil—were analyzed by ICPES, and six duplicate soil samples were analyzed by EDXRF. The data set is too small to make meaningful statements regarding the precision of each method. The analytical results for individual samples obtained by either method were qualified according to EPA guidelines criteria (EPA 1994, 48640) if duplicate sample analysis within the same batch indicated precision control problems with the measurement.

No matrix spike recovery results are available for the ICPES analysis of the TA-48 data set. However, matrix spike recovery results are available for the GFAA analysis of arsenic and selenium in soil (two samples) and water (three samples), and for the ICPMS analysis of antimony, lead, and thallium in water (three samples). The data set is insufficient to make meaningful conclusions regarding potential matrix-dependent biases in the water and soil samples. The analytical results for individual samples were qualified according to EPA guidelines criteria (EPA 1994, 48639) if the matrix spike recoveries indicated an unacceptable bias in the measurement of individual analytes.

The accuracy of the SW-846 methods was monitored by the concurrent analysis of aqueous LCS and aqueous single-blind PE samples; no apparent measurement bias was indicated for water matrices. Soil matrix control samples were not available at the time of analysis; therefore, no statement can be made regarding the precision or the bias of the SW-846 methods in the measurement of soil samples. Results for individual soil samples were qualified on the basis of the aqueous LCS and/or PE samples that were analyzed concurrently in the same batch.

3.1.2 Organic Analyses

3.1.2.1 Volatile Organic Compound Analysis

Soil and water samples were analyzed for VOCs using SW-846 Method 8260 to detect low-level contamination. All VOC analyses were carried out by the same laboratory over a period of two months. Technical holding times were met for all analyses. Analytical results that occurred between the instrument detection limit (IDL) and the estimated quantitation limit (EQL) were reported as "<EQL." The reported EQLs for soil samples were not corrected for dry weight and, consequently, exhibited low bias. There are 17 VOC analytes for which the EQL is greater than or equal to the SAL for water samples, as listed in Table 3-5. The EQLs for soil samples are less than the soil SALs for all VOC analytes.

Average surrogate recoveries and the associated precisions for three surrogate compounds, which are reported in Table 3-6, indicate acceptable analytical precision and no apparent bias for either soil or water matrices. Average recoveries of five spike compounds from eight soil matrix spike and matrix spike duplicate pairs also indicated no apparent bias. The average relative percent differences between recoveries of all five spike compounds from the soil duplicate pairs did not exceed 12%, which indicates acceptable method precision.

No contaminants were detected above the EQL in any of the method blank samples. In the analysis of 4 of the 11 analytical requests submitted for VOC analysis, the same method blank sample was analyzed for both water and soil samples. Protocol requires that separate blank samples be prepared for water and soil matrices. Water samples undergo an unheated purge, and soil samples undergo a heated purge. Whether the blank samples underwent heated or unheated purges is not known. Low levels of the target analyte compounds acetone, 2-butanone, and isopropyltoluene were detected in soil samples included in 3 of the 4 affected analytical requests, and laboratory contamination cannot be ruled out because of the improper blank analyses. In the analysis of 1 analytical request, there was a failed purge of the method blank; mandatory reanalysis did not occur because no target compounds were detected in any of the samples.

The common laboratory contaminants acetone and 2-butanone were detected above the EQL of 20 µg/kg in 11 soil samples. The levels of contamination were less than 5 times the EQL for all but 1 soil sample, and were several orders of magnitude lower than the SAL for either compound. The presence of acetone and 2-butanone at relatively low concentrations may be attributed to laboratory contamination introduced during sample preparation and analysis. In the soil sample from Location ID No. 48-2025, acetone was reported at 200 µg/kg, equivalent to 10 times the EQL. The initial and continuing calibrations for acetone were outside the QC criteria during sample analysis; therefore, the sample results should be regarded as estimates.

No contamination above the EQL was detected in any of the trip blank samples.

TABLE 3-5

COMPARISON OF ESTIMATED QUANTITATION LIMITS (USING SW-846 METHOD 8260) TO SCREENING ACTION LEVELS FOR VOC[a] ANALYTES IN WATER SAMPLES

Analyte	EQL[b] (µg/L)	SAL[c] (µg/L)
1,1,2,2-Tetrachloroethane	5	1.8
1,1,2-Trichloroethane	5	5
1,2-Dibromo-3-chloropropane	10	0.2
1,2-Dichloroethane	5	5
1,2-Dichloropropane	5	5
Benzene	5	5
Bromodichloromethane	5	0.56
Bromoform	5	4.4
Carbon tetrachloride	5	5
Dibromochloromethane	5	4.2
Dibromoethane	5	0.0004
Methylene chloride	5	5
Tetrachloroethene	5	5
Trichloroethene	5	5
Vinyl chloride	10	2
cis-1,3-Dichloropropene	5	0.19
trans-1,3-Dichloropropene	5	0.19

a. Volatile organic compound
b. Estimated quantitation limit
c. Screening action level

TABLE 3-6

RECOVERY OF VOC[a] SURROGATE COMPOUNDS FROM WATER AND SOIL SAMPLES

Surrogate	Water Sample	Soil Sample
1,2-Dichloroethane-d4	103% ± 12%	113% ± 12%
Toluene-d8	104% ± 9%	100% ± 10%
4-Bromofluorobenzene	105% ± 7%	114% ± 20%

a. Volatile organic compound

3.1.2.2 Semivolatile Organic Compound Analysis

Soil and water samples were analyzed for semivolatile organic compounds (SVOCs) using either the SW-846 Method 8270 or the Contract Laboratory Program OLM01.8 protocol to detect low-level contamination. Technical holding times were met for all analyses. Analytical results that occurred between the IDL, below which are nondetects, and the EQL were reported as "<EQL." For eight of the nine soil matrix analytical requests, the reported EQLs were not corrected for dry weights of soil samples and, consequently, exhibited a low bias.

There are 6 SVOC analytes for which the EQL for soil samples (0.330 mg/kg) is greater than the soil SAL: *m*-benzidine (0.003 mg/kg), benzo[a]pyrene (0.1 mg/kg), bis(2-chloroethyl) ether (0.12 mg/kg), dibenzo[a,h]anthracene (0.1 mg/kg), N-nitrosodi-n-propylamine (0.1 mg/kg), and N-nitrosodimethylamine (0.014 mg/kg). No standard, readily available method exists that could achieve EQLs as low as several parts per billion in soil for these compounds. There are 18 SVOC analytes for which the method EQL exceeds the SAL for water, as listed in Table 3-7.

TABLE 3-7

COMPARISON OF ESTIMATED QUANTITATION LIMITS (USING SW-846 METHOD 8270) TO SCREENING ACTION LEVELS FOR SVOC[a] ANALYTES IN WATER SAMPLES

Analyte	EQL[b] (µg/L)	SAL[c] (µg/L)
2,4,6-Trichlorophenol	10	3.2
3,3'-Dichlorobenzidine	20	0.078
Aniline	10	6.1
Azobenzene	10	0.32
Benzo[a]anthracene	10	0.1
Benzo[a]pyrene	10	0.2
Benzo[b]fluoranthene	10	0.2
Benzo[k]fluoranthene	10	0.2
Bis(2-chloroethyl) ether	10	0.032
Bis(2-ethylhexyl) phthalate	10	6
Chrysene	10	0.2
Dibenzo[a,h]anthracene	10	0.3
Hexachlorobenzene	10	1
Hexachlorobutadiene	10	4.5
Indeno[1,2,3-cd]pyrene	10	0.4
N-Nitrosodi-n-propylamine	10	0.005
N-Nitrosodimethylamine	10	0.0007
N-Nitrosodiphenylamine	10	7.1

a. Semivolatile organic compound
b. Estimated quantitation limit
c. Screening action level

All soil samples were extracted by sonication; all water samples were extracted by continuous liquid/liquid extraction. Eight of the nine soil analytical requests were analyzed by Laboratory A (see Table 3-8) over a period of two months, so a large data set is available. The ninth analytical request was analyzed by Laboratory B (see Table 3-8), and the statistics for this laboratory are based on a data set of only six soil samples and five water samples. Average surrogate recoveries and the associated precisions for six surrogate compounds, reported in Table 3-8, indicate acceptable analytical precision for both soil and water matrices. Laboratory A exhibited an apparently low bias for the recovery of three of the six surrogates from soil matrices: 2-fluorophenol (acid), phenol-d6 (acid), and nitrobenzene (base/neutral). Laboratory B exhibited a significant negative bias for the recovery of all six surrogate compounds. However, the observed negative bias of approximately 30% (Laboratory A) to 60% (Laboratory B) does not adversely affect the ability of the method to provide data of sufficient quality for screening or risk assessment. The method was adequate for the detection and reliable quantitation at concentrations near or above the SAL of those compounds for which the EQL is less than the SAL. The one possible exception may be hexachlorobenzene, for which the EQL is 0.330 mg/kg and the soil SAL is 0.44 mg/kg.

TABLE 3-8

RECOVERY OF SVOC[a] SURROGATE COMPOUNDS FROM WATER AND SOIL SAMPLES

Surrogate	Laboratory A		Laboratory B	
	Water	Soil	Water	Soil
2-Fluorophenol	46% ± 20%	69% ± 13%	62% ± 6%	46% ± 4%
Phenol-d6	47% ± 29%	74% ± 15%	62% ± 6%	43% ± 3%
2,4,6-Tribromophenol	64% ± 21%	98% ± 19%	57% ± 7%	33% ± 2%
Nitrobenzene-d5	68% ± 21%	78% ± 15%	54% ± 3%	36% ± 3%
2-Fluorobiphenyl	66% ± 20%	92% ± 17%	61% ± 4%	45% ± 3%
Terphenyl-d14	85% ± 14%	116% ± 20%	69% ± 2%	48% ± 5%

a. Semivolatile organic compound

The recoveries from water samples of all the surrogate compounds by Laboratory A, with the exception of terphenyl-d14 (base/neutral), exhibited low bias. In particular, the acid surrogates exhibited a negative bias of approximately 35% to 55%. Laboratory B exhibited a negative bias of approximately 40% in the recovery of all six surrogate compounds. However, the method was adequate for the detection and reliable quantitation at concentrations near or above the SAL of those compounds for which the EQL is less than the SAL.

Surrogate recoveries were out-of-control (two surrogates from either base/neutral or acid outside criteria, or recovery less than 10%) in the analysis of two soil samples and two method blank samples analyzed concurrently with the out-of-control soil samples. Base/neutral surrogate recoveries were out-of-control above the upper criteria limit for soil samples from Location ID Nos. 48-2014 and 48-2012 and two associated method blank samples. Because surrogate recoveries were above the upper criteria limit and no target analyte compounds were detected in the samples above the EQL, no qualification of the sample results is deemed necessary.

Recoveries of 11 spike compounds from 3 water and 10 soil matrix spike and matrix spike duplicate pairs indicated the same potential negative bias as revealed by the surrogate recoveries. Individual sample results were not qualified on the basis of matrix spike recoveries unless the surrogate recoveries also indicated a control problem with the measurement. The average relative percent differences between spike

recoveries from the soil duplicate pairs were less than 10% for all 11 spike compounds, which indicates acceptable method precision.

In 7 of the 15 analytical requests submitted for SVOC analysis, samples were extracted without a method blank being concurrently extracted. For 6 of the analytical requests, the reported dates of extraction for the method blanks did not agree with the sample extraction dates. For the seventh analytical request, a method blank extraction was not performed.

This absence of concurrent method blank extraction affected the analysis of 36 field samples. In 19 of the 36 samples, no target analyte compounds were detected above the EQL; therefore, no qualification of the sample results is necessary. In 5 of the 36 samples, the only target analyte compounds detected above the EQL were phthalate esters. The qualification of the data is discussed in the following paragraph. In the remaining 12 samples, a variety of polycyclic aromatic hydrocarbons (PAHs) were found at levels above the EQL; some PAHs were present at concentrations greater than 10 mg/kg. It is unlikely that such high levels and variety of PAHs in the samples would arise from contamination introduced during sample preparation; therefore, no qualification of the sample results is deemed necessary.

The common phthalate contaminants bis(2-ethylhexyl) phthalate and di-n-butyl phthalate were present in six soil samples. For three soil samples collected in Aggregate L, no phthalate contamination above the EQL was detected in the associated method blank sample. However, phthalate contamination was present in the associated bottle blank, which indicates that the contamination may have originated with the container. For the remaining three soil samples, which were collected in Aggregate N, no method blank analysis was reported. In four of the six soil samples, the level of phthalate contamination detected was less than five times the EQL and therefore may be attributed to laboratory contamination. In the remaining two soil samples, the level of phthalate contamination was more than five times the EQL, but, with no supporting method blank data, the possibility that the level of phlalate contamination is the result of laboratory contamination cannot be discounted.

3.1.2.3 Polychlorinated Biphenyl Compound Analysis

Soil and water samples were analyzed for polychlorinated biphenyl (PCB) compounds using the Laboratory internal protocol EO-430 (LANL 1993, 31794), which is a single-column method employing gas chromatography/electron capture detector instrumentation. Internal calibration methods were used. The method EQLs are 50 µg/kg and 5 µg/L for soil and water samples, respectively. The soil EQL is less than the soil SAL for PCB compounds, but the water EQL exceeds the water SAL by one order of magnitude. The only water samples that were analyzed for PCBs were field QC samples; therefore, the fact that the EQL exceeded the SAL was not a concern. Samples were analyzed for Aroclors (PCBs) 1242, 1254, and 1260, which are prevalent on the Laboratory site. Surrogate compounds were not added to the samples, so no statement regarding the accuracy or precision of the method can be made. Technical holding times were exceeded for one analytical request by one month. Because of the inherent chemical stability of PCBs, the usability of the data for Phase I screening assessment is not affected. The reported EQLs for the two soil analytical requests submitted for PCB analysis were not corrected for dry weight and therefore exhibited low bias.

3.1.3 Radiochemistry Analyses

Soil and water samples collected at TA-48 underwent the radiological analyses listed in Table 3-9. The required minimum detectable activities (MDAs) for the radioanalyses are also given for soil and water matrices. Gross-alpha, -beta, and -gamma radiation counting and a screening-level gamma spectroscopy analysis were performed in a mobile laboratory facility. Gamma spectroscopy and alpha spectrometry were performed at fixed-site laboratories. The radionuclides specifically measured included ^{241}Am, ^{144}Ce, ^{137}Cs, ^{60}Co, and ^{106}Ru (all by gamma spectroscopy) and ^{241}Am, ^{238}Pu, ^{239,240}Pu (unresolved isotopes), ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U, ^{235}U, and ^{238}U (all by alpha spectrometry). (Note that ^{241}Am is both a gamma- and alpha-emitter and can be detected by either emanation.) The analytical protocols used were either Laboratory

internal protocols (LANL 1993, 31794) or external protocols, which have much in common with the Laboratory radiochemistry methods. The radiochemistry procedures will vary somewhat from laboratory to laboratory because of the lack of promulgated radiological protocols. No holding time requirements exist for the radiological analyses.

TABLE 3-9

ANALYTICAL METHODS AND ASSOCIATED MDA[a] VALUES FOR RADIOLOGICAL ANALYSES

Analytical Suite	Analytical Method	MDA: Soil (pCi/g)	MDA: Water (pCi/L)
Gross-alpha and -beta emissions	Gross-alpha and -beta counting (mobile laboratory)	α: 63.1 β: 23.8	α: (4–8) x 10^3 β: (13–20) x 10^3
Gross-alpha and -beta emissions	Gross-alpha and -beta counting (fixed-site laboratory)	10	3
Gross-gamma emissions	Gross-gamma counting (mobile laboratory)	4.37	(1–2) x 10^3
Gross-gamma emissions	Gross-gamma counting (fixed-site laboratory)	2	100
^{241}Am, ^{144}Ce, ^{60}Co, ^{137}Cs, ^{106}Ru	Gamma spectroscopy (mobile laboratory)	2–10	NA[b]
^{241}Am, ^{144}Ce, ^{60}Co, ^{137}Cs, ^{106}Ru	Gamma spectroscopy (fixed-site laboratory)	0.1–2.0	20
^{241}Am ^{238,239,240}Pu ^{228,230,232}Th ^{234,235,238}U	Alpha spectrometry (fixed-site laboratory)	0.01	0.1

a. Minimum detectable activity
b. Not applicable

The radionuclides that were analyzed by gamma spectroscopy were chosen to be representative of the activation and fission products that may be present as a result of the radiochemical processing that has been carried out at TA-48 since 1957. The radiological properties of the selected radionuclides and the background UTL and SAL values for soil samples, where available, are given in Table 3-10. All of the five selected radionuclides emit gamma radiation, with the exception of ^{106}Ru, which emits a beta particle only. The radionuclide ^{106}Ru is quantified by the gamma emission of its shorter-lived daughter product ^{106}Rh. The radionuclides ^{144}Ce, ^{60}Co, and ^{137}Cs are beta/gamma emitters. The radionuclide ^{241}Am also emits an alpha particle, as discussed in the previous paragraph.

If the measured activity of a particular radionuclide is at or near background levels, the analytical results will exhibit a statistical distribution of both positive and negative numbers near zero activity. 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 signifi-

cance for an individual measurement but may be included in a larger data set to establish the distribution of values. The data set for TA-48 includes some negative activity values, but, in many cases, negative values were simply reported as "zero" activity.

The gross-alpha, -beta, and -gamma radiation screening measurements made on TA-48 soil samples were, with few exceptions, reported as negative values. Use of an inappropriate background material to correct sample results led to these negative values. The background material was a sample of Bandelier Tuff that had a greater radioactivity than almost all the soil samples collected at TA-48. Therefore, the gross-alpha, -beta and -gamma radiation measurements that were performed in the mobile laboratory were not used for screening assessments.

TABLE 3-10

RADIONUCLIDES MEASURED BY GAMMA SPECTROSCOPY

Radionuclide	Half-Life	Emissions	UTL[a] (pCi/g)	SAL[b] (pCi/g)
^{241}Am	432.7 yr	α, γ	NA[c]	17
^{144}Ce	284.6 days	β, γ	NA	64
^{60}Co	5.271 yr	β, γ	NA	0.9
^{137}Cs	30.17 yr	β, γ	1.4	4
^{106}Ru	1.020 yr	β	NA	14

a. Upper tolerance limit
b. Screening action level
c. Not available

Some of the reported sample results may be less than the MDA for the method. The MDA for a given isotope represents the 99% confidence level for the identification and quantification of an isotope by the given analytical technique. Therefore, values that are less than the MDA have a lower level of statistical confidence than values that are above the MDA. Values that are less than the MDA should be regarded as estimates; the true value lies in the range between zero activity and the MDA. The data set for TA-48 includes values that are less than the MDA for a particular isotope or a particular technique, but, in many cases, the measured values were reported as "<MDA" by the analytical laboratory.

The uncertainties that are reported with the alpha spectrometry and gamma spectroscopy 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. A longer count time results in a lower uncertainty. The reported uncertainties do not reflect the sources of variability arising from sample collection or sample preparation before analysis. The variability arising from sample preparation before the alpha spectrometry analyses was monitored by the addition of tracer isotopes. Measurement of tracer isotope recovery also allowed correction for any bias introduced into the analysis. The accuracy of the alpha-emitting radionuclide counting was also monitored by the analysis of LCS and/or single-blind PE samples. If the recovery from the LCS or PE sample was not within ±20% of the true value, associated sample results were qualified as estimates. Similarly, the accuracy of the gamma spectroscopy measurements was monitored by the recovery of ^{137}Cs from LCS and/or PE samples, and sample results were qualified accordingly.

Alpha-emitting tracer recoveries and the associated precisions for soil and water samples, reported in Table 3-11, indicate acceptable analytical precision. There was an apparent negative bias for the recovery of alpha-emitting radionuclides from either matrix. However, the reported sample results are corrected for

the chemical yield of the tracer isotope to account for matrix effects and losses during sample preparation. Chemical recoveries from soil and water matrices were approximately equivalent, which indicates that the low tracer recoveries were not due to matrix effects but rather were largely attributable to losses during sample digestion and isotope separation. Sample results were qualified only if the tracer recovery was less than 30%, because a very low tracer recovery may indicate that there has been an unusual occurrence during analysis.

TABLE 3-11

RECOVERY OF ALPHA-EMITTING TRACERS FOR ALPHA SPECTROMETRY ANALYSES

a-Tracer	Water	Soil
^{243}Am	40% ± 16%	42% ± 21%
^{242}Pu	63% ± 16%	67% ± 10%
^{229}Th	76% ± 2%	58% ± 24%
^{232}U	32% ± 14%	44% ± 24%

The analytical protocols for measurement of alpha-emitting radionuclides require that a method blank be prepared and analyzed concurrently with the samples. Blank contamination should not exceed five times the EQL for the particular isotope being measured. If blank contamination was detected, sample results less than five times the method blank result were qualified as undetected. Sample results greater than five times the method blank result were not qualified.

Detection and measurement of radionuclides by gamma spectroscopy were performed either in a mobile laboratory facility or at a fixed-site laboratory. The mobile laboratory analysis was a "screening" level technique, which produces higher MDAs than the fixed laboratory technique. The count times employed in the mobile facility were shorter than at the fixed-site laboratory; therefore, the uncertainties associated with the mobile laboratory screening results are greater. The results generated in the mobile laboratory facility should be used with caution when performing screening assessments of the data, and the large uncertainties associated with the measurements should be considered. Particularly for ^{60}Co and ^{137}Cs, the uncertainty associated with the reported results is often the same order of magnitude as the soil SAL values of 0.90 pCi/g and 4 pCi/g, respectively. To establish the validity of the screening data for assessment purposes, the measurements should be compared on a site-by-site basis to the results for confirmatory samples taken from the same site and analyzed at fixed-site laboratories. The appropriate comparisons have been made, where applicable, in the discussions of the individual aggregates.

3.1.4 High Explosives Analyses

No high explosives analyses were performed at this site.

3.1.5 Field Quality Control Activities

Elevated levels of lead (>5 ppb) were found in 17 of the 24 field QC water samples that were analyzed for trace metals by SW-846 methods. There was no correlation between the levels of lead contamination and the dates of collection or the dates of analysis; in addition, there was no correlation with the type of QC sample, such as bottle blank versus equipment rinsate blank. All the samples were analyzed at the same laboratory, so the lead contamination was probably not laboratory related. No evidence exists that the lead contamination observed in the field QC samples is indicative of similar contamination in regular field samples. The levels of lead measured in regular field water samples were always less than 5 ppb. The levels of lead measured in soil samples were not observed to be elevated relative to Laboratory site-specific back-

ground levels. The most likely explanation is that lead contamination was introduced by either the deionized water used to prepare the samples or the acid used to preserve the water samples. No qualification of the analytical results for the associated field samples is deemed necessary.

Phthalate contaminants were detected in five field QC water samples submitted for SVOC analysis. The method blank analyzed in conjunction with one of the field QC samples collected in Aggregate L contained bis(2-ethylhexyl) phthalate at greater than five times the EQL; therefore, the analysis was out-of-control. The method blank associated with QC samples collected in Aggregate M was actually extracted on a different date than the samples; therefore, the analysis was out-of-control. The method blank samples associated with the remaining three field QC samples were in control (phthalate contamination less than the EQL) at the time of analysis. However, the level of phthalate contamination detected in the samples was less than five times the EQL and, thus, may be attributed to contamination introduced during sample preparation and analysis. Phthalate contaminants were also detected in three field soil samples associated with a phthalate-contaminated bottle blank, and the analytical results have been qualified accordingly.

As mentioned previously in the discussion of the VOC analyses, no contamination was detected in any of the trip blanks submitted for analysis.

An indication of the uncertainty introduced by the sampling process was obtained by taking 70 field duplicate soil samples. In keeping with the stated objective for the Phase I investigation, the examination of the field duplicate analytical results focused on two possible conditions: 1) a COPC was detected in a field duplicate sample but not in the regular sample (or vice versa) and 2) a COPC was detected in a field duplicate sample at or near the UTL or SAL values but not in the regular sample (or vice versa). Only one field pair, consisting of a regular sample and a duplicate sample, met the second condition. However, eight regular/duplicate sample pairs met the first condition, as described in Table 3-12. Four soil samples from Aggregate N showed very low levels of acetone contamination in either the regular or duplicate sample. Acetone is a common laboratory contaminant, and the low levels detected in the soil samples (less than five times the EQL) may be attributed to contamination introduced during sample preparation and analysis.

TABLE 3-12

COMPARISON OF RESULTS FOR REGULAR AND DUPLICATE FIELD SOIL SAMPLES

Location ID No.	Analytes	Result (µg/kg)	
		Regular	Duplicate
48-2007	Carbon Disulfide	5.8	<5
48-2021	Acetone	<20	47
48-2022	Acetone	<20	29
48-2025	Acetone	42	<20
48-2025	Acetone	<20	54
48-2037	PCBs[a]	<50	260
48-2048	Fluoranthene, Pyrene	640 530	<330 <330
48-2048	Calcium	57×10^6	0.640×10^6

a. Polychlorinated biphenyls

Carbon disulfide was detected at 5.8 µg/kg, only slightly above the EQL, in a regular soil sample from Aggregate L but was not detected above the EQL in the duplicate sample. (Results below EQL were not reported by the analytical laboratory.) For a result that is at or very close to the EQL value, an approximately 50% chance exists of a "false negative" (<EQL) or "false positive" (≥EQL), assuming that the measurement error is symmetrically distributed. Therefore, the different results for the regular and duplicate samples should not be attributed to sampling variability. A similar argument can be made for the soil sample collected in Aggregate Y in which concentrations of PAHs very close to the method EQL were detected. However, the soil sample collected in Aggregate X does indicate a large uncertainty in the measurement for PCBs, which may be attributed to sampling variability. Assuming that PCBs were present in the regular sample at approximately the EQL value, the relative percent difference between the regular and the duplicate sample is 135%. The large relative percent difference of 196% for the calcium results in the soil sample pair from Location ID No. 48-2048 in Aggregate Y also indicates considerable soil heterogeneity at the site where the sample was taken.

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 contaminants of concern (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 possible COCs in the human health risk assessment is provided in Figure 3-1.

The second stage of the ecotoxicological 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 because of 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 potential COCs after additional evaluation (see Section 3.2.3.2). A decision logic diagram for identifying potential COCs for ecotoxicological risk assessment is provided in Figure 3-2. 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.

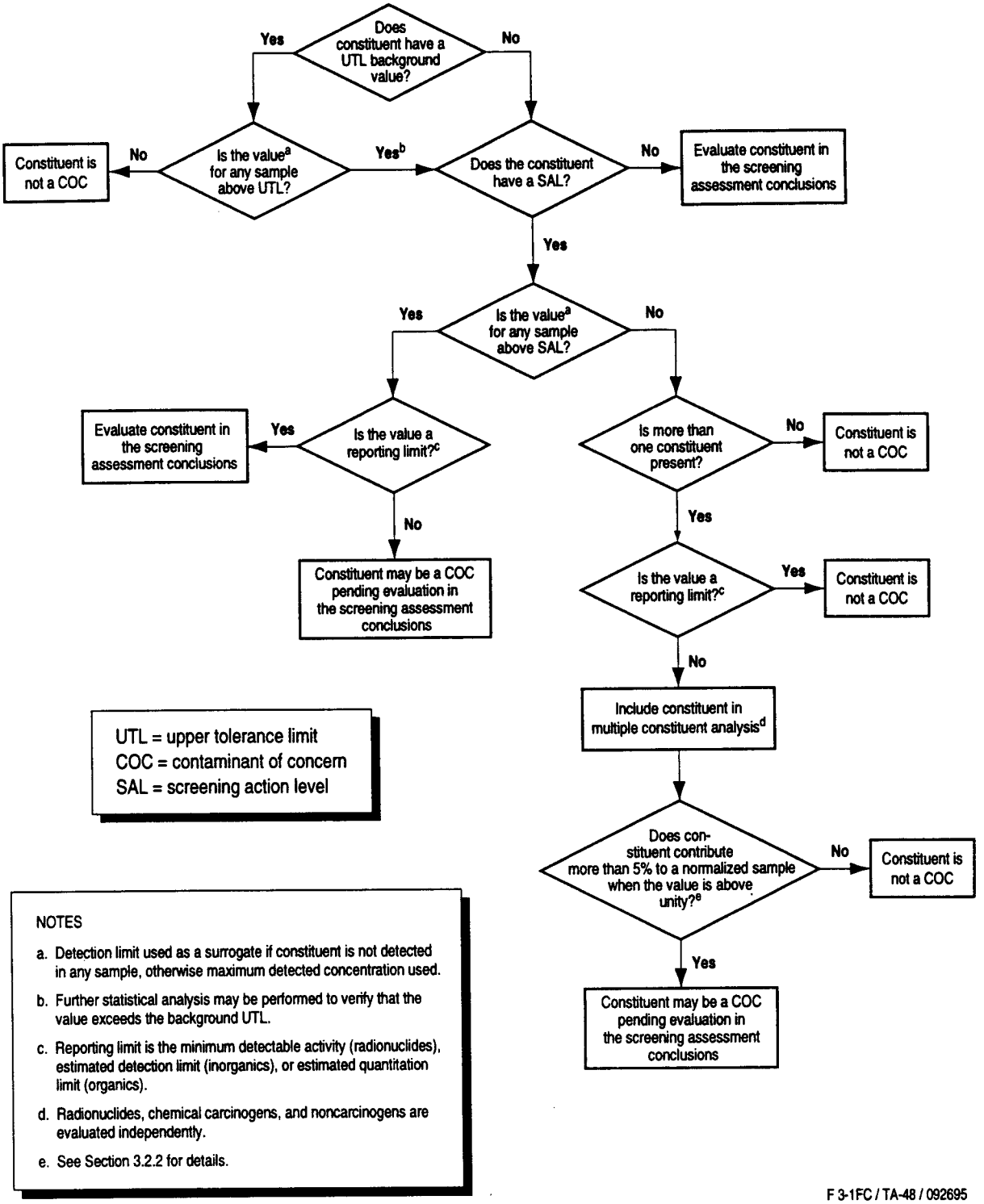

Figure 3-1. Decision logic for identifying contaminants of concern in the human health screening assessment.

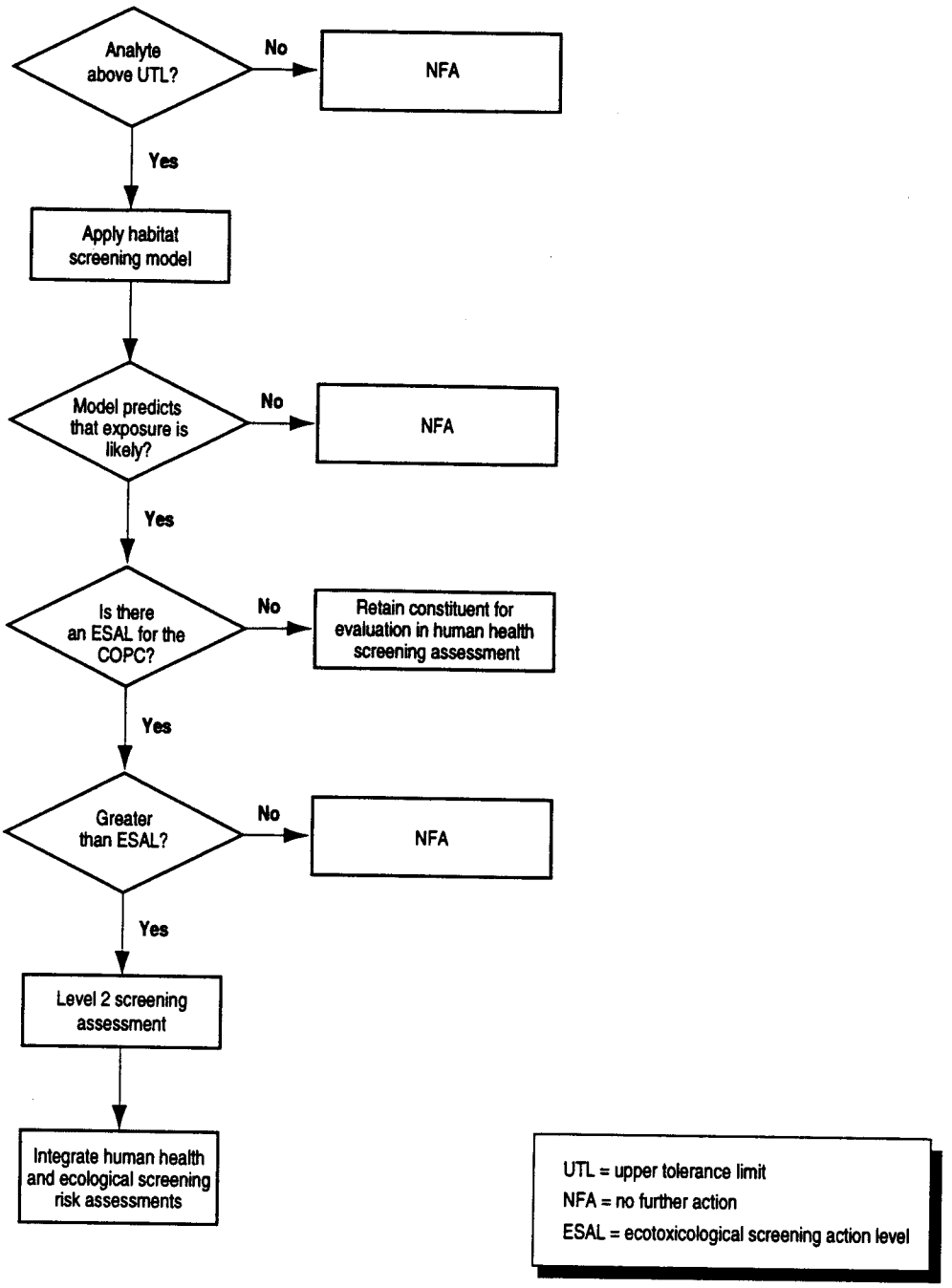

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Figure 3-2. Decision logic for screening of ecotoxicological risk.

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; 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 activity 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 Human Health 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 1.0 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 medium or more 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 report. If the sum of the normalized values is less than 1.0 for a COPC for all samples, the COPC is not evaluated further. If the sum of the normalized values exceeds 1.0 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, or a corrective measures study (CMS) may be recommended.

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 screening assessment are presented in Chapter 4.

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 no further action (NFA) or subjected to ESAL-based screening (see Figure 3-3).

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

a. No further action
b. Ecotoxicological screening action level

Figure 3-3. Habitat evaluation model for identifying PRSs that may be excluded from further consideration.

3.2.3.2 Ecotoxicological Screening Action Levels Comparison

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. Uranium was the only radionuclide considered because it is the only one for which a systemic ESAL was warranted (Ebinger et al. 1994, 48908). For uranium, the ESAL is equal to the background UTL. For other radionuclides, the human health screening assessments are assumed to protect wild populations (International Atomic Energy Agency 1992, 48852). 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 for which no ESAL exists or for which the reporting limit exceeds the ESAL should be retained as COPCs. Additional analyses may be performed to evaluate whether a site can be recommended for NFA. These analyses may consider factors such as data quality, frequency of detection, process knowledge, the likelihood of exposures to different ecological receptors, toxicological information, likely remediation impacts, or the amount by which the COPC concentrations exceed ESALs. For example, the ESAL for zinc is based on the toxicological reference dose for any adverse effect (Ebinger et al. 1994, 48908). If a toxicological reference dose based on inhibition of reproduction is used instead (Opresko et al. 1994, 49821), the ESAL is increased by a factor of 160.

3.3 Risk Assessment Methodology

The discussion of the methodology employed in risk assessment is divided into two separate subsections that address human health risk assessment and ecological risk assessment, respectively.

3.3.1 Human Health Risk Assessment Methodology

The general methodology for performing a human health risk assessment at the Laboratory has been addressed in Appendix K of the IWP (LANL 1993, 26078). A brief summary of the human health risk assessment methodology is provided here. Refer to the IWP for a more comprehensive treatment of the subject.

Following the identification of human health COCs in the screening assessment, an exposure assessment is performed to determine the rate of contaminant intake (or external gamma irradiation) for the identified receptors. The exposure assessment consists of an initial qualitative assessment in which potential exposure scenarios, exposure pathways, and human exposure routes, along with transport and exposure media, are identified. A quantitative exposure assessment is then performed within the conceptual framework.

The quantitative exposure assessment consists of identifying the source term concentrations of COCs in the exposure media and calculating exposure rates using parameters consistent with the exposure scenario(s). If more than one data set exists for a PRS or aggregate of PRSs (as might be the case if more than one analytical technique or laboratory was used), the data sets will be reviewed for correlation to determine whether they can be combined to calculate source term concentrations of analytes.

Because areas corresponding to PRSs or defined aggregates of PRSs do not necessarily correspond to likely exposure units, samples associated with one or more PRSs may be combined and evaluated separately if they comprise a readily identifiable exposure unit. In general, identification of a separate exposure unit may be desirable when one or more samples in a PRS or aggregate exceed screening values and there is an insufficient number of samples in the PRS or aggregate to support a risk-based decision. For decision purposes, all data that exceed screening values must be associated with a complete decision unit for evaluation: either a PRS, an aggregate of PRSs, or a separate exposure unit.

3.3.2 Ecological Risk Assessment Methodology

COPCs that cannot be eliminated by the screening process will be evaluated by a more comprehensive ecological risk assessment for representative ecological receptors. The baseline ecological risk assessment incorporates the screening assessment results with other factors such as the actual amount of time that an animal spends on contaminated sites, the effects of multiple contaminant exposures over multiple sites, the disturbance effect of any remediation activities, and the effects that contaminant transport may have on future ecological risk. The spatial scale of the assessment conforms to some natural ecological unit that is defined by the ecological risk assessment endpoint. Within this framework (EPA 1992, 48847) each PRS within the exposure unit can be evaluated for its contribution to the overall ecological risk.

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 CMS.

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

References for Chapter 3

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4.0 SITE-SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

The results of the investigation for each potential release site (PRS) are shown in Table ES-1.

TABLE ES-1

RESULTS OF THE INVESTIGATION

PRS	HSWA[a]		Proposed Action					Rationale
			NFA[b]	Accelerated Cleanup		Further Investigation		
	Yes	No		VCA[c]	EC[d]	Phase II	CMS[e]	
48-003	X		X					The PRS has only radionuclide components; RCRA[f] constituents were below SALs[g] or UTLs[h]
48-005	X		X					The PRS has only radionuclide components; RCRA constituents were below SALs or UTLs
48-007(a)	X		X					The PRS has only radionuclide components; RCRA constituents were below SALs or UTLs
48-007(b)	X		X					The PRS has radionuclide components; RCRA constituents above the SAL do not pose a risk to human health.
48-007(c)	X		X					The PRS has radionuclide components; RCRA constituents above the SAL do not pose a risk to human health.
48-007(d)	X		X					The PRS has only radionuclide components; RCRA constituents were below SALs or UTLs
48-007(f)	X		X					The PRS has radionuclide components; RCRA constituents above the SAL do not pose a risk to human health.
48-010	X		X					The PRS has only radionuclide components; RCRA constituents were below SALs or UTLs
48-001		X	X					Contamination below SALs or UTLs
48-002(e)		X	X					Contamination below SALs or UTLs or not present at levels that pose risk based on the anticipated future land use

a. Hazardous and Solid Waste Amendments
b. No further action
c. Voluntary corrective action
d. Expedited cleanup
e. Corrective measures study
f. Resource Conservation and Recovery Act
g. Screening action level
h. Upper tolerance limit (for soil background data)

4.1 Aggregate K

Aggregate K of Technical Area (TA) -48 consists of PRS No. 48-001, which is an air exhaust system composed of nine exhaust stacks that are associated with building TA-48-1, the radiochemistry laboratory (Figure 4-1). Three stacks exhaust unfiltered chemical fume hoods, three stacks exhaust combustion boilers, one stack exhausts individually filtered glove boxes, one stack exhausts filtered air from hot cell laboratories, and one stack exhausts air from a welding and degreasing booth in the basement building. The primary concerns associated with Aggregate K are the following stack releases:

- Volatile organic compound (VOC) and acid releases from the stacks associated with the chemical fume hoods. Most of the hoods are not filtered because of the common use of perchloric acid in the fume hoods; perchloric acid causes rapid degradation of the filter media. As an alternative to filters, many of the fume hoods are equipped with water sprayers designed to scrub contaminants from the exhaust air before releasing the air to the stacks. However, this method may not always be effective.

- Radionuclide releases from the stack associated with air exhaust from glove boxes that are located in Alpha Wing of building TA-48-1. These glove boxes are used for the handling of high-level gross-alpha, -beta, and -gamma radiation emitters. Possible radioactive particles in the exhaust are uranium, plutonium, and mixed fission products. The glove boxes are equipped with individual filters. The stack is currently permitted and monitored under the National Emission Standards for Hazardous Air Pollutants (NESHAP) permit. (Note that this stack was operational before the formal promulgation of the NESHAP regulations.)

Additional information on Aggregate K can be found in the work plan (LANL 1992, 7666).

4.1.1 Previous Investigations for Aggregate K

Reports covering the years 1967 to 1970 indicate routine airborne releases of plutonium, uranium, and mixed fission products from stacks at TA-48. Average daily releases of alpha-emitting radionuclides were estimated to be less than 0.1 pCi/m^3, and releases for beta-emitting radionuclides ranged from 0.4 to 20 pCi/m^3. In 1984, measured airborne releases totaled 1,566 mCi of mixed fission products, 1.3 mCi of uranium, and 2.6 mCi of plutonium (Becker et al. 1985, 6610). The high-efficiency particulate air filter for the exhaust system and the surrounding area were monitored for radioactivity levels during a 1988 Environmental Restoration (ER) Project reconnaissance survey. The level of radioactivity was 233 cpm (60 mR/h) above background (LANL 1988, 899).

In January 1991, five surface and five subsurface soil samples were collected from the site of a proposed parking lot immediately east of the security fence on the east side of TA-48. Levels of gross-beta and -gamma radiation activity in all surface and subsurface samples were at background. Gross-alpha radiation activity ranged from background to 45 pCi/g for surface soil samples and from background to 65 pCi/g for subsurface samples.

In April 1991, five surface and five subsurface soil samples were collected north of TA-48 as part of an ER Interim Action reconnaissance survey at the site of the proposed Weapons Isotope Separator Facility building (Fresquez 1991, 821). These samples included those collected in the vicinity of PRS No. 48-001. Levels of gross-alpha, -beta, and -gamma radiation were at background for all samples collected. No polychlorinated biphenyls (PCBs) or semivolatile organic compounds (SVOCs) were detected in any of the samples. Metals that were screened by the toxicity characteristic leaching procedure (TCLP) were all at concentrations less than the Environmental Protection Agency (EPA) guideline levels. Trace amounts of three VOCs (p-cymene, cumene, and Freon) were detected.

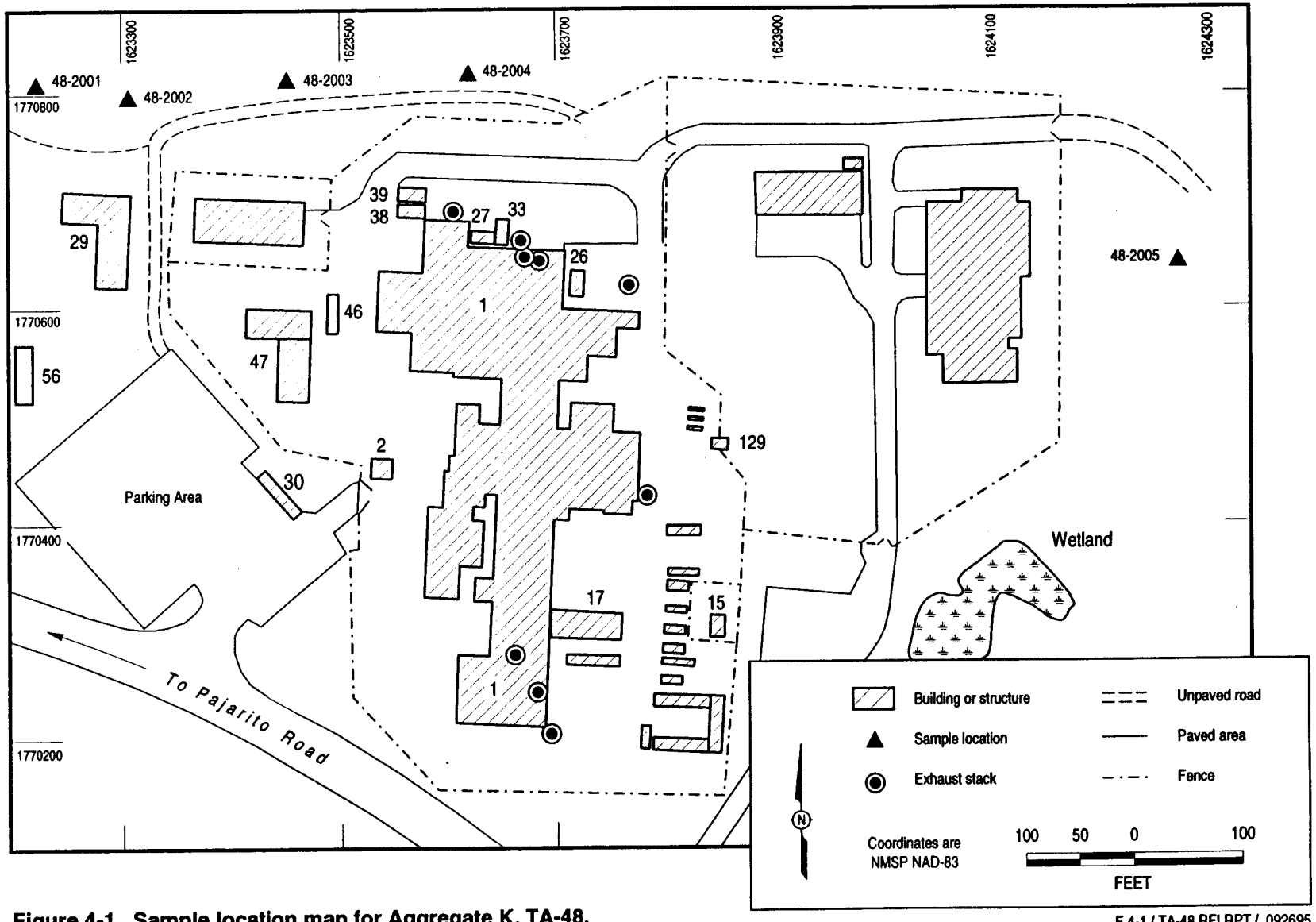


Figure 4-1. Sample location map for Aggregate K, TA-48.

F 4-1 / TA-48 RFI RPT / 092695

In the preliminary sampling and analysis plan (SAP) development for Aggregate K, the AIRDOS-EPA computer model was used to predict the location of contaminant particle deposition. This model calculates the dispersion of airborne radionuclides from constant point sources such as exhaust stacks and was used to model the emissions of ^{90}Sr, ^{144}Ce, ^{137}Cs, ^{241}Am, ^{238}Pu, and $^{239,240}Pu$. The modeling results were the basis for establishing areas of investigation and sampling locations for Aggregate K. Further discussion of the AIRDOS-EPA model is presented in Chapter 7, Section 7.2, of the work plan.

4.1.2 Field Investigations for Aggregate K

The discussion of the objectives of the investigation and the supporting conceptual model for Aggregate K is taken directly from Chapter 7, Section 7.15.1, of the work plan.

The basic objective of the characterization for this PRS was to confirm the presence or absence of contamination.

The conceptual model for transport of contaminants for PRS No. 48-001 is thought to involve a three-stage process.

1. Airborne material expelled from the exhaust systems is deposited onto the soil surface. The factors governing the deposition of contaminants are wind direction and velocity, stack height, and particle size.

2. Contaminants deposited on soils are washed into Mortandad Canyon. The factors governing sediment transport are runoff and particle size. Runoff is controlled by the amount of precipitation, the grade of the surface, and the rate of infiltration.

3. Contaminants deposited on soils are transported by water and infiltrate into the soil horizon (unsaturated zone) as colloids. The depth of migration of colloidal particles is controlled by flux and sorption.

An environmental survey (the areal extent of which was estimated using AIRDOS-EPA modeling) was conducted to locate areas of surface contamination. Within the survey area, an organic vapor analyzer (OVA) was used to detect VOCs, and a Bicron pancake probe 2000 was used to detect gross-alpha, -beta, and -gamma radiation.

Field sampling activities for Aggregate K were performed on July 13, 1993. Soil samples at Location ID Nos. 48-2001, 48-2002, 48-2003, and 48-2004 were collected from gullies at the canyon edge because the slopes leading to the canyon edge did not include enough soil to gather a sufficient sample to analyze. The soil in these sample locations was shallow and relatively undisturbed. The soil sample at Location ID No. 48-2005 was collected at the northeast edge of TA-48 in accordance with the work plan. Soil at this location was very shallow and disturbed, and it had to be collected from a larger area with the use of a soil scoop.

A summary of sampling activities for Aggregate K is presented in Table 4-1. Figure 4-1 shows the locations of all sample points in Aggregate K.

TABLE 4-1

SUMMARY OF SAMPLING ACTIVITIES FOR AGGREGATE K

Location ID No.	Sample Type	Sample Intervals	Sample Description	Comments	Date Collected
48-2001	Hand auger	0–0.5 ft	Bandelier Tuff	Drainage gully on canyon edge	7/13/93
48-2002	Hand auger	0–0.5 ft 6–12 in.	Bandelier Tuff at 12 in.	Drainage gully on canyon edge	7/13/93
48-2003	Hand auger	0–0.5 ft 0.5–1.0 ft	Bandelier Tuff at 12 in.	Drainage gully on canyon edge	7/13/93
48-2004	Hand auger	0–0.7 ft	Bandelier Tuff at 7 in.	Drainage gully on canyon edge	7/13/93
48-2005	Hand auger, Surface soil	0–0.2 ft	Bandelier Tuff at 2 in.	Large sample area	7/13/93

Deviations from the Work Plan

The SAP for Aggregate K, which is presented in the work plan, called for subsurface sampling using a hand auger to a depth of 3 ft or to the soil/tuff interface. Sampling from the hand-auger holes was limited by the shallow depth of the soil/tuff interface, which ranged from 2 to 12 in. No soil samples were collected at a depth greater than 1 ft. This deviation is minor and is consistent with the SAP; it does not influence the SAP rationale, SAP objectives, or the outcome of the field activities.

4.1.2.1 Results of Field Surveys

No VOCs were detected, and gross-alpha, -beta, and -gamma radiation readings were all within background values (120 cpm to 160 cpm).

4.1.2.2 Results of Field Screening

All samples were scanned for gross-alpha, -beta, and -gamma radiation with the Bicron pancake probe 2000 and scanned for VOCs with an OVA.

No elevated measurements indicative of contamination were recorded during the field screening process for any of the samples from Aggregate K.

4.1.3 Screening Assessment for Aggregate K

The screening assessment of the analytical results for samples collected at Aggregate K was conducted according to the methodology outlined in Chapter 3, Section 3.2. The screening assessment data tables are found in Tables B-1 through B-4 in Appendix B. The results of the screening assessment should be interpreted in conjunction with an evaluation of the quality of the analytical results and the SAP for Aggregate K. A summary of data quality considerations impacting the analytical results used for evaluating Aggregate K is presented in this section. A comprehensive assessment of the quality of the analytical data is presented in Chapter 3, Section 3.1. Additional information regarding the selection of radionuclide analytes is found in Chapter 3, Section 3.1.3.

For the purposes of the screening assessment, the noncarcinogenic constituent data set consists of both the inorganic constituents analyzed by SW-846 solid waste methods (EPA 1986, 31732) and the noncarcinogenic organic constituents. Because of the large number of organic constituents that were analyzed for, only those organic constituents that were present above the sample estimated quantitation limit (EQL) are included in the screening data tables. The screening action level (SAL) values for inorganic constituents analyzed at Aggregate K are based solely on noncarcinogenic endpoints. Screening comparisons for the inorganic constituents analyzed by the energy dispersive x-ray fluorescence (EDXRF) method were performed separately from the constituents that were analyzed by SW-846 methods. The data sets for the inorganic analyses cannot be directly compared since correlation factors are unavailable for those trace elements measured by both methods. As discussed in Chapter 3, Section 3.1, the EDXRF data set could not be screened against the site-specific background upper tolerance limit (UTL) values, since the background measurements were performed using SW-846 methods.

The carcinogenic data set for an aggregate consists of carcinogenic organic constituents that were present above the sample EQL. As noted above, no inorganic constituents are included in the carcinogenic data set. At Aggregate K, no carcinogenic organic constituents were detected above the sample EQL; therefore, a carcinogenic data set is not presented in Appendix B.

The sample results for radionuclide analyses are divided into two data sets. Separate screening comparisons were performed for measurements of radionuclide activity obtained from fixed-site and mobile laboratory analysis. The two data sets cannot be directly compared. The correlation between measurements performed at the fixed-site and mobile laboratories could not be determined because of the large uncertainties associated with the mobile laboratory analyses.

The analytical data quality evaluation for Aggregate K, which is found in Appendix A, does not indicate any problems that will affect the screening assessment. The soil sample at Location ID No. 48-2002 (0.5 ft) was lost in analysis; therefore, gamma spectroscopy results from the fixed-site laboratory are not available for this sample.

4.1.3.1 Comparison to Background and SAL Values

Comparison to Background Values

The sample data for Aggregate K were compared to background UTL values as an initial screening, as discussed in Chapter 3, Section 3.2.1. A distributional shift test was not performed because the field data sets were too small. The screening assessment data tables for the background UTL comparisons, which identify constituents of potential concern (COPCs) present above the UTL values for each sample, are provided in Tables B-1 through B-3 in Appendix B. The COPCs that were identified are listed in Table 4-2. Included in the list of COPCs are those constituents for which a background UTL is not available.

Eleven soil samples (including four duplicate samples) that were collected from five locations at depths ranging from surface to 1 ft were screened at the mobile laboratory facility for selected radionuclides by gamma spectroscopy. Seven soil samples from the same five locations were analyzed in a fixed-site laboratory by gamma spectroscopy; eight soil samples (including one duplicate sample) were analyzed for alpha-emitting radionuclides. A total of seven samples from Location ID Nos. 48-2001 through 48-2005 were analyzed at both mobile and fixed-site laboratories. Of the mobile laboratory analytes, no COPCs were eliminated during the background comparison. Of the fixed-site laboratory analytes, ^{228}Th, ^{232}Th, and ^{235}U were eliminated from further consideration as COPCs.

TABLE 4-2

COPCs CARRIED FORWARD TO THE SAL COMPARISON IN AGGREGATE K

Radionuclides	Noncarcinogenic Constituents
^{241}Am[a]	4-Isopropyltoluene
^{144}Ce[a]	Lithium[a]
^{60}Co[a]	Molybdenum[a]
^{137}Cs	Silver[a]
^{238}Pu	Strontium[a]
$^{239,240}Pu$	Zinc
^{106}Ru[a]	
^{230}Th[a]	
^{234}U	
^{238}U	

a. No background value is available for this analyte.

Two soil samples from Location ID Nos. 48-2001 and 48-2004, collected at depths ranging from surface to 0.7 ft, were analyzed for inorganic constituents by SW-846 methods and compared to background UTL values. COPCs that were eliminated from further consideration included aluminum, arsenic, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, potassium, magnesium, manganese, sodium, nickel, lead, antimony, selenium, thallium, and vanadium. Those inorganic constituents for which no background is available, which includes lithium, molybdenum, silver, and strontium, were carried forward to the next step in the screening assessment, the comparison to SAL values. Zinc was present above its UTL value of 101 mg/kg at Location ID No. 48-2004; therefore, it is carried forward to the SAL comparison.

Eight soil samples (including one duplicate sample) collected from five locations were analyzed for VOC and SVOC constituents. The noncarcinogenic VOC 4-isopropyltoluene was detected in the sample collected at Location ID No. 48-2002. The noncarcinogenic organic constituent was carried forward to the comparison to SALs since a UTL value is not available.

Comparison to Human Health Screening Action Levels

COPCs that were not eliminated in the background comparison were evaluated by comparison to human health SALs. The screening assessment data tables for the SAL comparisons are provided in Tables B-1 through B-4 in Appendix B. Because of the large number of analytes, SAL comparisons for organic constituents are provided only for those organics present above their reporting limit. The EDXRF data set consisted of eight soil samples, including one duplicate, from five locations at depths ranging from surface to 1 ft.

Constituents with one or more sample values exceeding a SAL and those that contribute greater than 5% to a SAL-normalized sum exceeding 1.0 in the multiple constituent analyses are considered to be potential contaminants of concern (COCs). No radionuclides or noncarcinogenic constituents exceeded SALs, and none were identified as potential COCs in the multiple constituent analysis in Aggregate K. No carcinogenic constituents were present above EQL in any of the soil samples analyzed for VOCs or SVOCs.

Constituents Not Identified as Potential COCs

Constituents that do not have SAL values or for which SAL values are lower than the reporting limit require further evaluation as part of the screening assessment methodology (see Figure 3-1). The evaluation of those constituents is presented in this section.

Organic constituents with reporting limits exceeding their SAL included benzo[a]pyrene, dibenz[a,h]-anthracene, m-benzidine, bis(2-chloroethyl) ether, N-nitrosodi-n-propylamine, and N-nitrosodimethyl-amine. Benzidine is used in the production of dyes, and the nitrosamines are used as additives in gasoline and lubricants. Neither benzidine nor the nitrosamine compounds are reasonably associated with stack emissions for Aggregate K. The two polycyclic aromatic hydrocarbon (PAH) compounds have SAL values of approximately one-third their EQL in soil samples. Although these compounds are often detected at trace levels at industrial sites, none were present above the sample EQL at Aggregate K. No reasonable basis exists for suspecting that these constituents are present at hazardous levels as a result of stack emissions at Aggregate K.

Approximately 132 individual organic constituents were analyzed for at Aggregate K. Of this total, approximately 18 do not have SAL values. The noncarcinogenic VOC 4-isopropyltoluene, which does not have a SAL value, was detected above EQL at Location ID No. 48-2002. The concentration of 4-isopropyl-toluene was 0.01 mg/kg. No other organic constituents were detected. It is unlikely that organic constituents are major contaminants in stack emissions of an isotope facility such as building TA-48-1. Therefore, these constituents do not need further evaluation.

Of the inorganic constituents present in the soil samples that were analyzed by SW-846 methods, the following do not have SAL values: arsenic, aluminum, calcium, iron, lithium, magnesium, potassium, and sodium. Of these, aluminum, calcium, iron, magnesium, potassium, and sodium are recognized by the EPA as being essentially nontoxic under typical environmental exposure scenarios (EPA 1989, 8021) and do not warrant further evaluation for human health risk. A site-specific background UTL value is available for arsenic and is used for screening assessment purposes. Two soil samples from two locations in Aggregate K were analyzed for arsenic by the graphite furnace atomic absorption (GFAA) method. The maximum arsenic concentration observed was 1.8 mg/kg, which is below the UTL value of 11.6 mg/kg. The maximum lithium concentration observed in the two soil samples was 4.4 mg/kg. There is no evidence that lithium was associated with the stack emissions at TA-48; therefore, lithium does not need further evaluation.

Inorganic constituents in soil measured by the EDXRF method were not compared to the UTL background values for reasons discussed in Chapter 3, Section 3.1.1. Of the constituents measured by EDXRF, excluding the nontoxic analytes discussed above, the following do not have SAL values: arsenic, thorium, titanium, and uranium. Titanium, which is widespread in the environment, is generally recognized as being physiologically inert. There is no reason to recommend further evaluation of titanium in Aggregate K. The alpha-emitting isotopes of thorium and uranium were analyzed by alpha spectrometry, and the risk associated with the presence of thorium and uranium was evaluated on an isotopic basis. Arsenic was not detected above the EDXRF detection limit of 10 mg/kg in Aggregate K. Arsenic was not present above its UTL value in any of the soil samples analyzed by SW-846 methods, and it does not need further evaluation.

All radionuclides identified as potential COPCs by the background screening process had SAL values, and no reporting limits exceeded these values in any sample.

4.1.3.2 Data Interpretation

Constituents were detected above background at the following sample locations in PRS No. 48-001 (see Figure 4-1): Location ID Nos. 48-2001 and 48-2002 (^{238}Pu and $^{239,240}Pu$); Location ID No. 48-2003 (^{137}Cs, ^{238}Pu, $^{239,240}Pu$, and ^{238}U); Location ID No. 48-2004 (^{238}Pu and $^{239,240}Pu$); and Location ID No. 48-2005 (^{137}Cs, ^{238}Pu, $^{239,240}Pu$, ^{234}U, and ^{238}U). Radionuclide activities above background were the highest at Location ID No. 48-2003, which is what the AIRDOS model predicted (LANL 1992, 7666). The uranium and plutonium activities associated with Location ID No. 48-2005 could be attributed to the PRS in Aggregate M. Although activities were measured slightly above background levels (see Tables B-1 and B-2 in Appendix B), no COCs were identified during the human health screening assessment for this PRS.

4.1.3.3 Risk Assessment

No human health or ecological risk assessment was performed for PRS No. 48-001.

4.1.3.4 Ecotoxicological Screening Assessment

The ecotoxicological screening assessment of the analytical results for samples collected at Aggregate K was conducted according to the methodology outlined in Chapter 3, Section 3.2.3. The screening assessment data tables for the ecotoxicological screening action level (ESAL) comparisons are provided in Table C-1 in Appendix C.

Ranking of Habitat Condition and Receptor Accessibility to COPCs

Ecological characteristics of PRS No. 48-001 in Aggregate K were reviewed to estimate the likelihood that ecological receptors could come in contact with COPCs to a significant degree. The location of this PRS (see Figure 1-3) and the frequency of human disturbance are such that ecological receptors use the site for some, but not all, portions of their life cycles. Therefore, this PRS was given a landscape condition score of two. COPCs could be widely dispersed in the area, so the site was given a receptor access score of three. These scores suggest that exposure is quite possible; therefore, a comparison to ESAL values is required for this PRS (see Figure 3-3 to review the decision model).

Comparison to Ecotoxicological Screening Assessment Levels

Aggregate K contains habitat that is suitable for use by spotted bats, which are candidates for listing under the Federal Endangered Species Act and are classified as endangered by the State of New Mexico. Therefore, the COPCs carried forward to the human health SAL comparison (Table 4-2) were also carried forward to the ecotoxicological screening assessment. Uranium, because of its systemic toxicity, was the only radionuclide evaluated. Potential COCs with one or more values exceeding an ESAL are identified in Table 4-3.

TABLE 4-3

POTENTIAL COCs IDENTIFIED DURING ECOTOXICOLOGICAL SCREENING IN AGGREGATE K

Radionuclides	Inorganic Constituents	Organic Constituents
Uranium[a]	Zinc	None identified

a. Identified as a potential COC based on systemic toxicity.

The ecotoxicological screening assessment identified uranium and zinc as potential COCs. No organic constituents were identified as potential COCs. Two samples contained ^{238}U activities that were greater than the uranium background UTL and the ESAL; these activities could adversely affect ecological receptors that make exclusive use of these sampling locations. When other uranium samples in the aggregate are averaged for a risk assessment, the value is below the uranium UTL. One reported zinc concentration was above its background UTL and ESAL values; this concentration could affect the reproduction process for ecological receptors that make exclusive use of these sampling locations. Any ecological receptors of concern (in this case, spotted bats) would use an area that is much larger than Aggregate K, making it unlikely that uranium or zinc from this aggregate alone would cause significant adverse effects to the environment.

4.1.4 Conclusions and Recommendations for Aggregate K

According to the decision process described in Chapter 5 of the work plan, the data collected during the Phase I investigation and the results of the human health screening assessment showed that no potential COCs were identified at PRS No. 48-001, the air exhaust system. Based on no further action (NFA) criterion number 4 (the PRS has been characterized, and available data indicate that COCs are not present), PRS No. 48-001 will not be added to the Hazardous and Solid Waste Amendments (HSWA) Module of the Laboratory's Resource Conservation and Recovery Act (RCRA) operating permit.

Two potential COCs were identified by the ecological screening assessment; however, any ecological receptors of concern would use an area that is much larger than Aggregate K, making it unlikely that uranium or zinc from this aggregate alone would cause significant adverse effects to the environment. Because exposure to these and other potential COCs around the Laboratory may be part of a process leading to cumulative adverse effects to ecological receptors, it is recommended that if a site-wide ecological risk assessment is conducted, these potential COCs be included.

4.2 Aggregate M

Aggregate M consists of PRS No. 48-003, an inactive septic system. The system served TA-48 from 1957 through January 1986 when it was removed from service and abandoned. The septic system consisted of a septic tank (TA-48-5), a filter bed (TA-48-6), and an outfall that discharged into Mortandad Canyon north of TA-48.

The septic tank and filter bed were decommissioned and removed in 1986. Building TA-48-45 was subsequently constructed over the site of the former septic system. In 1973 an environmental assessment, performed in conjunction with a project to improve the septic system, stated that the system was suspected of accidentally receiving hazardous chemicals and radionuclides.

4.2.1 Previous Investigations for Aggregate M

Readings taken in 1988 for an ER Project site reconnaissance survey measured 14 mR/h of gamma radiation activity 3 ft below the surface near the former site of the filter bed. This result suggests that the decontamination and decommissioning (D&D) activities performed at the site in 1986 may not have been adequate.

4.2.2 Field Investigations for Aggregate M

The discussion of the objectives of the investigation and the supporting conceptual model for Aggregate M is taken directly from Chapter 7, Section 7.17.1, of the work plan.

The investigations at Aggregate M were designed primarily to answer the following questions.

- Does surface and subsurface contamination currently exist in Aggregate M?
- Do any near-surface artifacts remain that represent potential contaminant release points?
- What is the potential for surface and subsurface migration of contaminants?
- What are the current waste stream constituents?

The conceptual model is as follows.

- The waste stream is not defined because archival information indicates that, along with sanitary waste, an unknown variety and amount of other wastes were deposited into the septic system.
- Any remaining contaminant plumes may have moved vertically along fracture planes that are in contact with the leach fields and outfalls because of the transport mechanism provided by liquids associated with the waste stream.

Archival engineering drawings of the septic system and TA-48-45 (drawing numbers ENG-C20799 [LASL 1957, 32019] and C-44955 [LANL 1985, 48887], respectively) and photographs from the site reconnaissance performed in 1988 were reviewed to determine the location of the septic system with respect to the current structure of TA-48-45.

An environmental survey (the areal extent of which was determined by the archival review described above) was conducted to locate areas of surface contamination. Within the survey area, an OVA was used

to detect VOCs, and a Bicron pancake probe 2000 was used to detect gross-alpha, -beta, and -gamma radiation.

The filter beds were located during the preliminary engineering survey when personnel from the Environmental, Safety, and Health (ESH) Division performed a radiation site-walkover. The site-walkover was performed by a certified industrial hygienist and was based on the professional judgment of the industrial hygienist and the geologist who conducted the site-walkover. No radiation above background levels was detected; therefore, the formal radiation grid survey, as described in the SAP for Aggregate M, was not performed. The SAP for Aggregate M is presented in the work plan. This deviation does not influence the rationale or objectives of the SAP. All samples were screened for radioactivity during sample collection and before being submitted to the laboratory for analysis.

Borehole sample sites were chosen based on the configuration of the current TA-48-45 and the location of the former septic system and associated filter beds piping runs. To ensure that the location of the septic outfall was adequately investigated, sample sites were chosen along natural outfalls and drainage channels along the canyon edge and into the canyon where the outfall would most likely have been located. Based on the results of the aerial photograph review discussed above, additional hand-auger hole locations were selected in a sandy area suspected to be the material from the excavated filter bed.

Field sampling activities for Aggregate M were performed on July 15, 19, and 20, 1993. Six boreholes were drilled to a depth of 15 ft in the area of the former septic system. Three soil samples were collected from each borehole for laboratory analysis. Two hand-auger holes were drilled to a maximum depth of 3.5 ft in the area where the excavated material from the filter bed was deposited. Five surface soil samples obtained with a hand auger were collected along Mortandad Canyon in areas where outfalls were likely to have been located.

A summary of sampling activities for Aggregate M is presented in Table 4-4. Figure 4-2 shows the locations of all sample points in Aggregate M. Figures D-1 through D-5 in Appendix D show geological logs for the boreholes drilled in Aggregate M.

Deviations from the Work Plan

The outfall location at PRS No. 48-003 could not be positively identified during the engineering surveys because the site had been decommissioned and recontoured, and a new building had been built on the site of the former septic tank. Archival photographs from the 1988 site reconnaissance were reviewed to determine the outfall location. Because of the recent construction at the site, the surface soil sample at Location ID No. 48-2016 was not collected from the outfall discharge point, the surface soil samples at Location ID Nos. 48-2017 and 48-2018 were not collected from the outfall drainage channel, and the samples at Location ID Nos. 48-2019 and 48-2020 were not collected at the toe of the slope. Instead, the sample sites were located along drainage channels near the edge of the mesa and along the canyon side in the area where the outfall is understood to have been located (see Figure 4-2). Wet weather conditions during sampling and the steep topography of the canyon side hampered sample collection efforts. Two sample sites were located in a sandy area that was identified in 1988 archival photographs as the sand filter beds. The deviation in sample locations does not influence the rationale or objectives of the SAP because samples were collected in the leach field area and downslope from the former septic system.

TABLE 4-4

SUMMARY OF SAMPLING ACTIVITIES FOR AGGREGATE M

Location ID No.	Sample Type	Sample Intervals	Sample Description	Comments	Date Collected
48-2010	Borehole	4–5 ft 8.5–9.5 ft 14–15 ft	Weathered tuff Clay seam in tuff Welded tuff	Former filter bed location	7/19/93
48-2011	Borehole	1.8–3.7 ft 7–8 ft 11–12 ft 14–15 ft	Silty sand and tuff Clay and tuff Clay and tuff Welded tuff	Former sand filter bed location, possible fracture at 7–9 ft	7/20/93
48-2012	Borehole	4–5 ft 9–10 ft 14–15 ft	Weathered tuff Welded tuff Welded tuff		7/19/93
48-2013	Borehole	2.5–3.8 ft 9–10 ft 14–15 ft	Filter location, fractures 9–10 ft; sand, clay, tuff		7/20/93
48-2014	Borehole	4–5 ft 7.0–7.3 ft 9–10 ft 14–15 ft	Former sand filter bed		7/20/93
48-2015	Borehole	0.5–1.5 ft 4–5 ft 9–10 ft 14–15 ft	Removed sand filter bed, tuff		7/20/93
48-2016	Surface soil	0–0.5 ft	Water drainages, sand	Mortandad Canyon	7/15/93
48-2017	Surface soil	0–0.5 ft	Water drainages, sand	Mortandad Canyon	7/15/93
48-2018	Surface soil	0–0.5 ft	Water drainages, sand	Mortandad Canyon	7/15/93
48-2019	Surface soil	0–0.5 ft	Water drainages, sand	Mortandad Canyon	7/15/93
48-2020	Surface soil	0–0.5 ft	Sand filter bed	Mortandad Canyon	7/15/93
48-2054	Hand auger	0–0.5 ft 0.5–1.5 ft 1.4–2.5 ft	Sand, soil at 1.4 ft		7/15/93
48-2055	Hand auger	0–0.5 ft 0.5–1.5 ft 1.5–2.5 ft 2.5–3.5 ft	Sand, tuff at 3.5 ft		7/15/93

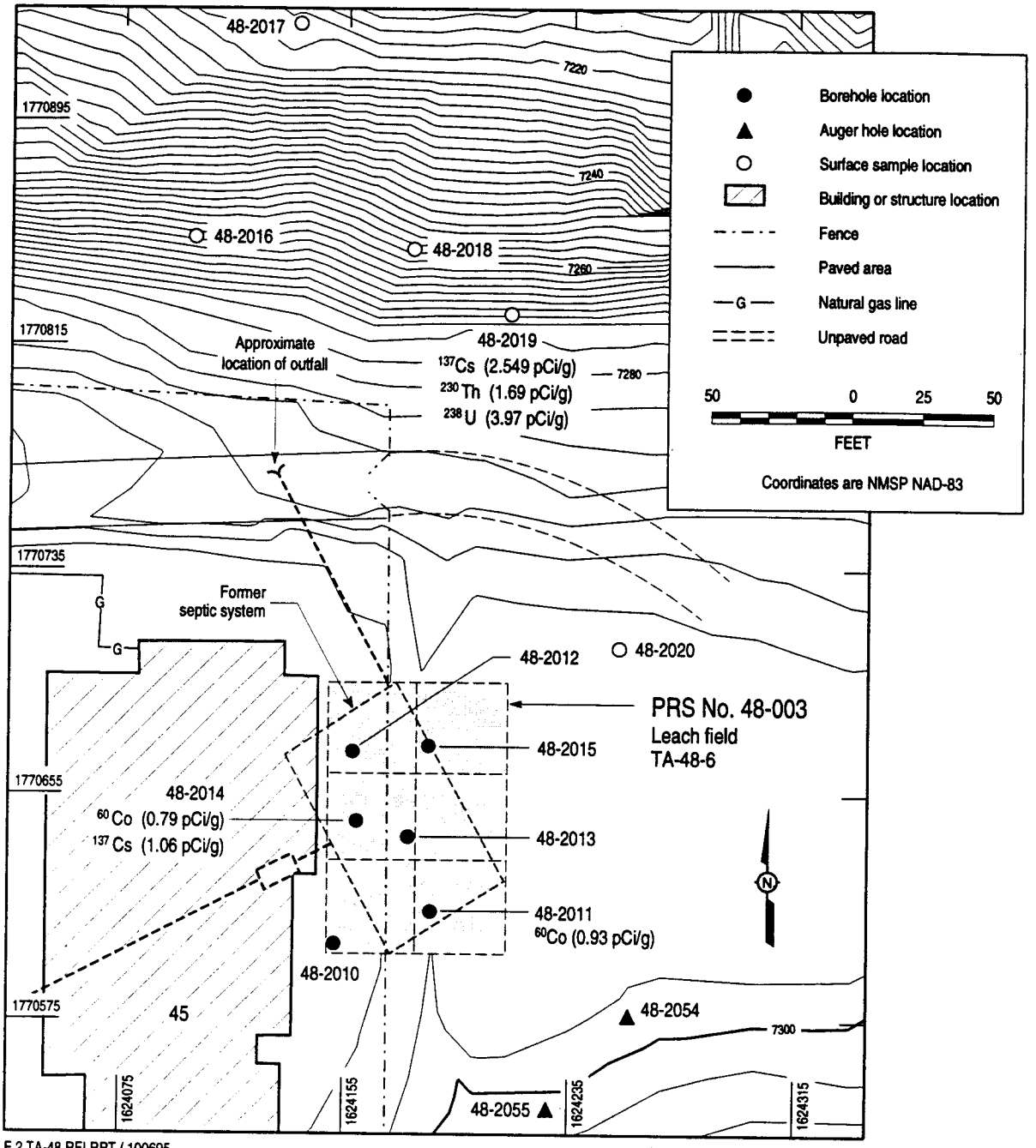


Figure 4-2. Sample locations and associated potential contaminants of concern for Aggregate M, TA-48.

4.2.2.1 Results of Field Surveys

As a result of the field and engineering survey, sample sites were chosen along drainage channels on the canyon edge downslope from the former septic system. The location of the outfall from the septic tank into Mortandad Canyon could not be positively identified from the engineering drawings and archival photographs.

No VOCs were detected and gross-alpha, -beta, and -gamma radiation readings were within background values (120 to 160 cpm).

4.2.2.2 Results of Field Screening

All samples were scanned for gross -alpha, -beta. and -gamma radiation with the Bicron pancake probe 2000 and scanned for VOCs with an OVA.

Positive OVA readings were observed for samples at Location ID Nos. 48-2010 and 48-2012; a maximum reading of 3 ppm occurred at a depth of 14 to 15 ft for the sample at Location ID No. 48-2012. These readings probably indicate the presence of methane because the samples are located in an area where methane can form and accumulate. No methane filter was used on the OVA instrument when the readings were observed.

No other elevated measurements indicative of contamination were recorded during the field screening process for the samples from Aggregate M.

4.2.3 Screening Assessment for Aggregate M

The screening assessment of the analytical results for samples collected at Aggregate M was conducted according to the methodology outlined in Chapter 3, Section 3.2. The screening assessment data tables are found in Tables B-5 through B-8 in Appendix B. The results of the screening assessment should be interpreted in conjunction with an evaluation of the quality of the analytical results and the SAP for Aggregate M. A summary of data quality considerations impacting the analytical results used for evaluating Aggregate M is presented in this section. A comprehensive assessment of the quality of the analytical data is presented in Chapter 3, Section 3.1. Additional information regarding the selection of radionuclide analytes is found in Chapter 3, Section 3.1.3.

For the purposes of the screening assessment, the noncarcinogenic constituent data set consists of both the inorganic constituents analyzed by SW-846 solid waste methods (EPA 1986, 31732) and the noncarcinogenic organic constituents. The SAL values for inorganic constituents analyzed at Aggregate M are based solely on noncarcinogenic endpoints. Screening comparisons for the inorganic constituents analyzed by the EDXRF method were performed separately from the constituents that were analyzed by SW-846 methods. The data sets for the inorganic analyses cannot be directly compared since correlation factors are unavailable for those trace elements measured by both methods. As discussed in Chapter 3, Section 3.1, the EDXRF data set could not be screened against the site-specific background UTL values since the background measurements were performed using SW-846 methods. No organic constituents were detected above the sample EQL; therefore, there are neither noncarcinogenic nor carcinogenic organic compounds to be considered. A carcinogenic data set for Aggregate M is not presented in Appendix B.

The sample results for radionuclide analyses are divided into two data sets. Separate screening comparisons were performed for measurements of radionuclide activity obtained from fixed-site and mobile laboratory analysis. The two data sets cannot be directly compared. The correlation between measurements

performed at the fixed-site and mobile laboratories could not be determined because of the large uncertainties associated with the mobile laboratory analyses.

The analytical data quality evaluation for Aggregate M, which is found in Appendix A, does not indicate any problems that affect the screening assessment. Ten soil samples were lost in analysis: Location ID No. 48-2010 (4 to 5 ft and 8.5 to 9.5 ft); Location ID No. 48-2012 (9 to 10 ft and 14 to15 ft); Location ID No. 48-2014 (4 to 5 ft, 7 to 7.2 ft, and 9 to 10 ft); Location ID No. 48-2054 (0.5 to1.5 ft and 1.5 to 2.5 ft); and Location ID No. 48-2055 (0.5 to 1.5 ft). Therefore, gamma spectroscopy results from the fixed-site laboratory are not available for these samples.

4.2.3.1 Comparison to Background and SAL Values

Comparison to Background Values

The sample data for Aggregate M were compared to background UTL values as an initial screening, as discussed in Chapter 3, Section 3.2.1. A distributional shift test was not performed because the field data sets were too small. The screening assessment data tables for the background UTL comparisons, which identify COPCs present above the UTL values for each sample, are provided in Tables B-5 through B-7 in Appendix B. The COPCs that were identified are listed in Table 4-5. Included in the list of COPCs are those constituents for which a background UTL is not available.

TABLE 4-5

COPCs CARRIED FORWARD TO THE SAL COMPARISON IN AGGREGATE M

Radionuclides	Noncarcinogenic Constituents
^{241}Am[a]	Chromium
^{144}Ce[a]	Lithium[a]
^{60}Co[a]	Molybdenum[a]
^{137}Cs	Nickel
^{238}Pu	Silver[a]
^{239,240}Pu	Strontium[a]
^{106}Ru[a]	Zinc
^{230}Th[a]	
^{234}U	
^{235}U	
^{238}U	

a. No background value is were available for this analyte.

Forty-eight soil samples (including 18 duplicate samples) that were collected from 13 locations at depths ranging from the surface to 15 ft were screened at the mobile laboratory facility for selected radionuclides by gamma spectroscopy. Seventeen soil samples (including six duplicate samples) were analyzed in a fixed-site laboratory by gamma spectroscopy. Among the gamma spectroscopy analytes, no COPCs were eliminated during the background comparison. Based on mobile laboratory measurements, ^{137}Cs was present above UTL at Location ID Nos. 48-2018 (0 to 0.5 ft) and 48-2055 (1.5 to 2.5 ft and 2.5 to 3.5 ft). The radionuclide ^{137}Cs was also detected above UTL in the fixed-site laboratory analysis of the sample collected at Location ID No. 48-2019 (0 to 0.5 ft). The radionuclides ^{241}Am, ^{144}Ce, ^{60}Co, and ^{106}Ru were carried forward to SAL comparison since UTL values are not available.

Thirty-six soil samples (including three duplicate samples) that were collected from 13 locations at depths ranging from the surface to 15 ft were analyzed for alpha-emitting radionuclides. The radionuclide ^{238}Pu was present above its UTL value at 11 locations, and ^{239}Pu was present above its UTL value at 9 locations at depths ranging from the surface to 15 ft. The radionuclide ^{234}U was measured above its UTL at 4 locations at depths ranging from the surface to 2.5 ft. The radionuclide ^{235}U was present above its UTL at 8 locations at depths ranging from the surface to 10 ft. The radionuclide ^{238}U was present above its UTL at 5 locations at depths ranging from the surface to 2.5 ft. The radionuclides ^{228}Th and ^{232}Th were not present above background levels and are eliminated from further consideration. The radionuclide ^{230}Th was carried forward to the SAL comparison since a UTL value is not available.

Ten soil samples (including three duplicate samples) that were collected from Location ID Nos. 48-2010, 48-2011, 48-2013, 48-2014, 48-2017, and 48-2054 at depths ranging from surface to 15 ft were analyzed for inorganic constituents by SW-846 methods. COPCs that were eliminated from further consideration included aluminum, antimony, arsenic, barium, beryllium, calcium, cadmium, cobalt, copper, iron, potassium, magnesium, manganese, sodium, lead, selenium, thallium, and vanadium. Chromium and nickel were detected above their respective UTL values at Location ID No. 48-2014 (7 to 7.2 ft), and zinc was present above its UTL value at Location ID No. 48-2054 (0 to 0.5 ft). Therefore, chromium, nickel, and zinc were carried forward to the SAL comparison. Those inorganic constituents for which a background UTL value is not available (lithium, molybdenum, silver, and strontium) were also carried forward to the SAL comparison.

Twenty-five soil samples (including four duplicate samples) were analyzed for VOCs; thirty-nine soil samples (including six duplicate samples) were analyzed for SVOCs. No organic compounds were detected above EQL in any of the soil samples analyzed for organic constituents in Aggregate M.

Comparison to Human Health Screening Action Levels

COPCs that were not eliminated in the background comparison were evaluated by comparison to human health SALs. The screening assessment data tables for SAL comparisons and multiple constituent analyses are provided in Tables B-5 through B-8 in Appendix B. Because of the large number of organic analytes, SAL comparisons for organic constituents, either carcinogenic or noncarcinogenic, are provided only for those organics present above the sample EQL. For Aggregate M, no organic constituents were detected above the sample EQL. The EDXRF data set consisted of 36 soil samples (including 3 duplicate samples) that were collected from 13 locations at depths ranging from the surface to 15 ft.

Constituents with one or more sample values exceeding a SAL and those that contribute greater than 5% to a SAL-normalized sum exceeding 1.0 in the multiple constituent analysis are considered to be potential COCs and are identified in Table 4-6. Only radionuclides were identified as potential COCs. No inorganic or organic constituents exceeded SALs, and none were identified as potential COCs in the multiple constituent analysis. The sample locations where COCs were identified are shown in Figure 4-2.

Of the radionuclide COPCs, ^{137}Cs, ^{230}Th, and ^{238}U were identified as potential COCs based on the fixed-site laboratory analyses. Although none of these radionuclides exceeded a SAL value, they are included based on the results of the multiple constituent analysis for the sample at Location ID No. 48-2019 (0 to 0.5 ft). The radionuclide ^{60}Co was identified at a value slightly above its SAL value in the mobile laboratory analysis for the sample at Location ID No. 48-2011 (1.7 to 3.7 ft). The radionuclides ^{60}Co and ^{137}Cs were also identified as potential COCs in the mobile laboratory analysis for the sample at Location ID No. 48-2014 (4 to 5 ft), based on the results of the multiple constituent analysis. These results are further evaluated in the following section.

Constituents Identified as Potential COCs

The radionuclides ^{137}Cs, ^{230}Th, and ^{238}U were identified as potential COCs based on the results of the multiple constituent analysis. The radionuclides ^{230}Th and ^{238}U were identified in only one sample, Location ID No. 48-2019 (0 to 0.5 ft), which is located on the south rim of Mortandad Canyon and is associated with the outfall for the septic system comprising Aggregate M (see Figure 4-2). The SAL-normalized value for the sample at Location ID No. 48-2019 (0 to 0.5 ft) is 1.2 pCi/g. The data quality evaluation for the sample at Location ID No. 48-2019 (0 to 0.5 ft) indicates that the ^{230}Th result should be considered an estimated value because of poor tracer recovery. Although an estimated value generally has a large confidence interval associated with it, the value is not expected to be biased. The radionuclides ^{137}Cs, ^{230}Th, and ^{238}U are designated potential COCs based on the fixed-site laboratory results for the sample at Location ID No. 48-2019 (0 to 0.5 ft).

TABLE 4-6

POTENTIAL COCs IDENTIFIED IN AGGREGATE M

Radionuclides	Noncarcinogenic Constituents
^{60}Co[a]	None identified
^{137}Cs[b]	
^{230}Th[c]	
^{238}U[c]	

a. Identified in two mobile laboratory samples; one above SAL and one based on a multiple constituent analysis.
b. Identified as a potential COC in one fixed-site laboratory and one mobile laboratory sample based on a multiple constituent analysis.
c Identified as a potential COC in one fixed-site laboratory sample.

The radionuclide ^{60}Co was identified in the mobile laboratory sample at Location ID No. 48-2011 (1.7 to 3.7 ft) at a value of 0.93 ± 0.81 pCi/g (see Figure 4-2), thus exceeding its SAL of 0.9 pCi/g. Two fixed-site laboratory samples (a regular sample and a duplicate) were taken at the same location and depth as the mobile laboratory sample. The regular fixed-site sample had a value of 0.013 ± 0.013 pCi/g, and the duplicate sample had a value of 0.0411 ± 0.012 pCi/g. The confidence intervals for all these samples represent the inherent uncertainty associated with the gross count and therefore are a function of the counting interval employed in the analyses. The values for the fixed-site laboratory samples occur outside the confidence interval associated with the mobile laboratory value of 0.93 pCi/g. Additional sources of uncertainty that may account for this discrepancy include small-scale contaminant spatial heterogeneity at the sample point and differences in sample preparation, sample moisture content, and measurement methods between the fixed-site laboratory and mobile laboratory analyses for these samples. The relatively close correlation between the regular and duplicate fixed-site laboratory samples, as well as adequate control standard results for ^{137}Cs (94% recovery), indicates that relatively good accuracy and precision exist in the fixed-site laboratory analyses for these samples. QC data for the mobile laboratory are not available for this sample. Therefore, ^{60}Co is highly unlikely to be present at Location ID No. 48-2011 at levels associated with human health risks.

The radionuclides ^{60}Co and ^{137}Cs were identified as potential COCs based on the multiple constituent analysis for the mobile laboratory sample at Location ID No. 48-2014 (4 to 5 ft). This sample point is located in the area of the former septic system east of building TA-48-45 on the mesa top (see Figure 4-2 for sample location and potential COC activity). Fixed-site laboratory data for the radionuclides ^{60}Co and ^{137}Cs for Location ID No. 48-2014 are unavailable for comparison to the mobile laboratory results. Therefore, ^{60}Co and ^{137}Cs are designated potential COCs based on the mobile laboratory results for the sample at Location ID No. 48-2014 (4 to 5 ft).

Constituents Not Identified as Potential COCs

Constituents for which a SAL value is not available or for which the SAL value is lower than the reporting limit require further evaluation as a part of the screening assessment methodology (see Figure 3-1). The evaluation of those constituents is presented in this section.

Organic constituents with reporting limits exceeding their SAL included benzo[a]pyrene; dibenz[a,h]-anthracene; m-benzidine; bis(2-chloroethyl) ether; N-nitrosodi-n-propylamine; and N-nitrosodimethyl-amine. Benzidine is used in the production of dyes, and the nitrosamine compounds are used as additives in gasoline and lubricants. Neither benzidine nor the nitrosoamine compounds are reasonably associated with the septic tank at Aggregate M. The two PAH compounds have SAL values of 0.1 mg/kg, which is approximately one-third the EQL value of 0.33 mg/kg. Although PAH compounds are often detected at trace levels at industrial sites, significant or widespread contamination would result in numerous samples exceeding detection limits. None were present above detection limits in Aggregate M. No reasonable basis exists for suspecting that these constituents are present at hazardous levels at Aggregate M.

Approximately 132 individual organic constituents were analyzed for at Aggregate M. Of this total, approximately 18 do not have SAL values. None of the organic compounds lacking SAL values were detected above their EQL in any sample collected from Aggregate M. It is unlikely that constituents that never exceeded their reporting limits are present at Aggregate M. Therefore, these constituents do not need further evaluation.

Several inorganic constituents that do not have SAL values are recognized by the EPA (EPA 1989, 8021) as essentially nontoxic under typical environmental exposure scenarios. These constituents include aluminum, calcium, iron, magnesium, potassium, and sodium. Of these constituents, calcium, iron, and potassium were found above background levels in Aggregate M. They do not warrant further evaluation for human health risk.

The maximum value for lithium (analyzed by SW-846 methods) was approximately 4 ppm; however, no evidence exists that lithium is associated with processes at TA-48.

Inorganic constituents analyzed by the EDXRF method were not compared to the UTL background values for reasons discussed in Chapter 3, Section 3.1. Of these constituents (except the nontoxic analytes described above), thorium, titanium, and uranium do not have SAL values for comparison. Thorium and uranium are evaluated by isotope as radionuclides. Titanium, which is widespread in the environment, is generally recognized as being physiologically inert; therefore, there is no reason to recommend further evaluation of titanium at Aggregate M. Arsenic was not found above the background UTL in the four samples analyzed by SW-846 methods, and no process is associated with Aggregate M that would contribute to arsenic in the environment at this location. Therefore, further evaluation of arsenic is not needed.

All radionuclides identified as COPCs by the background screening process had SAL values, and no reporting limits exceeded these values in any sample.

4.2.3.2 Data Interpretation

The sample locations in Aggregate M where potential COCs have been identified are shown in Figure 4-2. The only potential COCs that have been identified as a result of the Phase I investigation are the radionuclide constituents ^{137}Cs, ^{230}Th, ^{238}U, and ^{60}Co. The range of depths at which radiological contamination was found varies from the surface (on the canyon rim) to 5 ft (at the former septic tank and filter bed). At the location of the former septic tank and filter bed, potential COCs were found at a depth of 4 to 5 ft. No potential COCs were identified below this depth. Hollow-stem auger boreholes were advanced to 15 ft at

five different sample locations in Aggregate M (see Figures D-1 through D-5 in Appendix D). The vertical extent of contamination at the former septic system and filter bed is loosely constrained to the top 5 ft. The purpose of the Phase I investigation was to establish the presence or absence of COCs at PRS No. 48-003. Insufficient data exist to ascertain a complete picture of the lateral extent of contamination at the former leach field. However, potential COCs were not identified in the samples collected 60 ft south of the leach field. Therefore, the lateral extent is loosely constrained to the area around the leach field. It is also evident that the contamination is not uniform across the area of the leach field but is sporadic. Insufficient data exist to establish the vertical and lateral extent of radiological contamination at the outfall. However, it appears that potential COCs are not present down the hydraulic gradient from the septic system outfall. No artifacts were found near the surface during the Phase I investigation that constitute potential release points. It is apparent that the structures associated with the septic system were removed during the decommissioning in 1986.

4.2.3.3 Risk Assessment

No human health or ecological risk assessment was performed for PRS No. 48-003.

4.2.3.4 Ecotoxicological Screening Assessment

The ecotoxicological screening assessment of the analytical results for samples collected at Aggregate M was conducted according to the methodology outlined in Chapter 3, Section 3.2.3. The screening assessment data tables for ESAL comparisons are provided in Table C-2 in Appendix C.

Ranking of Habitat Condition and Receptor Accessibility to COPCs

Ecological characteristics of PRS No. 48-003 in Aggregate M were reviewed to estimate the likelihood that ecological receptors could come in contact with COPCs to a significant degree. The location of this PRS (see Figure 1-3) and the frequency of human disturbance are such that ecological receptors use the site for some, but not all, portions of their life cycles. Therefore, this PRS was given a landscape condition score of two. COPCs could be dispersed to the canyon area from the outfall, so the site was given a receptor access score of three. These scores indicate that exposure is quite possible; therefore, a comparison to ESAL values is required for this PRS (see Figure 3-3 to review the decision model).

Comparison to Ecotoxicological Screening Action Levels

Aggregate M contains habitat that is suitable for use by spotted bats, which are candidates for listing under the Federal Endangered Species Act and are classified as endangered by the state of New Mexico. Therefore, the COPCs carried forward to the human health SAL comparison (Table 4-5) were also carried forward to the ecotoxicological screening assessment. Uranium, because of its systemic toxicity, was the only radionuclide evaluated. Potential COCs with one or more values exceeding an ESAL are identified in Table 4-7.

The ecotoxicological screening assessment identified uranium and zinc as potential COCs. No organic constituents were identified as potential COCs. Five samples contained ^{238}U activities that were greater than uranium background UTL and the ESAL; these activities could adversely affect ecological receptors that make exclusive use of these sampling locations. When other uranium samples in the aggregate are averaged for a risk assessment, the value is below the uranium UTL. One reported zinc concentration was above its background UTL and the ESAL; this concentration could affect the reproduction process for ecological receptors that make exclusive use of these sampling locations. Any ecological receptors of concern (in this case, spotted bats) would use an area that is much larger than Aggregate M, making it unlikely that uranium or zinc from this aggregate alone could cause significant adverse effects to the environment.

TABLE 4-7

POTENTIAL COCs IDENTIFIED DURING ECOTOXICOLOGICAL SCREENING IN AGGREGATE M

Radionuclides	Inorganic Constituents	Organic Constituents
Uranium[a]	Zinc	None identified

a. Identified as a potential COC based on systemic toxicity.

4.2.4 Conclusions and Recommendations for Aggregate M

According to the decision process described in Chapter 5 of the work plan, the data collected during the Phase I investigation confirmed the presence of COCs at PRS No. 48-003. The potential COCs identified at PRS No. 48-003 are alpha- and gamma-emitting radionuclides. No other hazardous constituents, inorganic or organic, were identified as potential COCs in the human health screening assessment. Based on NFA criterion number 1 (the PRS has only radionuclide components), a Class III permit modification will be requested to remove PRS No. 48-003 from the HSWA Module of the Laboratory's RCRA operating permit. This PRS may become a candidate for voluntary corrective action if additional sampling to determine extent of potential radiological contamination shows that there is a risk to human health and the environment.

Two potential COCs were identified by the ecotoxicological screening assessment; however, any ecological receptors of concern would use an area that is much larger than Aggregate M, making it unlikely that uranium or zinc from this aggregate alone could cause significant adverse effects to the environment. Because exposure to these and other potential COCs around the Laboratory may be part of a process leading to cumulative adverse effects to ecological receptors, it is recommended that if a site-wide ecological risk assessment is conducted, these potential COCs be included.

4.3 Aggregate N

Aggregate N consists of PRS No. 48-005, which includes abandoned radioactive Waste Lines 34, 36, and 38. Also included in PRS No. 48-005 is an outfall into Mortandad Canyon that originated from Waste Line 37. No survey work or sampling was performed on Waste Line 36 because no outfall is associated with this line, and the entire line is contained within the security fence for TA-48.

From 1957 to 1965, underground industrial waste lines were used to transport liquid wastes containing radionuclides and chemicals from TA-48 to a chemical waste treatment plant at TA-45. Beginning in 1963, liquid wastes from TA-48 were diverted through new underground waste lines to the new liquid waste treatment facility at TA-50. Portions of the abandoned waste lines that were located outside the security fence for TA-48 were removed in D&D operations in 1981 and 1984. Portions of the waste lines located inside the security fence were not removed.

4.3.1 Previous Investigations for Aggregate N

In April 1991, five surface and five subsurface soil samples were collected north of building TA-48-8, in the northwest part of TA-48, as part of an ER Interim Action reconnaissance survey at the site of the proposed Weapons Isotope Separator Facility building (Fresquez 1991, 821). The samples located near PRS No. 48-005 included samples from the area of Waste Lines 36 and 37. Levels of gross-alpha, -beta, and -gamma radiation were at background levels for all samples collected. No PCBs or SVOCs were detected in any of the samples. All samples revealed concentrations of TCLP metals (silver, arsenic, barium, cadmium, chromium, mercury, lead, and selenium) to be less than EPA guideline levels. Trace concentrations of several VOCs were identified in several of the samples. For further information, refer to Chapter 3, Section 3.5.2.4, of the work plan.

4.3.2 Field Investigations for Aggregate N

The discussion of the objectives of the investigation and the supporting conceptual model for Aggregate N is taken directly from Chapter 7, Section 7.18.1, of the work plan.

The surface investigation at Aggregate N was designed primarily to answer the following questions.

- Does surface and subsurface contamination currently exist in Aggregate N?
- Do any near-surface artifacts remain that represent potential contaminant release points?
- What is the potential for surface and subsurface migration of contaminants?
- What are the current waste stream constituents?

The conceptual model was as follows.

- Any remaining COPCs were thought to be localized in the proximity of the former line trenches.
- Previous D&D activity may not have cleaned the line traces to background levels.
- The waste stream was not defined; therefore, Phase I samples were analyzed for a wide range of COPCs.

Engineering drawing package ENG-C43943 (LANL 1981, 33072) and the report *Radioactive Liquid Waste Lines Removal Project at Los Alamos (1981–1986)* (Elder et al. 1986, 3089) were reviewed to aid in determining sample locations.

The location of the trench for Waste Line 34 was estimated by scaling microfiche copies of the engineering drawings and measuring from known locations in the field. The initial drilling attempts, based on these locations, proved unsuccessful. Full-scale copies of the engineering drawings were obtained, and the location of the trench was re-estimated. Drilling at the new locations proved successful in locating the trench.

The location of the outfall for Waste Line 37 was determined by reviewing the engineering drawings and locating the part of Line 37 that remains in place behind the security fence. Sample locations were chosen along the drainage channel that led from the outfall into the canyon.

The location of the trench for Waste Line 38 was determined by reviewing the engineering drawings and locating the part of Line 38 that remains in place behind the security fence.

An environmental survey (the areal extent of which was determined by the engineering drawing review and field observations described above) was conducted to locate areas of surface contamination. Within the survey area, an OVA was used to detect VOCs, and a Bicron pancake probe 2000 was used to detect gross-alpha, -beta, and -gamma radiation.

Because no positive readings were observed in the environmental survey, surface sample locations were selected in drainage channels at points where residual contamination, if present, would most likely accumulate. Borehole locations were based on the work plan and on the results of the engineering drawing reviews discussed above.

Field sampling activities for Aggregate N were performed on July 12, 21, 22, and 23, 1993, and October 28, 1993. A summary of sampling activities for Aggregate N is presented in Table 4-8. Figures 4-3 and 4-4 show the locations of all sample points in Aggregate N. Figures D-6 through D-14 in Appendix D show geological logs for the boreholes drilled in Aggregate N.

Deviations from the Work Plan

A radiation site-walkover was performed by ESH personnel before beginning field activities, and no radioactivity was detected above background levels. Therefore, a formal radiation grid survey was not performed. This deviation does not influence the SAP objectives or rationale. The SAP for Aggregate N is presented in the work plan.

4.3.2.1 Results of Field Surveys

No VOCs were detected, and gross-alpha, -beta, and -gamma radiation readings were within background values (120 to 160 cpm).

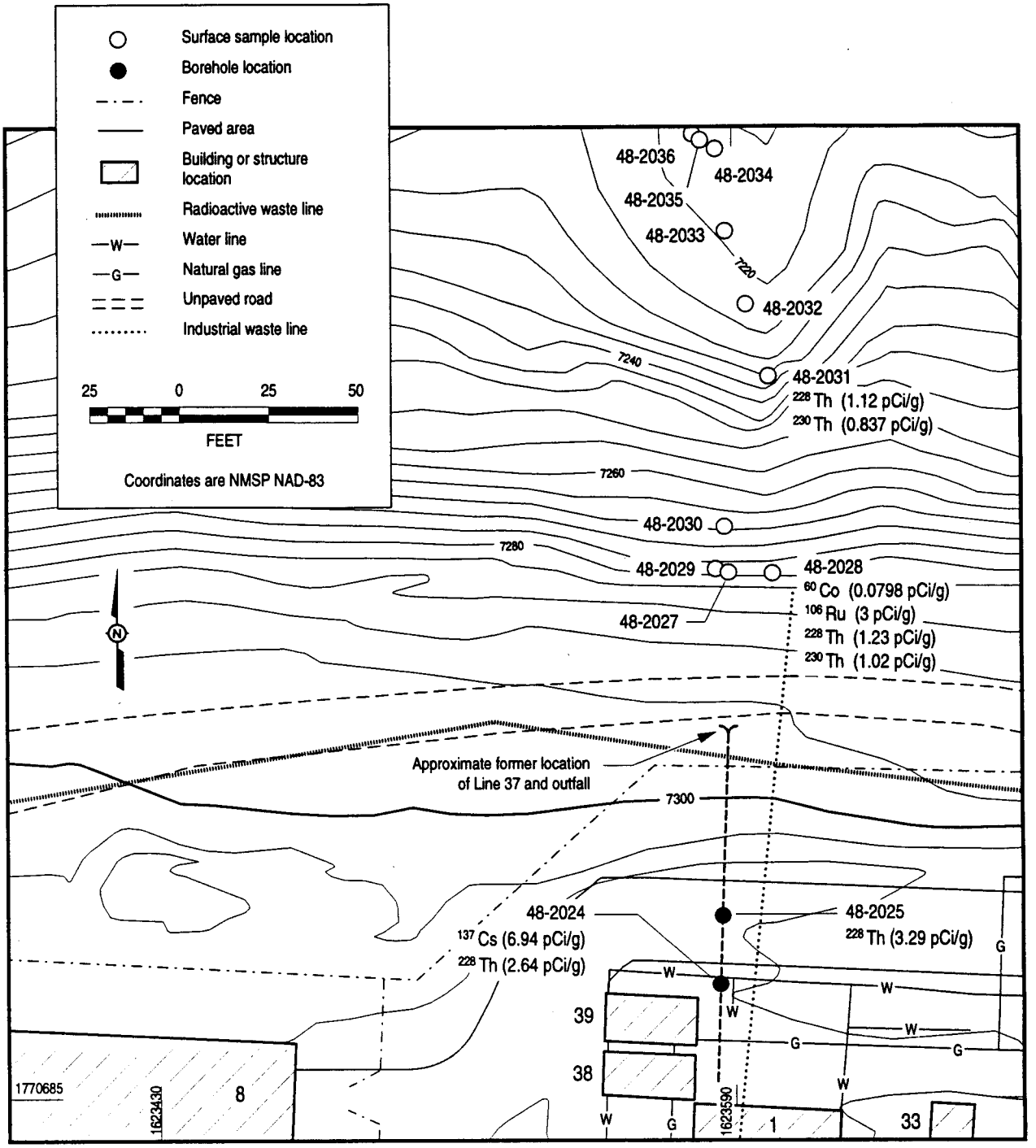
4.3.2.2 Results of Field Screening

All samples were scanned for gross-alpha, -beta, and -gamma radiation with the Bicron pancake probe 2000 and scanned for VOCs with an OVA. A positive OVA reading of 5.5 ppm was observed at a depth of 7.5 to 8.5 ft in the borehole at Location ID No. 48-2025. No other elevated measurements indicative of contamination were recorded during the field screening process for samples from Aggregate N.

TABLE 4-8

SUMMARY OF SAMPLING ACTIVITIES FOR AGGREGATE N

Location ID No.	Sample Type	Sample Intervals	Sample Description	Comments	Date Collected
48-2021	Borehole	2.5–3.7 ft 9–10 ft 14–15 ft	Silt/sand, tuff	Waste Line 34 trench	7/21/93
48-2022	Borehole	4–5 ft 9–10 ft 14–15 ft	Weathered tuff Tuff Tuff	Along outside Line 34	7/21/93
48-2023	Borehole	4–5 ft 9–10 ft 14–15 ft	Weathered tuff Tuff Clay seam in tuff	Along outside Line 34	7/21/93
48-2024	Borehole	4–5 ft 8–9 ft 14–15 ft	Backfill to 8.7 ft Fill, tuff Welded tuff	Drilling along former Line 37	7/22/93
48-2025	Borehole	4–5 ft 5.5–6.5 ft 7.5–8.5 ft 9–10 ft 13–14 ft	Backfill Backfill to 6.3 ft Weathered tuff Weathered tuff Welded tuff	Drilling along former Line 37	7/22/93
48-2026	Borehole	1.5–2.5 ft 6–7.4 ft 14–15 ft	Backfill to 7.1 ft over unwelded tuff	Drilling along former Line 38	7/23/93
48-2027	Surface soil	0–0.5 ft	Dry, sandy soil with tuff pebbles	Outfall from former Line 37	7/12/93.
48-2028	Surface soil	0–0.5 ft	Dry, sandy soil with tuff pebbles	Outfall from former Line 37	7/12/93
48-2029	Surface soil	0–0.5 ft	Gravelly sand and weathered tuff	Outfall from former Line 37	7/12/93
48-2030	Surface soil	0–0.5 ft	Clayey sand; rocky	Outfall from former Line 37	7/12/93
48-2031	Surface soil	0–0.5 ft	Clayey, gravelly soil; roots	Outfall from former Line 37	7/12/93
48-2032	Surface soil	0–0.5 ft	Clayey, sandy soil	Outfall from former Line 37	7/12/93
48-2033	Surface soil	0–0.5 ft	Clayey sand	Outfall from former Line 37	7/12/93
48-2034	Surface soil	0–0.5 ft	Sand and weathered tuff pebbles	Outfall from former Line 37	7/12/93
48-2035	Surface soil	0–0.5 ft	Clayey, sandy soil	Outfall from former Line 37	7/12/93
48-2036	Surface soil	0–0.5 ft	Clayey, sandy soil; rocky	Outfall from former Line 37	7/12/93
48-2067	Borehole	4.4–5.0 ft 6.4–7.0 ft	Backfill to 6.6 ft over tuff	Waste Line 34 trench	10/28/93
48-2068	Borehole	7–8 ft	Backfill to 7.6 ft	Waste Line 34 trench	10/28/93
48-2069	Borehole	2.5–3.0 ft 5.5–7.0 ft	Backfill to 6.8 ft	Waste Line 34 trench	10/28/93



F 4-3 / N-NORTH TA-48 RFI / 100495

latamap236.gra from ta48aggn.aml

Figure 4-3. Sample locations and associated potential contaminates of concern for Aggregate N North, TA-48.

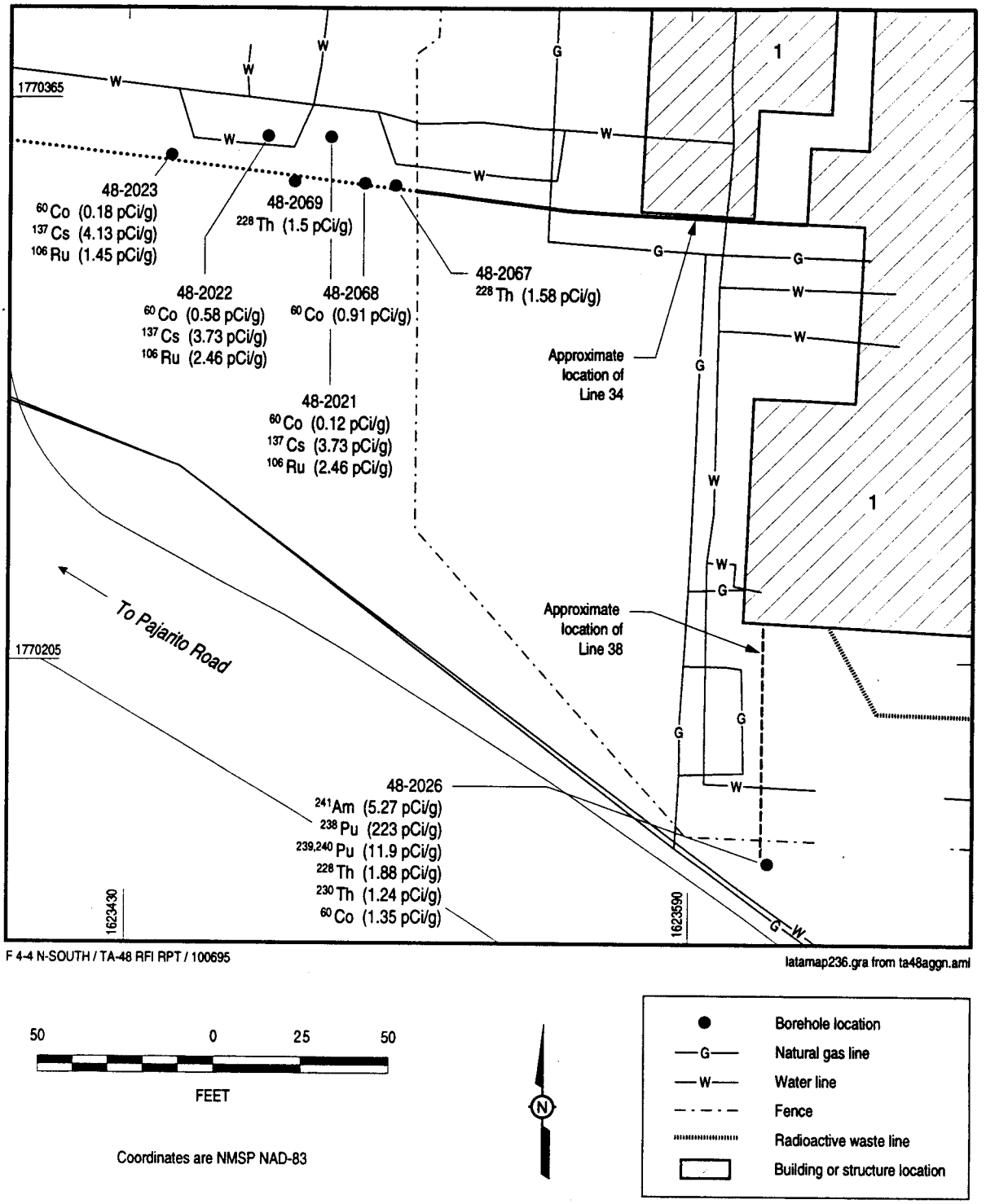


Figure 4-4. Sample locations and associated potential contaminates of concern for Aggregate N South, TA-48.

4.3.3 Screening Assessment for Aggregate N

The screening assessment of the analytical results for samples collected at Aggregate N was conducted according to the methodology outlined in Chapter 3, Section 3.2. The screening assessment data tables are found in Tables B-9 through B-12 in Appendix B. The results of the screening assessment should be interpreted in conjunction with an evaluation of the quality of the analytical results as well as the SAP for Aggregate N. A summary of data quality considerations impacting the analytical results used for evaluating Aggregate N is presented in this section. A comprehensive assessment of the quality of the analytical data is presented in Chapter 3, Section 3.1. Additional information regarding the selection of radionuclide analytes is found in Chapter 3, Section 3.1.3.

For the purposes of the screening assessment, the noncarcinogenic constituent data set consists of both the inorganic constituents analyzed by SW-846 solid waste methods (EPA 1986, 31732) and the noncarcinogenic organic constituents. Because of the large number of organic constituents that were analyzed for, only those organic constituents that were present above the sample EQL are included in the screening data tables. The SAL values for inorganic constituents analyzed at Aggregate N are based solely on noncarcinogenic endpoints. Screening comparisons for the inorganic constituents analyzed by the EDXRF method were performed separately from the constituents that were analyzed by SW-846 methods. The data sets for the inorganic analyses cannot be directly compared since correlation factors are unavailable for those trace elements measured by both methods. As discussed in Chapter 3, Section 3.1, the EDXRF data set could not be screened against the site-specific background UTL values since the background measurements were performed using SW-846 methods.

The carcinogenic data set for an aggregate consists of carcinogenic organic constituents that were present above the sample EQL. As noted above, no inorganic constituents are included in the carcinogenic data set. At Aggregate N, no carcinogenic organic constituents were detected above the sample EQL; therefore, a carcinogenic data set is not presented in Appendix B.

The sample results for radionuclide analyses are divided into two data sets. Separate screening comparisons were performed for measurements of radionuclide activity obtained from fixed-site and mobile laboratory analysis. The two data sets cannot be directly compared. The correlation between measurements performed at the fixed-site and mobile laboratories could not be determined because of the large uncertainties associated with the mobile laboratory analyses.

The analytical data quality evaluation for Aggregate N, which is found in Appendix A, revealed several problems that affect the screening assessment. For nine soil samples collected at Location ID Nos. 48-2024, 48-2025 (Line 37) and 48-2026 (Line 38), the method blank analyzed for the isotopic thorium measurements was contaminated with significant levels of both ^{228}Th and ^{230}Th. Therefore, the reported results for ^{228}Th should be regarded as the EQLs for all nine samples. For samples from Location ID Nos. 48-2024 (5 to10 ft and 10 to 15 ft) and 48-2026 (0 to 5 ft, 5 to 10 ft, and 10 to 15 ft), the reported results for ^{230}Th should be regarded as the EQLs. For soil samples collected at Location ID Nos. 48-2067 and 48-2068 (Line 34), the reported results for ^{241}Am measured by alpha spectrometry are unusable because of poor tracer recovery. The EDXRF results for nickel are unusable for the following soil samples collected at the Line 37 outfall: Location ID Nos. 48-2027 through 48-2036. Eight soil samples collected at the Line 37 outfall (Location ID Nos. 48-2027, 48-2029, 48-2030, and 48-2032 through 48-2036) were lost during fixed-site laboratory gamma spectroscopy analysis.

4.3.3.1 Comparison to Background and SAL Values

Comparison to Background Values

The analytical results for radionuclide and noncarcinogenic constituents in soil samples collected from Aggregate N were compared to background UTL values as an initial step in the screening assessment, as

discussed in Chapter 3, Section 3.2.1. A distributional shift test was not performed because the data sets were too small. The screening assessment data tables for the background UTL comparisons, which identify COPCs present above the UTL values for each sample, are provided in Tables B-9 through B-11 in Appendix B. The COPCs that were identified are listed in Table 4-9. Included in the list of COPCs are those constituents for which a background UTL value is not available.

TABLE 4-9

COPCs CARRIED FORWARD TO THE SAL COMPARISON IN AGGREGATE N

Radionuclides	Noncarcinogenic Constituents
^{241}Am[a]	Acetone[a]
^{144}Ce[a]	2-Butanone[a]
^{137}Cs	Di-n-butyl phthalate[a]
^{238}Pu	Lithium[a]
$^{239,240}Pu$	Molybdenum[a]
^{106}Ru[a]	Silver[a]
^{228}Th	Strontium[a]
^{230}Th[a]	
^{234}U	
^{235}U	
^{238}U	

a. COPC is carried forward because UTL value is not available.

Ten soil samples (including three duplicate samples) that were collected from locations at Lines 34 and 37 (including the Line 37 outfall) were analyzed for the radionuclides ^{144}Ce, ^{137}Cs, ^{60}Co, and ^{106}Ru by gamma spectroscopy at a fixed-site laboratory. No gamma spectroscopy results from fixed-site laboratory analysis are available for Line 38. Thirty-eight soil samples (including three duplicate samples) that were collected from locations at Lines 34, 37, and 38, as well as the Line 37 outfall were analyzed for alpha-emitting isotopes of americium, plutonium, thorium, and uranium. The results of the screening comparison for those isotopes for which background UTL values are available indicated that the following radioisotopes were present above background levels: $^{238,239,240}Pu$, ^{228}Th, and $^{234,235,238}U$. The measured activities of ^{137}Cs and ^{232}Th were below background levels. Fifty-one soil samples, including seventeen duplicate samples, collected at all sample locations, were analyzed by gamma spectroscopy at the mobile laboratory facility. The background UTL value of 1.4 pCi/g for ^{137}Cs was exceeded for five sample locations at Lines 34, 37, and 38: Location ID Nos. 48-2021, 48-2022, 48-2023, 48-2024, and 48-2026. Therefore, only ^{232}Th was eliminated from further consideration among the radionuclide analytes as a result of the background comparison.

Nine soil samples (including three duplicate samples) were analyzed for inorganic constituents using SW-846 methods. The samples were collected at six separate locations and at depths ranging from surface to 15 ft at the locations of Lines 34, 37, and 38, as well as the Line 37 outfall. Of those constituents for which UTL values are available, none were detected above background levels. Those inorganic constituents for which no background UTL value is available (lithium, molybdenum, silver, and strontium) were carried forward to the next step in the screening assessment, which is the comparison to SAL values.

Soil samples from all sample locations were analyzed for organic compounds. Forty soil samples (including five duplicate samples) were analyzed for SVOCs; twenty-five soil samples (including four duplicate sam-

ples) were analyzed for VOCs. The noncarcinogenic SVOCs 2-butanone and di-n-butyl phthalate were detected in four soil samples. The noncarcinogenic VOC acetone was detected in nine soil samples. The organic constituents were carried forward to the comparison to SAL since UTL values are not available.

Comparison to Human Health Screening Action Levels

COPCs that were not eliminated in the background comparison were evaluated by comparison to human health SALs. EDXRF analyses were obtained for thirty-seven soil samples (including two duplicate samples) collected at all sample locations. The screening assessment data tables for the SAL comparisons and the multiple constituent analysis are provided in Tables B-9 through B-12 in Appendix B. Because of the large number of organic analytes, SAL comparisons for organic constituents are provided only for analytical results greater than the EQL.

Constituents with one or more sample values exceeding a SAL and those that contribute greater than 5% to a SAL-normalized sum exceeding 1.0 in the multiple constituent analysis are considered to be potential COCs and are identified in Table 4-10. The table shows that radionuclides were the only constituents identified as COCs at Aggregate N. The sample locations where potential COCs were identified in Aggregate N are shown in Figures 4-3 and 4-4.

TABLE 4-10

POTENTIAL COCs IDENTIFIED IN AGGREGATE N

Radionuclides	Noncarcinogenic Constituents
^{241}Am[a]	None identified
^{137}Cs[b]	
^{60}Co[b]	
^{238}Pu[b]	
$^{239,240}Pu$[a]	
^{106}Ru[a]	
^{228}Th[b]	
^{230}Th[a]	

a. Identified as a potential COC based on multiple constituent analysis.
b. Potential COC that was detected above SAL value.

Of the potential COCs, ^{137}Cs, ^{60}Co, ^{238}Pu, and ^{228}Th were detected at levels that exceeded their respective SAL values. At the site of Line 38 (Location ID No. 48-2026) the measured activity of ^{238}Pu at a depth of 6 to 7.4 ft was 223 pCi/g (the SAL is 20 pCi/g). The measured activity of ^{60}Co at a depth of 6 to 7.4 ft was 1.35 pCi/g (the SAL is 0.90 pCi/g). The measured activity of ^{228}Th at a depth of 1.5 to 2.5 ft was 1.6 pCi/g and at a depth of 6 to 7.4 ft was1.88 pCi/g (the SAL is 1.5 pCi/g). See Figure 4-4 for the sample location and the maximum activity detected for each potential COC.

At the site of Line 34, ^{60}Co was detected above SAL in the surface soil sample collected at Location ID No. 48-2068 (7 to 8 ft). The reported activity of ^{228}Th exceeded the SAL value in surface soil samples collected at Location ID Nos. 48-2067 and 48-2069. The radionuclide ^{137}Cs was measured above its SAL of 4 pCi/g at a depth of 0 to 5 ft at Location ID No. 48-2023 (4 to 5 ft). In samples at Location ID Nos. 48-2024 (4 to 5 ft, 8 to 9 ft, and 14 to 15 ft) and 48-2025 (5.5 to 6.5 ft, 7.5 to 8.5 ft, 9 to 10 ft, and 13 to 14 ft), collected at Line 37, ^{228}Th was detected above SAL. The radionuclide ^{137}Cs was also measured above SAL

at depths of 5 to 15 ft in samples collected at Location ID No. 48-2024 (8 to 9 ft and 14 to 15 ft). These analytical data are discussed further in the following subsection.

The noncarcinogenic SVOCs 2-butanone and di-n-butyl phthalate were detected in three soil samples at concentrations several orders of magnitude less than the SAL values. Consequently, 2-butanone and di-n-butyl phthalate, which are common laboratory contaminants, are eliminated from further consideration. The noncarcinogenic VOC acetone was present in eight soil samples at concentrations several orders of magnitude less than its SAL value. Consequently acetone, which is also a common laboratory contaminant, is eliminated from further consideration. No inorganic constituent was detected at concentrations exceeding its SAL value.

Constituents Identified as Potential COCs

In samples collected at depths ranging from surface to 15 ft at the location of Line 34, ^{60}Co, ^{137}Cs, and ^{106}Ru were identified as potential COCs because of elevated measurements from mobile laboratory analyses. The mobile laboratory results are regarded as estimated values because of the large uncertainty associated with the reported activities. Two confirmatory samples from Location ID No. 48-2021 (2.5 to 3.7 ft), one confirmatory sample from Location ID No. 48-2023 (9 to 10 ft), and one confirmatory sample from Location ID No. 48-2069 (2.5 to 3 ft) were analyzed at fixed-site laboratories. The sample activities measured at the fixed-site laboratory were one-to-two orders of magnitude less than the sample activities measured at the mobile laboratory, and none of the measured activities exceeded SAL values. The mobile laboratory data should not be used for a risk assessment because of the uncertainty of the measurements. Insufficient data exist from confirmatory samples to adequately characterize the site. Therefore, the risk presented to human health cannot be assessed on the basis of the existing data.

At Line 38, samples were collected from a single borehole at Location ID No. 48-2026. The radionuclides ^{238}Pu and ^{60}Co were measured at activities exceeding their respective SALs at a depth of 6 to 7.4 ft. The measured activity of ^{238}Pu, 223 pCi/g, was an order of magnitude greater than the SAL value of 20 pCi/g. The radionuclides ^{241}Am, ^{239,240}Pu, and ^{230}Th were also identified as potential COCs in the sample collected at a depth of 6 to 7.4 ft. The reported activity of ^{228}Th measured in samples collected at depths of 1.5 to 2.5 ft and 6 to 7.4 ft slightly exceeded the SAL value of 1.5 pCi/g. The radionuclides ^{228}Th and ^{230}Th were also identified as potential COCs in the sample collected at depths of 14 to 15 ft. However, the method blank sample that was counted concurrently with the samples was contaminated with 1.68 pCi/g of ^{228}Th and 0.368 pCi/g of ^{230}Th. Therefore, the reported results for ^{228}Th and ^{230}Th should be regarded as the EQLs for the affected samples. Because the EQL values for ^{228}Th and ^{230}Th in these samples are close to or exceed the respective SAL values, the results should not be used for risk assessment. Although the presence of multiple radionuclide contaminants at depths of 6 to 7.4 ft has been established at the site of Line 38, the single borehole is insufficient to establish the extent of contamination.

At the site of Line 37 and the associated outfall, ^{228}Th, ^{230}Th, ^{137}Cs, ^{60}Co, and ^{106}Ru were identified as potential COCs. The measured activity of ^{228}Th slightly exceeded the SAL value in samples collected at depths of 0 to 15 ft at Location ID Nos. 48-2024 and 48-2025. However, the method blank sample that was counted concurrently with the samples was contaminated with 1.68 pCi/g of ^{228}Th and 0.368 pCi/g of ^{230}Th. Consequently, the reported results for ^{228}Th should be regarded as the EQLs for all samples collected at Location ID Nos. 48-2024 and 48-2025. The reported results for ^{230}Th should be regarded as the EQLs for samples at Location ID No. 48-2024 (8 to 9 ft and 14 to 15 ft). Because the EQLs for ^{228}Th and ^{230}Th in these samples is close to or exceeds the respective SAL values, the results should not be used for risk assessment.

The activity of ^{137}Cs measured in the mobile laboratory slightly exceeded the SAL value of 4 pCi/g in samples at Location ID No. 48-2024 (8 to 9 ft and 14 to 15 ft), with a maximum observed activity of 7 pCi/g in one sample at Location ID No. 48-2024 (14 to 15 ft). Confirmatory samples that were collected at Location ID Nos. 48-2024 (8 to 9 ft) and 48-2025 (5.5 to 6.5 ft) for analysis at a fixed-site laboratory had no measur-

able activity above the minimum detectable activity (MDA) of 0.3 pCi/g arising from ^{137}Cs. Therefore, insufficient data exist from fixed-site laboratory analyses for the radionuclide constituents to confirm or deny the presence of radiological potential COCs in the area of former Line 37. The risk presented to human health cannot be assessed on the basis of the existing data.

Fixed-site laboratory gamma spectroscopy measurements for two surface soil samples collected at Location ID Nos. 48-2028 and 48-2031 at the Line 37 outfall are available. For both samples, the alpha-emitting isotopes ^{228}Th and ^{230}Th were identified as potential COCs in the multiple constituent analysis. The radionuclides ^{60}Co and ^{106}Ru were also identified at Location ID No. 48-2028. The radionuclide ^{228}Th was identified as a COPC present above background level on the basis of questionable analytical results for soil samples collected at Line 37 and contributed the largest percentage to the SAL-normalized sum for both samples from the Line 37 outfall. However, the measured activities of ^{228}Th for all the samples analyzed from the outfall were less than half of the background value. If ^{228}Th was eliminated from consideration for the Line 37 outfall, the SAL-normalized value would not exceed 1.0 for any of the samples, and there would be no potential COCs identified. However, because of the poor quality of the analytical data for Line 37, the presence or absence of potential COCs, in particular ^{228}Th and ^{230}Th, cannot be established.

Constituents Not Identified as Potential COCs

Constituents for which a SAL value is not available or for which the SAL value is lower than the reporting limit require further evaluation as part of the screening assessment methodology (see Figure 3-1). The evaluation of these constituents is presented in his section.

Organic constituents with reporting limits exceeding their soil SAL values included benzo[a]pyrene, dibenz[a,h]anthracene, m-benzidine, bis(2-chloroethyl) ether, N-nitrosodi-n-propylamine, and N-nitrosodimethylamine. Benzidine is used in the production of dyes, and the nitrosoamine compounds are used as additives in gasoline and lubricants. Neither benzidine nor the nitrosoamine compounds are reasonably associated with the radioactive waste lines in Aggregate N. The two PAH compounds have SAL values of 0.1 mg/kg, which is approximately one-third the EQL value of 0.33 mg/kg. Although PAH compounds are often detected at trace levels at industrial sites, significant or widespread contamination would result in numerous samples exceeding the EQL for not only benzo[a]pyrene and dibenz[a,h]anthracene but also a wide range of other PAH compounds. No PAH compounds were detected above EQL in any sample collected from Aggregate N. Therefore, the six SVOCs listed above do not need further evaluation.

Approximately 132 individual organic constituents were analyzed for at Aggregate N. Of this total, approximately 18 do not have SAL values. None of the organic compounds lacking SAL values were detected above their EQL in any sample collected from Aggregate N. Therefore, these constituents do not need further evaluation.

Of the inorganic constituents present in the soil samples that were analyzed by SW-846 methods, the following do not have SAL values: arsenic, aluminum, calcium, iron, lithium, magnesium, potassium, and sodium. Of these, aluminum, calcium, iron, magnesium, potassium, and sodium are recognized by the EPA as being essentially nontoxic under typical environmental exposure scenarios (EPA 1989, 8021) and do not warrant further evaluation for human health risk. A site-specific background UTL value is available for arsenic and is used for screening assessment purposes. Two samples from Line 34, one sample from Line 37, one sample from Line 38, and two samples from the Line 37 outfall were analyzed for arsenic by the GFAA method. The maximum arsenic concentration observed was 3.1 mg/kg, which is below the UTL value of 11.6 mg/kg. The maximum lithium concentration observed in soil samples collected at Aggregate N was 7.3 mg/kg. No evidence exists that lithium was associated with the acid waste lines; therefore, lithium does not need further evaluation.

Inorganic constituents in soil measured by the EDXRF method were not compared to the UTL background values for reasons discussed in Chapter 3, Section 3.1. Of the constituents measured by EDXRF (except the nontoxic analytes discussed above) the following do not have SAL values: arsenic, thorium, titanium, and uranium. Titanium, which is widespread in the environment, is generally recognized as being physiologically inert. Therefore, there is no reason to recommend further evaluation of titanium at Aggregate N. The alpha-emitting isotopes of thorium and uranium were analyzed by alpha spectrometry, and the risk associated with the presence of thorium and uranium was evaluated on an isotopic basis. Arsenic was not detected above the EDXRF detection limit of 10 mg/kg at Aggregate N. Arsenic was not present above its UTL value in any of the soil samples analyzed by SW-846 methods, and it does not need further evaluation.

All radionuclides identified as COPCs by the background screening process have SAL values, and no reporting limits exceeded these values in any sample.

4.3.3.2 Data Interpretation

The sample locations in Aggregate N where potential COCs have been identified are shown in Figures 4-3 and 4-4. The only potential COCs that have been identified as a result of the Phase I investigation are the radionuclide constituents ^{241}Am, ^{137}Cs, ^{60}Co, ^{238}Pu, ^{239,240}Pu, ^{106}Ru, ^{228}Th, and ^{232}Th. Although Aggregate N consists of the single PRS No. 48-005, there are four logical units within the aggregate to be considered: the areas of former Lines 34, 37, and 38, and the Line 37 outfall at the canyon rim. The industrial waste lines, which have been removed from the areas outside the TA-48 security fence, were located at depths ranging from 7 to 11 ft. Radiological potential COCs have been identified at depths ranging from surface to 15 ft at the locations of former Lines 34 and 37. The range of depths at which radiological contamination was found does not correspond with the reported depths of the waste pipelines. It is possible that soil contaminated by leaking waste pipelines was redistributed during the D&D operation. The purpose of the Phase I investigation was only to establish the presence or absence of COCs. Insufficient data exist to establish the lateral or vertical extent of the radiological contamination at the site of either Line 34 or Line 37.

Surface soil radiological contamination may be present at the Line 37 outfall at the canyon rim. As discussed in Chapter 4, Section 4.3.3.1, the identification of potential COCs at the outfall may be a consequence of questionable analytical results for ^{228}Th in soil samples collected at Line 37. Because of the poor quality of the analytical data, the presence or absence of radiological contamination at Line 37 and the associated outfall cannot be determined. Furthermore, insufficient data exist to establish the lateral or vertical extent of the contamination at the outfall.

At the location of former Line 38, the maximum activity of radiological potential COCs was found at depths of 6 to 7 ft, which corresponds to the former location of the waste pipeline. The radionuclides ^{238}Pu, ^{228}Th, and ^{60}Co were detected above their respective SAL values in the sample collected at 6 to 7.4 ft. The radionuclides ^{228}Th and ^{230}Th were identified as potential COCs in the sample collected at 14 to 15 ft; however, as discussed above, the identification is based on questionable analytical results. The purpose of the Phase I investigation was to establish the presence or absence of COCs, and the borehole that was sampled at Line 38 is insufficient to establish the lateral extent of contamination.

4.3.3.3 Risk Assessment

Insufficient data exist to perform an assessment of the risk to human health posed by the presence of radionuclides at the locations of Lines 34, 37, and 38 at Aggregate N. The area of the Line 37 outfall is too small to comprise a reasonable exposure unit for the purposes of risk assessment. Therefore, the radiological potential COCs identified at the Line 37 outfall may be evaluated as part of a larger canyon rim exposure unit, described in Chapter 4, Section 4.5.3.3.

4.3.3.4 Ecotoxicological Screening Assessment

The ecotoxicological screening assessment of the analytical results for samples collected at Aggregate N was conducted according to the methodology outlined in Chapter 3, Section 3.2.3. The screening assessment data tables for ESAL comparisons are provided in Table C-3 in Appendix C.

Ranking of Habitat Condition and Receptor Accessibility to COPCs

Ecological characteristics of PRS No. 48-005 in Aggregate N were reviewed to estimate the likelihood that ecological receptors could come in contact with COPCs to a significant degree. The location of the Line 37 outfall (see Figure 4-3) and the frequency of human disturbance are such that ecological receptors use the site for some, but not all, portions of their life cycles. Therefore, this PRS was given a landscape condition score of two, even though the majority of the structures (radioactive waste lines) associated with this PRS are located at depth. COPCs could be dispersed to the canyon area from the Line 37 outfall, so the site was given a receptor access score of three. These scores indicate that exposure is quite possible; therefore, a comparison to ESAL values is required for this PRS (see Figure 3-3 to review the decision model).

Comparison to Ecotoxicological Screening Assessment Levels

Aggregate N contains habitat that is suitable for use by spotted bats, which are candidates for listing under the Federal Endangered Species Act and are classified as endangered by the state of New Mexico. Therefore, the COPCs carried forward to the human health SAL comparison (Table 4-9) were also carried forward to the ecotoxicological screening assessment. Uranium, because of its systemic toxicity, was the only radionuclide evaluated. Potential COCs with one or more values exceeding an ESAL are identified in Table 4-11.

TABLE 4-11

POTENTIAL COCs IDENTIFIED DURING ECOTOXICOLOGICAL SCREENING IN AGGREGATE N

Radionuclides	Inorganic Constituents	Organic Constituents
Uranium[a]	None identified	None identified

a. Identified as a potential COC based on systemic toxicity.

The ecotoxicological screening assessment identified uranium as a potential COC. No organic or inorganic constituents were identified as potential COCs. Several sample locations contained measured uranium activities that were greater than background UTLs and greater than ESALs; these activities could adversely affect ecological receptors that make exclusive use of these sampling locations. When other uranium samples in the aggregate are averaged for a risk assessment, the value is below the uranium UTL. Any ecological receptors of concern (in this case, spotted bats) would use an area that is much larger than Aggregate N, making it unlikely that uranium from this aggregate alone could cause significant adverse effects to the environment.

4.3.4 Conclusions and Recommendations for Aggregate N

According to the decision process described in Chapter 5 of the work plan, the data collected during the Phase I investigation confirmed the presence of potential COCs at the three radioactive waste lines

(Lines 34, 37, and 38) in PRS No. 48-005. The potential COCs identified at PRS No. 48-005 are alpha- and gamma-emitting radionuclides. No other hazardous constituents, inorganic or organic, were identified as potential COCs. Based on NFA criterion number 1 (the PRS has only radionuclide components), a Class III permit modification will be requested to remove PRS No. 48-005 from the HSWA Module of the Laboratory's RCRA operating permit. Because the potential COCs were found distributed from the surface to various depths (see Section 4.3.3.4) and because part of the radioactive waste lines still remain (see Section 4.3) in areas of current operations (inside the fence) at TA-48, it is not feasible at this time to either remove the lines inside the fence or perform a cleanup in areas outside the fence. Cleaning the areas outside the fence will only provide a partial remedy, and it is unknown whether the remaining portions of lines inside the fence contribute to the radiological contamination. Therefore, this site should be re-evaluated at the time the facilities at TA-48 are decontaminated and decommissioned. Insufficient data are available from the Phase I investigation to assess the risk to human health posed by the potential COCs at this time. Therefore, it is recommended that final disposition of PRS No. 48-005 be deferred until later when the TA-48 facilities are decommissioned.

One potential COC was identified by the ecological screening assessment; however, any ecological receptors of concern would use an area that is much larger than Aggregate N making it unlikely that uranium from this aggregate alone could cause significant adverse effects to the environment. Because exposure to these and other potential COCs around the Laboratory may be part of a process leading to cumulative adverse effects to ecological receptors, it is recommended that if a site-wide ecological risk assessment is conducted, these potential COCs be included.

4.4 Aggregate X

Aggregate X consists of PRS Nos. 48-002(e), 48-007(a and d), and 48-010. PRS No. 48-002(e) is a small container storage area located on the east side of building TA-48-1. Nearly all the PRS is covered with asphalt paving. The area of this PRS was listed in the 1988 Laboratory Active Container Storage database and was used for many years to store solvents such as cutting oil. All containers and other material were removed from the area in 1989 or 1990. Since June 1992, the area has been used to store a liquid nitrogen tank and several compressed-gas cylinders.

PRS Nos. 48-007(a and d) are the discharge areas for active outfalls included under the Laboratory's National Pollutant Discharge Elimination System (NPDES) Permit No. NM002835. PRS No. 48-007(a) is the discharge area for treated cooling water and is located in the northwest part of an unlined surface impoundment area (PRS No. 40-010, which is discussed below) east of the parking area for building TA-48-45. PRS No. 48-007(d) is the discharge area for noncontact cooling water and is located at the southwestern edge of the unlined surface impoundment area.

PRS No. 48-010, the unlined surface impoundment area, is located east of the parking area for building TA-48-45 and lies on the western edge of the rim of Mortandad Canyon. This impoundment area receives storm water runoff from the parking area as well as outfall effluent as described above. A wetland has developed in the vicinity of the impoundment area.

4.4.1 Previous Investigations for Aggregate X

Runoff from the asphalt paving that covers most of PRS No. 48-002(e) flows toward an area where samples were collected during a reconnaissance survey for the proposed TA-48-45 parking lot. Seven surface and five subsurface samples were collected there in 1990. No significant concentrations of organic, inorganic, or radiological constituents were identified.

4.4.2 Field Investigations for Aggregate X

The discussion of the objectives of the investigation and the supporting conceptual model for Aggregate X is taken directly from Chapter 7, Section 7.28.1, of the June 1994 addendum to the work plan.

The objectives of this Phase I sampling plan were to determine the presence or absence of soil contamination at the small, exposed area within PRS No. 48-002(e) and to determine whether water and/or soil contamination exists at the surface impoundment area and wetland area (PRS No. 48-010).

The selection of sample locations was biased toward areas where residual contamination was most likely to be present on the basis of the following conceptual model.

- If spills have occurred at PRS No. 48-002(e), most have been isolated from the environment by the large expanse of asphalt at the site. A small area of ground is exposed, and leaks from barrels containing COPCs may have contaminated this area.
- Since 1978, PRS No. 48-010 has been receiving cool-down water that contains water-treatment chemicals of unknown composition.
- Evaporation from the impoundment area is concentrating these chemicals.

An environmental survey (the areal extent of which was determined by the work plan, FIMAD map observations, and the field observations described above) was conducted to locate areas of surface contamination. Within the survey area, an OVA was used to detect VOCs, and a Bicron pancake probe 2000 was used to detect gross-alpha, -beta, and -gamma radiation.

Field sampling activities for Aggregate X were performed on July 26 and July 30, 1993, and May 15, 1995. The May 15 sampling event was necessary because the Laboratory's Chemical Science and Technology Group (personnel who are responsible for providing laboratory analytical results) were unable to complete analyses of samples at Location ID Nos. 48-2038, 48-2039, 48-2041, and 48-2053. As a result, four replacement samples at Location ID Nos. 48-2080, 48-2081, 48-2082, and 48-2083 were collected.

A summary of sampling activities for Aggregate X is presented in Table 4-12. Figure 4-5 shows locations of all sample points in Aggregate X.

Deviations from the Work Plan

PRS No. 48-002(e) contains a small concrete pad (3 ft by 6 ft) located east of building TA-48-1 and north of building TA-48-17. A stain, which appears to consist of cutting oil, is located 4 to 7 ft east of the pad. Sample Location ID No. 48-2037 was situated approximately halfway between the concrete storage pad and the visible oil staining, in an area of exposed soil 8 ft west of the planned original sample site location. The hand-auger hole was relocated because of safety concerns associated with nearby buried utility lines that were near the original sample site. A surface soil sample at Location ID No. 48-2057 was collected at the original sampling location, adjacent to the concrete pad, where surface runoff sediment had collected. This deviation in sample locations does not influence the SAP objectives or rationale. The SAP for Aggregate X is presented in the June 1994 addendum to the work plan.

Comparisons of field observations of the outfalls (PRS Nos. 48-007[a and d]) shown on the Facility for Information Management, Analysis, and Display (FIMAD) map No. G100966 (LANL 1993, 48853) indicated that the outfall locations had been altered during construction of the parking lot at building TA-48-45. Because of this alteration, samples were collected at the new outfall locations and an additional sample was collected at the former location of the outfall associated with PRS No. 48-007(d).

A radiation site-walkover was performed by ESH personnel before beginning any field activities. No radioactivity was detected above background; therefore, a formal radiation grid survey was not performed. This deviation does not influence the SAP objectives or rationale.

4.4.2.1 Results of Field Surveys

No VOCs were detected, and gross-alpha -beta, and -gamma radiation readings were within background values (120 cpm to 160 cpm).

4.4.2.2 Results of Field Screening

All samples were scanned for gross-alpha, -beta, and -gamma radiation with the Bicron pancake probe 2000 and scanned for VOCs with an OVA.

TABLE 4-12

SUMMARY OF SAMPLING ACTIVITIES FOR AGGREGATE X

Location ID No.	Sample Type	Sample Intervals	Sample Description	Comments	Date Collected
PRS No. 48-002(e)					
48-2037	Hand auger	0–0.5 ft 0.5–1.5 ft 1.5–3.0 ft	Moist sandy clay backfill material		7/30/93
48-2057	Surface	0–0.5 ft	Sand, clay, and pea gravel		7/30/93
PRS No. 48-007(a and d)					
48-2038	Surface	0–0.5 ft	Sand, and fine gravel	At outfall from PRS No. 48-007(a)	7/26/93
48-2039	Water	NA[a]	Directly in outfall	Temp: 72.4°F pH: 8.93 conductivity: 507 µMhos/cm	7/26/93
48-2080	Surface	0–0.5 ft	Brown, wet silty soil	Resampling to replace 48-2038	5/15/95
48-2081	Water	NA	Directly in outfall	Resampling to replace 48-2039	5/15/95
PRS No. 48-010					
48-2040	Surface	0–0.5 ft	Sandy, rocky soil	From berm around edge of pond	7/26/93
48-2041	Surface	0–0.5 ft	Sand and silty mud	Associated with PRS No. 48-007(d)	7/26/93
48-2042	Water	NA	Near outfall discharge	Temp: 79.7°F pH: 7.77 conductivity: 182 µMhos/cm	7/26/93
48-2052	Surface	0–0.5 ft	Sand, clay, tuff pebbles	Previous outfall location	7/26/93
48-2053	Water	NA	Outfall	Temp: 85.6°F pH: 6.88 conductivity: 145 µMhos/cm	7/26/93
48-2082	Surface	0–0.5 ft	Dark brown, wet sandy soil	Resampling to replace 48-2041	5/15/95
48-2083	Water	NA	Outfall	Resampling to replace 48-2053	5/15/95

a. Not applicable

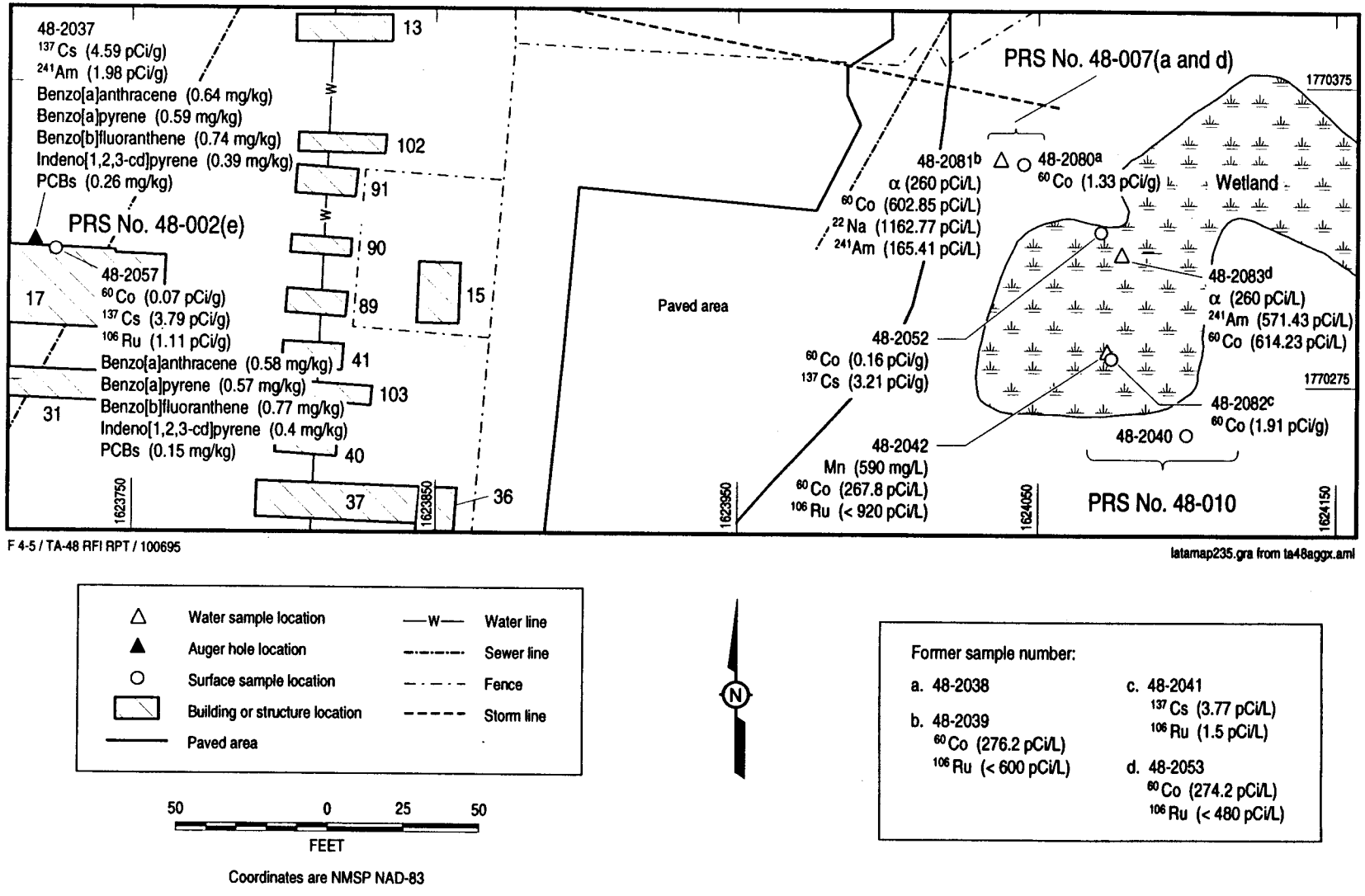


Figure 4-5. Sample locations and associated potential contaminants of concern for Aggregate X, TA-48.

Positive OVA readings were observed in samples at Location ID Nos. 48-2041 and 48-2082 (the re-sampling location to replace Location ID No. 48-2041). This sample location is an outfall point into a wetlands area where methane is likely to accumulate from decomposing vegetation. Since no methane filter was used on the OVA instrument, it is possible that the positive reading is the result of methane. No other elevated measurements were observed in any of the soil samples from Aggregate X during the field screening process.

No other elevated measurements indicative of contamination were recorded during the field screening process for the samples from Aggregate X.

4.4.3 Screening Assessment for Aggregate X

The screening assessment of the analytical results for samples collected in Aggregate X was conducted according to the methodology outlined in Chapter 3, Section 3.2. The screening assessment data tables are found in Tables B-13 through B-17 in Appendix B. The analytical data for all the PRSs within Aggregate X were grouped together for the screening assessment. The results of the screening assessment should be interpreted in conjunction with an evaluation of the analytical data quality and the SAP for Aggregate X. A summary of data quality considerations impacting the analytical results used for evaluating Aggregate X is presented in this section. A more comprehensive assessment of the quality of the analytical data is presented in Chapter 3, Section 3.1. Additional information regarding the selection of radionuclide analytes is found in Chapter 3, Section 3.1.3.

For the purposes of the screening assessment, the noncarcinogenic constituent data set consists of both the inorganic constituents analyzed by SW-846 solid waste methods (EPA 1986, 31732) and the noncarcinogenic organic constituents. Because of the large number of organic constituents that were analyzed for, only those organic constituents that were present above the sample EQL are included in the screening data tables. The SAL values for inorganic constituents analyzed in Aggregate X are based solely on noncarcinogenic endpoints. Screening comparisons for the inorganic constituents analyzed by the EDXRF method were performed separately from the constituents that were analyzed by SW-846 methods. The data sets for the inorganic analyses cannot be directly compared since correlation factors are unavailable for those trace elements measured by both methods. As discussed in Chapter 3, Section 3.1, the EDXRF data set could not be screened against the site-specific background UTL values since the background measurements were performed using SW-846 methods.

The carcinogenic data set for Aggregate X consists of carcinogenic organic constituents that were present above the sample EQL. As noted above, no inorganic constituents are included in the carcinogenic data set.

The sample results for radionuclide analyses are divided into two data sets. Separate screening comparisons were performed for measurements of radionuclide activity obtained from fixed-site and mobile laboratory analysis. The two data sets cannot be directly compared. The correlation between measurements performed at the fixed-site and mobile laboratories could not be determined because of the large uncertainties associated with the mobile laboratory analyses. The gamma spectroscopy analysis of samples from Location ID Nos. 48-2080 through 48-2083 included the analytes ^{140}Ba, ^{237}Np, and ^{22}Na, in addition to ^{241}Am, ^{144}Ce, ^{60}Co, ^{137}Cs, and ^{106}Ru. Water samples were not filtered before analysis in the mobile laboratory.

The analytical data quality evaluation for Aggregate X, which is found in Appendix A, indicated the following problems that will affect the screening assessment. In the analysis of three soil samples for mercury, the preparation blank was contaminated with mercury. Therefore, the reported results for mercury for samples from Location ID Nos. 48-2080 (regular and duplicate) and 48-2082 should be regarded as the

EDL. Samples from Location ID Nos. 48-2037 (0.5 to 1.5 ft and 1.5 to 3 ft) and 48-2057 (0 to 0.5 ft) were lost in analysis; therefore, gamma spectroscopy results are not available for these samples.

4.4.3.1 Comparison to Background and SAL Values

Comparison to Background Values

The analytical results for radionuclide and noncarcinogenic constituents in soil samples collected from Aggregate X were compared to background UTL values as an initial step in the screening assessment, as discussed in Chapter 3, Section 3.2.1. A distributional shift test was not performed because the data sets were too small. The screening assessment data tables for the background UTL comparisons, which identify COPCs present above the UTL values for each sample, are provided in Tables B-13 through B-15 in Appendix B. The COPCs that were identified are listed in Table 4-13. Included in the list of COPCs are those constituents for which a background UTL value is not available.

TABLE 4-13

COPCs CARRIED FORWARD TO THE SAL COMPARISON IN AGGREGATE X

Radionuclides	Noncarcinogenic Constituents
^{241}Am[a]	Fluoranthene[a]
^{140}Ba[a]	Lithium[a]
^{144}Ce[a]	Molybdenum[a]
^{137}Cs	Phenanthrene[a]
^{60}Co[a]	Pyrene[a]
^{237}Np[a]	Silver[a]
^{238}Pu	Strontium[a]
$^{239,240}Pu$	
^{106}Ru[a]	
^{230}Th[a]	
^{235}U	

a. COPC is carried forward because a UTL value is not available.

One soil sample, collected from Location ID No. 48-2037 at PRS No. 48-002(e) at a depth of 1.5 to 3 ft, was analyzed for inorganic constituents using SW-846 methods. Of those constituents for which UTL values are available, none were detected above background levels. Those inorganic constituents for which no background value is available (lithium, molybdenum, silver, and strontium) are carried forward to the next step in the screening assessment, which is the comparison to SAL values.

The noncarcinogenic semivolatile PAHs fluoranthene, phenanthrene, and pyrene were detected in soil samples collected from Location ID Nos. 48-2037 (0 to 0.5 ft) and 48-2057 (0 to 0.5 ft) at PRS No. 48-002(e). Background values are not available, so the PAH compounds are carried forward to the SAL comparison.

The following samples were analyzed at fixed-site laboratories for the alpha-emitting isotopes of americium, plutonium, thorium, and uranium: four samples collected from Location ID Nos. 48-2037 and 48-2057 at PRS No. 48-002(e) at depths ranging from 0 to 3 ft, and three surface samples collected from Location ID No. 48-2080 at PRS Nos. 48-007(a and d) and Location ID Nos. 48-2040 and 48-2041 at PRS

No. 48-010. One surface sample each from Location ID Nos. 48-2037 at PRS No. 48-002(e), 48-2038 at PRS Nos. 48-007(a and d), and 48-2041 at PRS No. 48-010 was analyzed by gamma spectroscopy at fixed-site laboratories. The results of the screening comparison indicated that the following radionuclides were present above background levels at the four PRSs in Aggregate X: ^{238}Pu, ^{239,240}Pu, and ^{235}U. The activities of ^{137}Cs, ^{228}Th, ^{232}Th, ^{234}U, and ^{238}U measured at the fixed-site laboratories were below background levels.

Soil samples from locations at each of the four PRSs were analyzed by gamma spectroscopy at the mobile laboratory facility. The radionuclide ^{137}Cs was present above the UTL value of 1.4 pCi/g at Location ID Nos. 48-2037 (0 to 0.5 ft, 0.5 to 1.5 ft, 1.5 to 3 ft) and 48-2057 (0 to 0.5 ft) at PRS No. 48-002(e), and in surface samples collected at Location ID Nos. 48-2041 and 48-2052 in PRS No. 48-010. The activities of all other radionuclides measured at the mobile laboratory facility for which UTL values are available were below background levels. The radionuclides ^{241}Am, ^{140}Ba, ^{144}Ce, ^{60}Co, ^{237}Np, and ^{106}Ru were carried forward to the SAL comparison since background values are unavailable for these isotopes.

Comparison to Human Health Screening Action Levels

COPCs that were not eliminated in the background comparison were evaluated by comparison to human health SALs. The carcinogenic and EDXRF inorganic constituent data sets also underwent the comparison to SAL values. The screening assessment data tables for the SAL comparisons and the multiple constituent analysis are provided in Tables B-13 through B-17 in Appendix B. Because of the large number of organic analytes, SAL comparisons for organic constituents, both carcinogenic and noncarcinogenic, are provided only for analytical results greater than the sample EQL.

EDXRF analyses were obtained for nine soil samples (including one duplicate sample) that were collected from sample locations at each of the four PRSs. Soil samples from PRS No. 48-002(e) that were collected at Location ID Nos. 48-2037 and 48-2057 were analyzed for PCBs, VOCs, and SVOCs; these results are included in the carcinogenic constituent data set.

Constituents with one or more sample values exceeding a SAL and those that contribute greater than 5% to a SAL-normalized sum exceeding 1.0 in the multiple constituent analysis are considered to be potential COCs and are identified in Table 4-14. The sample locations where potential COCs were identified in Aggregate X are shown in Figure 4-5.

At PRS No. 48-002(e), the PCB Aroclor 1254 and a range of PAH compounds, including four carcinogenic PAHs, were detected in soil samples collected at Location ID Nos. 48-2037 and 48-2057 at depths ranging from 0 to 1.5 ft. The noncarcinogenic PAH compounds fluoranthene and pyrene were present at concentrations several orders of magnitude less than their respective SAL values and therefore were eliminated from further consideration. A SAL value is not available for phenanthrene. The PCBs and benzo[a]pyrene were measured at concentrations that exceed the respective SAL values of 0.09 mg/kg and 0.1 mg/kg at both sample locations. The PAHs benzo[a]anthracene, benzo[b]fluoranthene, and indeno[1,2,3-cd]pyrene were identified as carcinogenic COCs as a result of the multiple constituent analysis. Chrysene, which is also a carcinogen, was present at concentrations two orders of magnitude below its SAL value and was eliminated from further consideration.

In addition to the carcinogenic COCs identified at PRS No. 48-002(e), the radionuclides ^{241}Am, ^{60}Co, ^{137}Cs, and ^{106}Ru were identified as potential COCs on the basis of measurements made in the mobile laboratory facility. Of these, ^{137}Cs was detected above its SAL value of 4 pCi/g at Location ID No. 48-2037 (0.5 to 1.5 ft). No inorganic constituents, measured by either EDXRF or SW-846 methods, were present at concentrations exceeding SAL values at PRS No. 48-002(e).

In the soil sample collected from Location ID No. 48-2080 at PRS Nos. 48-007(a and d), ^{60}Co was detected above its SAL value of 0.9 pCi/g in the mobile laboratory analysis. The radionuclide ^{60}Co was

also present above SAL in the water sample collected from the outfall at Location ID No. 48-2039. In the second water sample collected from the outfall at Location ID No. 48-2081, gross-alpha activity, ^{241}Am, ^{60}Co, and ^{22}Na exceeded their respective SAL values. No inorganic constituents in the soil samples analyzed by EDXRF were identified as potential COCs.

At the wetlands in PRS No. 48-010, ^{60}Co, ^{137}Cs, and ^{106}Ru were identified as potential COCs in surface soil samples collected at Location ID Nos. 48-2041, 48-2052, and 48-2080. The mobile laboratory measurement for ^{60}Co exceeded the SAL value at Location ID No. 48-2080. Radionuclides identified as potential COCs in three water samples collected from Location ID Nos. 48-2042, 48-2053, and 48-2083 in the wetlands include ^{241}Am and ^{60}Co. The SAL values for ^{241}Am and ^{60}Co were exceeded in all three water samples. The SAL value for alpha activity in the unfiltered sample was exceeded at Location ID No. 48-2083.

TABLE 4-14

POTENTIAL COCs IDENTIFIED IN AGGREGATE X

PRS N o.	Radionuclides	Noncarcinogenic Constituents	Carcinogenic Constituents
48-002(e)	$^{241}Am^{a}$ $^{137}Cs^{b}$ $^{60}Co^{a}$ $^{106}Ru^{a}$	None identified	PCBs (Aroclor 1254[b]) Benzo[a]anthracene[a] Benzo[a]pyrene[b] Benzo[b]fluoranthene[a] Indeno[1,2,3-cd]pyrene[a]
48-007(a and d)	$^{241}Am^{b,c}$ $^{60}Co^{b}$ Gross-alpha[b,c] $^{22}Na^{b,c}$	None identified	None identified
48-010	$^{241}Am^{b,c}$ $^{137}Cs^{a}$ $^{60}Co^{b}$ Gross-alpha[b,c] $^{106}Ru^{a}$	Manganese[b,c]	None identified

a. Identified as a potential COC in soil based on multiple constituent analysis.
b. Potential COC that was detected above SAL value.
c. Identified as a potential COC in water matrix only.

The noncarcinogenic constituent manganese is identified as a potential COC since the measured value of 590 µg/L in the water sample from Location ID No. 48-2042 exceeds the SAL value of 180 µg/L. No other inorganic constituents, analyzed by either EDXRF (soil samples) or SW-846 methods (water samples), were identified as potential COCs.

Constituents Identified as Potential COCs

Several potential COCs were identified at PRS No. 48-002(e) at depths ranging from surface to 1.5 ft. Potential COCs present in the soil include carcinogenic constituents Aroclor 1254, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, and indeno[1,2,3-cd]pyrene and the radionuclide constituents ^{241}Am, ^{137}Cs, ^{60}Co, and ^{106}Ru. Although these constituents were identified as potential COCs in the screening assessment, it is not recommended that they be evaluated in a risk assessment at this time, for reasons outlined in Section 4.4.3.2.

The outfalls in PRS Nos. 48-007(a and d) discharge into the unlined containment pond at PRS No. 48-010, and these three PRSs should be considered together as a single exposure unit. The identification of potential COCs in soil samples collected at the outfalls and wetland was based solely on measurements made at the mobile laboratory facility; no potential COCs were identified based on the results of fixed-site laboratory analyses. The radionuclide ^{60}Co was identified as a potential COC in one of the two soil samples collected at the outfalls based on gamma spectroscopy measurements made in the mobile laboratory facility. The second soil sample was analyzed by gamma spectroscopy at a fixed-site laboratory, and no radionuclides were detected above MDA. The radionuclides ^{137}Cs, ^{60}Co, and ^{106}Ru were identified as potential COCs in three out of four surface soil samples collected at PRS No. 48-010 on the basis of mobile laboratory analyses. Gamma spectroscopy of one of the four samples was performed at a fixed-site laboratory, and no radionuclides were detected above the MDA. As discussed in Chapter 3, Section 3.1, the measurements made at the mobile laboratory have a greater associated uncertainty than fixed-site laboratory analyses and should not be used for risk assessment calculations. Alpha spectrometry results are available for only three soil samples collected from the outfalls and wetland. Further characterization of the soil at the outfalls and wetland, based on measurements of acceptable quality, is required to determine if radionuclide constituents are truly present at levels that present a risk to human health.

Four soil samples collected from PRS Nos. 48-007(a and d) and 48-010 were analyzed for inorganic constituents by EDXRF. There was no analysis for inorganic constituents in soil performed by SW-846 methods. No inorganic constituents were identified as potential COCs based on the EDXRF measurements.

On the basis of both fixed-site and mobile laboratory analyses, the radionuclides ^{241}Am, ^{60}Co, and ^{22}Na, were identified as potential COCs in the two water samples collected at PRS Nos. 48-007(a and d), and ^{241}Am and ^{60}Co were identified in three water samples collected at PRS No. 48-010. Gross-alpha activity in the unfiltered water samples, measured at the mobile laboratory facility, also exceeded the SAL value at PRS Nos. 48-007(a and d) and the wetland. No analysis for specific alpha-emitting isotopes was performed for the water samples. Further characterization of the potential COCs that may be present in the water at PRS Nos. 48-007(a and d) and PRS No. 48-010, particularly specific alpha- and beta-emitting radionuclides, would be required to perform a human health risk assessment.

The only inorganic constituent that was analyzed for in water at PRS Nos. 48-007 (a and d) was mercury. The purpose of this analysis was to determine if PRS Nos. 48-007(a and d) were impacted by runoff water from PRS No. 48-002(a) in Aggregate L, which was the site of a mercury spill. The concentration of mercury in the water sample was 0.1 µg/L, which is well below the SAL value of 2 µg/L. Therefore, it appears that PRS Nos. 48-007(a and d) have not been contaminated by runoff from the site of the mercury spill. No other inorganic constituents were analyzed for in water samples collected from the outfalls; however, the alkaline pH and high conductivity of water samples collected from Location ID No. 48-2039 (see Table 4-12) may be indicative of contamination. One water sample from PRS No. 48-010 was analyzed for trace element constituents by SW-846 methods, and manganese was identified as a potential COC.

Constituents Not Identified as Potential COCs

Constituents for which a SAL value is not available or for which the SAL value is lower than the reporting limit require further evaluation as part of the screening assessment methodology (see Figure 3-1). The evaluation of these constituents is presented in this section.

Organic constituents with reporting limits exceeding their soil SAL values included benzo[a]pyrene, dibenz[a,h]anthracene, m-benzidine, bis(2-chloroethyl) ether, N-nitrosodi-n-propylamine, and N-nitrosodimethylamine. Analysis for organic constituents in Aggregate X was performed only for soil samples collected from PRS No. 48-002(e). The PAH compounds benzo[a]pyrene and dibenz[a,h]anthracene have SAL values of 0.1 mg/kg, which is approximately one-third the EQL value of 0.33 mg/kg for soil samples. Benzo[a]pyrene was detected above the EQL in two of the four soil samples collected at PRS No. 48-002(e). A range of other PAH compounds was also present in the two soil samples; however, dibenz[a,h]anthracene was not detected above the EQL. It is possible that dibenz[a,h]anthracene is also present at concentrations below 0.33 mg/kg at PRS No. 48-002(e).

Benzidine is used in the production of dyes; the nitrosamine compounds are used as additives in gasoline and lubricants. Benzidine is not reasonably associated with the known activities at TA-48. No petroleum hydrocarbon compounds were detected at PRS No. 48-002(e); therefore, it is very unlikely that nitrosamine compounds commonly associated with petroleum products are present.

The radionuclide ^{106}Ru was analyzed in water samples collected in Aggregate X using gamma spectroscopy. The MDAs for the fixed-site laboratory analysis ranged from 480 pCi/L to 920 pCi/L, which exceeds the water SAL value of 200 pCi/L. The radionuclide ^{106}Ru was not detected above MDA in any of the water samples that were collected at PRS Nos. 48-007(a and d) and 48-010. However, ^{106}Ru was identified as a potential COC in soil samples collected from the outfalls and wetland. Other radionuclides that were present in soil samples were also identified as potential COCs in the water samples. It is possible that the water in contact with the soil at these PRSs is also contaminated with ^{106}Ru. Therefore, ^{106}Ru should be regarded as a potential COC in water medium at PRS Nos. 48-007(a and d) and 48-010.

Approximately 132 individual organic constituents were analyzed for at PRS No. 48-002(e). Of this total, approximately 18 do not have SAL values. With the exception of phenanthrene, which is a noncarcinogen, none of the organic compounds lacking SAL values were detected above their EQL in any sample collected from PRS No. 48-002(e). Therefore, these constituents do not need further evaluation. Pyrene is commonly used as a toxicity surrogate for phenanthrene. The soil SAL value for pyrene is 2,400 mg/kg. The maximum detected concentration of phenanthrene was 1.1 mg/kg, which is three orders of magnitude less than the pyrene SAL value. Phenanthrene is unlikely to pose a risk to human health at the levels detected, and further evaluation is not needed.

The radionuclides ^{140}Ba, ^{144}Ce, and ^{237}Np were analyzed in soil and water samples collected in Aggregate X. Water SAL values are not available for any of the three radionuclides; soil SAL values are not available for ^{140}Ba or ^{237}Np. Gamma activity from ^{144}Ce was not detected in the water samples above MDA values, which ranged from 260 pCi/L to 340 pCi/L; it was also not detected above background level in any of the soil samples. Therefore, further evaluation of ^{144}Ce in water samples is not recommended. The maximum gamma activity from ^{140}Ba, which is also a beta-emitting radionuclide, was 1,903 pCi/L in water and 3.83 pCi/g in soil. The maximum gamma activity from ^{237}Np, which is also an alpha-emitting radionuclide, was 2,722 pCi/L in water and 3.65 pCi/g in soil. The radionuclides ^{140}Ba and ^{237}Np are recommended for further evaluation as potential COCs in both soil and water media at PRS Nos. 48-007(a and d) and 48-010.

Gross-gamma and gross-beta activity were also measured in the water samples. Since the water samples were also analyzed by gamma spectroscopy, no further evaluation of the gross-gamma activity is required.

The maximum beta activity measured in unfiltered water samples collected at the outfalls and wetland was 6.5 pCi/L. There was no analysis of the beta activity arising from specific isotopes.

Of the inorganic constituents present in the single soil sample that was analyzed by SW-846 methods, the following do not have SAL values: arsenic, aluminum, calcium, iron, lithium, magnesium, potassium, and sodium. Of these, aluminum, calcium, iron, magnesium, potassium, and sodium are recognized by the EPA as being essentially nontoxic under typical environmental exposure scenarios (EPA 1989, 8021) and do not warrant further evaluation for human health risk. A site-specific background UTL value is available for arsenic and is used for screening assessment purposes. The lithium concentration measured in the single soil sample, which was collected at PRS No. 48-002(e), was 28 mg/kg. No evidence exists that lithium-containing compounds were associated with PRS No. 48-002(e); therefore, lithium does not need further evaluation.

Of the inorganic constituents present in the water samples that were analyzed by SW-846 methods, excluding those regarded as nontoxic, cobalt and lithium do not have SAL values. The lithium concentration measured in the single water sample collected at PRS No. 48-010 was 21 µg/L. No evidence exists that lithium-containing compounds are associated with the outfall discharges; therefore, lithium does not need further evaluation at PRS Nos. 48-007(a and d) and 48-010. The cobalt concentration was reported as <4 µg/L, which is less than the EDL of 7 µg/L listed in SW-846 Method 610 for water analysis (EPA 1986, 31732). Therefore, cobalt does not need further evaluation.

Inorganic constituents in soil measured by the EDXRF method were not compared to the UTL background values, for reasons discussed in Chapter 3, Section 3.1.1. Of the constituents measured by EDXRF (except the nontoxic analytes discussed above) the following do not have SAL values: arsenic, thorium, titanium, and uranium. Titanium, which is widespread in the environment, is generally recognized as being physiologically inert. The alpha-emitting isotopes of thorium and uranium were analyzed by alpha spectrometry, and the risk associated with the presence of thorium and uranium was evaluated on an isotopic basis. Arsenic was not detected above the EDXRF detection limit of 10 mg/kg, and it is not a suspected contaminant at Aggregate X. Therefore, further evaluation of arsenic is not needed.

4.4.3.2 Data Interpretation

The presence of potential COCs in both soil and water media was established in the Phase I investigation of Aggregate X. The sample locations where potential COCs have been identified are shown in Figure 4-5. Lateral and vertical extent of the radiological contamination at PRS Nos. 48-007(a and d) and 48-010 was not established in the Phase I investigation. Certain areas have been impacted by activities and processes at TA-48, such as the deposition of stack emission particulates on surrounding soils. Surface-deposited constituents, which are present at levels that do not pose a health risk, may become concentrated as they collect in the wetland. It is also possible that there is no ongoing source of contamination at the outfalls and wetland. Rather, the soil in the area may have been contaminated by a previous release event at TA-48. Contamination of water entering the outfall drainage and wetland would then occur by suspension of sedimentary particulates.

The size of the wetland changes each season depending on the amount of precipitation. Water-borne contaminants are deposited over a changing area as the water rises and recedes through the seasons. Resuspension and deposition of contaminated sediments led to redistribution and migration of contaminants. The potential migration pathways from the wetlands to the discharge point at the rim of Mortandad Canyon have not been characterized. To fully assess the risk to human health and the environment, the sources and the distribution between water and soil media of contaminants must be established. Additionally, the potential for migration of contaminants away from the wetland must be investigated to develop the appropriate exposure scenarios. Further characterization of PRS Nos. 48-007(a and d) and

48-010 is required to determine the maximum levels of potential COCs and establish the lateral and vertical extent and distribution of contamination at the outfalls and wetland.

The container storage area associated with PRS No. 48-002(e) is almost entirely covered with asphalt. The unpaved area where the soil samples were taken is only a few square feet and has been left unpaved to allow access to underground utility lines. The amount of worker exposure to contaminated soil at PRS No. 48-002(e) is likely to be very small. No "hot spots" were identified at this PRS; potential contamination appears to be equally distributed among the samples collected. Only slightly elevated levels of PAHs are present (all below 1 ppm). Radiological constituents are also present at very low activities; the amount of ^{137}Cs present is 0.6 pCi/g greater than the residential scenario derived SAL.

4.4.3.3 Risk Assessment

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

4.4.3.4 Ecotoxicological Screening Assessment

The ecotoxicological screening assessment of the analytical results for samples collected at Aggregate X was conducted according to the methodology outlined in Chapter 3, Section 3.2.3. The screening assessment data tables for ESAL comparisons are provided in Table C-4 in Appendix C.

Ranking of Habitat Condition and Receptor Accessibility to COPCs

Ecological characteristics of PRS Nos. 48-002(e), 48-007(a and d), and 48-010 at Aggregate X were reviewed to estimate the likelihood that ecological receptors could come in contact with COPCs to a significant degree.

The location of PRS No. 48-002(e) (see Figure 1-3) and the effects of current use of the site warrant assigning a landscape condition score of one. Ongoing operations at TA-48 will continue to limit the amount of contact that ecological receptors would have with COPCs. Therefore, this PRS was given a receptor access score of one. Based on the scores for this PRS, no further action is required at this site with respect to ecological risk, and no comparisons of COPCs to ESALs are required (see Figure 3-3 to review the decision model).

The locations of PRS Nos. 48-007(a and d) and PRS No. 48-010 (see Figure 1-3) and the frequency of human disturbance are such that ecological receptors use the site for some, but not all, portions of their life cycles. Therefore, these PRSs were given a landscape condition score of two. COPCs are discharged directly from the outfall to the wetland, so the site was given a receptor access score of three. These scores indicate that exposure is quite possible; therefore, a comparison to ESAL values is required for these PRSs.

Comparison to Ecotoxicological Screening Action Levels

Aggregate X includes areas where ecological receptors can be exposed to contaminants. In particular, a small wetland is present, and the general area contains other habitat that is suitable for use by spotted bats (which are candidates for listing under the Federal Endangered Species Act and are classified as endangered by the state of New Mexico). Therefore, the COPCs carried forward to the human health SAL comparison (Table 4-13) were also carried forward to the ecotoxicological screening assessment. Because of its systemic toxicity, uranium was the only radionuclide evaluated.

No potential COCs were identified for wetland sediments. The wetland supports a number of amphibious species. Unfortunately, little is known about the transport of radionuclides in these species. The Jemez Mountains salamander (which is a candidate for listing under the Federal Endangered Species Act and is

classified as endangered by the state of New Mexico) may be exposed to radionuclides when it is on Laboratory property. This wetland should be preserved for its positive impacts on water quality, its positive effect on local biological diversity, and its potential use for collecting data to validate exposure models for ecological receptors such as the Jemez Mountains salamander.

4.4.4 Conclusions and Recommendations for Aggregate X

According to the decision process described in Chapter 5 of the work plan, the data collected during Phase I investigation confirmed the presence of potential COCs at PRS Nos. 48-002(e), 48-007(a and d) and 48-010.

The potential COCs identified in PRS No. 48-002(e) are radionuclides, PAHs, and PCBs. No other hazardous constituents, inorganic or organic, were identified as potential COCs. Even though PAHs and PCBs were identified, the levels of PCBs (maximum of 0.26 mg/kg) at this PRS are well below the established cleanup levels of 10 mg/kg (guidance for evaluation and cleanup of PCBs) for industrial sites with other COCs. Only the PAH benzo[a]pyrene (detected at less than 1 ppm) and the radionuclide ^{137}Cs (detected at 0.6 pCi/g above the SAL) were present above the SAL. This site is in a highly industrialized area of TA-48 in which a residential scenario is not appropriate. Worker exposure to contaminated soil at PRS No. 48-002(e) on a routine basis is likely to be very small. However, quantifying such exposure is difficult because of the need to integrate an assessment of the probability that exposure might occur on any given day. Therefore, based on NFA criterion number 4 (the PRS has been characterized, and available data indicate that COCs are not present at levels that pose risk based on the future land use), a class III permit modification will be requested to remove PRS No. 48-002(e) from the HSWA Module of the Laboratory's RCRA operating permit.

PRS No. 48-002(e) was recommended for NFA from an ecotoxicological standpoint in the habitat-based exposure rating (see Section 4.4.3.4).

The potential COCs confirmed at PRS Nos. 48-007(a and d) and 48-010 are radionuclides and manganese. The extent of contamination in water and soil media at the outfalls and the wetland in Aggregate X has not been established. However, based on NFA criterion number 3 (the PRS is regulated or closed under a different authority, which addresses corrective action), a Class III permit modification will be requested to remove these PRSs from the HSWA Module of the Laboratory's RCRA operating permit. The outfalls (PRS Nos. 48-007[a and d]) are permitted outfalls (see Section 4.4), and the potential COCs identified at the site are mainly radiological. The only RCRA potential COC was manganese in water, which exceeded the action level (the drinking water standard for manganese). However, the water in the wetland is not used for drinking water.

No potential COCs were identified during the ecological screening assessment for PRS Nos. 48-007(a and d) and 48-010. It is recommended that the wetland (PRS No. 48-010) be preserved for its positive impacts on water quality, its positive effect on local biological diversity, and its potential use for collecting data to validate exposure models for ecological receptors.

4.5 Aggregate Y

Aggregate Y is located north of building TA-48-1 and consists of PRS Nos. 48-007(b, c, and f). These PRSs are outfalls that discharge to the north into Mortandad Canyon.

PRS Nos. 48-007(b and c) discharge noncontact cooling water that cools vacuum pumps housed in building TA-48-1. PRS No. 48-007(b) discharges up to 420 gal. per day into Mortandad Canyon and was "grandfathered" into the NPDES permit (LANL 1985, 853). It has NPDES Permit No. 016 EPA 04A. PRS No. 48-007(c) discharges up to 110 gal. per day and was submitted for inclusion under the NPDES permit in 1987 (LANL 1991, 21557). It has NPDES Permit No. 131 EPA 04A.

PRS No. 48-007(f) was submitted to the EPA in November 1987 for inclusion under the NPDES permit to discharge up to 100 gal. per day of noncontact cooling water from x-ray equipment located in building TA-48-46 (LANL 1990, 7511). It has NPDES Permit No. 137 EPA 04A.

4.5.1 Previous Investigations for Aggregate Y

No documentation of previous investigation efforts has been located for the PRSs that are included in Aggregate Y.

4.5.2 Field Investigations for Aggregate Y

The discussion of the objectives of the investigation and the supporting conceptual model for Aggregate Y is taken directly from Chapter 7, Section 7.29.1, of the June 1994 addendum to the work plan.

This Phase I investigation was designed primarily to determine if surface contamination currently exists in Aggregate Y.

The selection of sample locations was biased toward areas where residual contamination was most likely to be present on the basis of the following conceptual model.

- In the past, unknown chemicals may have been disposed of in the drains that discharge to the outfalls in Aggregate Y.
- The channels for the outfalls may concentrate radioactive particles from materials washed from the facility by surface runoff.
- Contaminants present in the outfalls may concentrate in the drainages where evaporation is occurring.

A preliminary engineering survey was performed in support of sampling activities at Aggregate Y. FIMAD maps misplace the pipe and outfall location of the outfall at PRS No. 48-007(b) by approximately 50 ft. Figure 4-6 shows the correct location of the outfall; however, FIMAD coverages have not been plotted. Engineering drawings, FIMAD maps, and field observations were used to locate the outfalls.

An environmental survey (the areal extent of which was determined by FIMAD map observations and field observations) was conducted to locate areas of surface contamination. Within the survey area, an OVA was used to detect VOCs, and a Bicron pancake probe 2000 was used to detect gross-alpha, -beta, and -gamma radiation.

Field sampling activities for Aggregate Y were performed on July 16, 1993. A summary of sampling activities for Aggregate Y is presented in Table 4-15. Figure 4-6 shows the locations of all sample points in Aggregate Y.

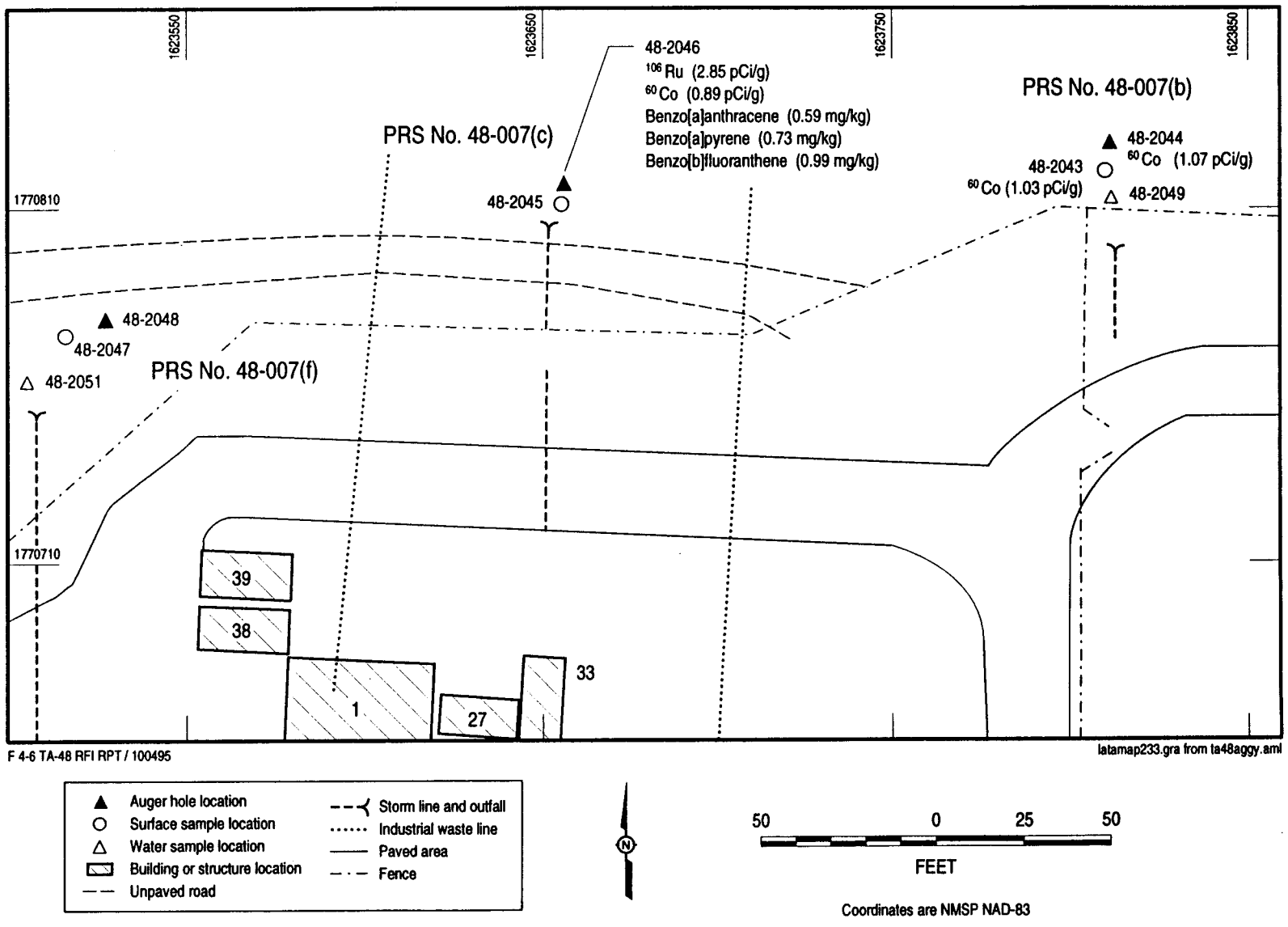


Figure 4-6. Sample locations and associated potential contaminants of concern for Aggregate Y, TA-48.

TABLE 4-15

SUMMARY OF SAMPLING ACTIVITIES FOR AGGREGATE Y

Location ID No.	Sample Type	Sample Intervals	Sample Description	Comments	Date Collected
48-2043	Surface	0–0.5 ft	Sandy soil with organic material	4 ft north and west of outfall source, PRS No. 48-007(b)	7/16/93
48-2044	Hand Auger	0–0.5 ft 0.5–1.5 ft 1.5–2.5 ft	Sand and organics Sand Sandy clay	Near Loc. ID No. 48-2043, PRS No. 48-007(b)	7/16/93
48-2045	Surface	0–0.5 ft	Sand, silt, and weathered tuff	6 ft north of inactive outfall source, PRS No. 48-007(c)	7/16/93
48-2046	Hand Auger	0–0.5 ft 0.5–1.5 ft 1.5–2.0 ft	Sandy soil Sandy soil and clay Clay; tuff at 2 ft	10 ft north of inactive outfall source, PRS No. 48-007(c)	7/16/93
48-2047	Surface	0–0.5 ft	Moist, sandy clay with organics	Near outfall source at PRS No. 48-007(f), north of fence	7/16/93
48-2048	Hand Auger	0–0.5 ft 0.5–1.5 ft	Sand; pea gravel Sand and clay; tuff at 1.5 ft	Near Loc. ID No. 48-2047, PRS No. 48-007(f)	7/16/93
48-2049	Water		From outfall at PRS No. 48-007(b)	5 ft north of source, pH: 8.24, temp: 87°F, conductivity: 474 µMhos/cm, flow: 1 gpm	7/16/93
48-2051	Water		From outfall at PRS No. 48-007(f)	South of 48-2047, pH: 8.25, temp: 84.3°F, conductivity: 405 µMhos/cm, flow: 2 gpm	7/16/93

Deviations from the Work Plan

The SAP for Aggregate Y is presented in the June 1994 addendum to the work plan. The SAP specifies that three types of samples were to be collected from each outfall drainage, with additional samples collected from any contaminated spots that may be detected in a radiological survey. Samples were to consist of a hand-auger hole, surface samples, and water samples (where water was present). The hand-auger holes were to be 3 ft deep if possible, and samples were to be collected from the following intervals: 0 to 1 ft, 1 to 2 ft, and 2 to 3 ft. For each of the three outfall drainages, the surface samples and the hand-auger hole samples were collected. The total depth of the hand-auger holes ranged from 1.5 to 2.5 ft because the soil/tuff contact was reached at these depths, where further advancement of the hand auger was not possible. The actual sample collection intervals from the hand-auger holes were 0 to 0.5 ft, 0.5 to 1.5 ft, and 1.5 to total depth. Water samples were not collected at the outfall at PRS No. 48-007(c) because the outfall was not active at the time of the sampling effort, but water samples were collected from the outfalls at PRS No. 48-007(b and f).

Radiation and OVA grid surveys were not performed in support of field sampling activities at this aggregate. The samples were screened for radiation and organic vapors at the time of sampling. No radiation readings above background levels were recorded. Organic vapor measurements above zero were recorded at one sample location, as discussed in Section 4.5.2.2.

4.5.2.1 Results of Field Surveys

No VOCs were detected, and gross-alpha, -beta, and -gamma radiation readings were within background values (120 cpm to 160 cpm).

4.5.2.2 Results of Field Screening

All samples were scanned for gross-alpha, -beta, and -gamma radiation with the Bicron pancake probe 2000 and scanned for VOCs with an OVA.

Positive OVA readings were observed in the hand-auger hole at Location ID No. 48-2048. A reading of 100 ppm was recorded at the 0.5 to 1.5 ft interval.

No other elevated measurements indicative of contamination were recorded during the field screening process for the samples from Aggregate Y.

4.5.3 Screening Assessment for Aggregate Y

The screening assessment of the analytical results for samples collected in Aggregate Y was conducted according to the methodology outlined in Chapter 3, Section 3.2. The screening assessment data tables are found in Tables B-21 through B-25 in Appendix B. The analytical data for all three PRSs within Aggregate Y were grouped together for the screening assessment. The results of the screening assessment should be interpreted in conjunction with an evaluation of the analytical data quality and the SAP for Aggregate Y. A more comprehensive assessment of the quality of the analytical data is presented in Chapter 3, Section 3.1. Additional information regarding the selection of radionuclide analytes is found in Chapter 3, Section 3.1.3.

For the purposes of the screening assessment, the noncarcinogenic constituent data set consists of both the inorganic constituents analyzed by SW-846 solid waste methods (EPA 1986, 31732) and the noncarcinogenic organic constituents. Because of the large number of organic constituents that were analyzed for, only those organic constituents that were present above the sample EQL are included in the screening data tables. The SAL values for inorganic constituents analyzed in Aggregate Y are based solely on noncarcinogenic endpoints. Screening comparisons for the inorganic constituents analyzed by the EDXRF method are performed separately from the constituents that were analyzed by SW-846 methods. The data sets for the inorganic analyses cannot be directly compared since correlation factors are unavailable for those trace elements measured by both methods. As discussed in Chapter 3, Section 3.1, the EDXRF data set could not be screened against the site-specific background UTL values since the background measurements were performed using SW-846 methods.

The carcinogenic data set for Aggregate Y consists of carcinogenic organic constituents that were present above the sample EQL. As noted above, no inorganic constituents are included in the carcinogenic data set.

The sample results for radionuclide analyses are divided into two data sets. Separate screening comparisons were performed for measurements of radionuclide activity obtained from fixed-site and mobile laboratory analysis. The two data sets cannot be directly compared because of large uncertainties associated with the mobile laboratory analyses.

The analytical data quality evaluation for Aggregate Y, which is found in Appendix A, indicates only one problem that will affect the screening assessment: the inductively coupled plasma emission spectroscopy result for calcium in the sample collected at Location ID No. 48-2048 (0 to 0.5 ft) should be regarded as estimated and potentially biased high.

4.5.3.1 Comparison to Background and SAL Values

Comparison to Background Values

The analytical results for radionuclide and noncarcinogenic constituents in soil samples collected from Aggregate Y were compared to background UTL values as an initial step in the screening assessment, as discussed in Chapter 3, Section 3.2.1. A distributional shift test was not performed because the data sets were too small. The screening assessment data tables for the background UTL comparisons, which identify COPCs present above the UTL values for each sample, are provided in Tables B-21 through B-23 in Appendix B. The COPCs that were identified are listed in Table 4-16. Included in the list of COPCs are those constituents for which a background UTL value is not available.

TABLE 4-16

COPCs CARRIED FORWARD TO THE SAL COMPARISON IN AGGREGATE Y

Radionuclides	Noncarcinogenic Constituents
^{241}Am[a]	Acetone[a]
^{144}Ce[a]	Benzo[g,h,i]perylene[a]
^{60}Co[a]	Calcium
^{238}Pu	Fluoranthene[a]
^{239,240}Pu	Lithium[a]
^{106}Ru[a]	Molybdenum[a]
^{230}Th[a]	Phenanthrene[a]
^{234}U	Pyrene[a]
^{235}U	Silver[a]
^{238}U	Strontium[a]

a. COPC is carried forward because a UTL value is not available.

Twenty soil samples (including nine duplicate samples) that were collected from six locations (two locations for each PRS) at depths ranging from the surface to 2.5 ft were screened at the mobile laboratory facility for selected radionuclides by gamma spectroscopy. Twelve soil samples (including one duplicate sample) were analyzed at a fixed-site laboratory for the alpha-emitting isotopes of americium, plutonium, thorium, and uranium. Of the alpha-emitting radionuclides, ^{238}Pu, ^{239,240}Pu, ^{234}U, ^{235}U, and ^{238}U were present above background levels and were carried forward to the SAL comparison. The radionuclides ^{228}Th and ^{232}Th were eliminated from further consideration. The activities of the radionuclides for which UTL values are available that were measured at the mobile laboratory facility were below background levels. The radionuclides ^{241}Am, ^{144}Ce, ^{60}Co, ^{106}Ru, and ^{230}Th were carried forward to the SAL comparison since background values are unavailable for these radionuclides.

Three soil samples (including one duplicate sample) that were collected from PRS No. 48-007(f) at depths ranging from the surface to 1.5 ft were analyzed for inorganic constituents by SW-846 methods. Calcium

was present at a concentration exceeding its UTL value at Location ID No. 48-2048 at PRS No. 48-007(f) and was carried forward to the SAL comparison. Those inorganic constituents for which no background value is available (including lithium, molybdenum, silver, and strontium) were also carried forward to the SAL comparison.

Six soil samples (including three duplicate samples) that were collected from one location at each PRS were analyzed for VOCs and SVOCs. No organic constituents were detected in the samples from Location ID No. 48-2044 at PRS No. 48-007(b). The noncarcinogenic semivolatile PAHs benzo[g,h,i]perylene, fluoranthene, phenanthrene, and pyrene were detected in the soil sample collected from Location ID No. 48-2046 (0.5 to 1.5 ft) at PRS No. 48-007(c). The noncarcinogenic organic constituents acetone, fluoranthene, and pyrene were present in the soil sample collected from Location ID No. 48-2048 (0.5 to 1.5 ft) at PRS No. 48-007(f). Background values are not available; therefore, these noncarcinogenic constituents were carried forward to the SAL comparison.

Comparison to Human Health Screening Action Levels

COPCs that were not eliminated in the background comparison were evaluated by comparison to the human health SALs. The carcinogenic and EDXRF inorganic constituent data sets also underwent the comparison to SAL values. The screening assessment data tables for the SAL comparisons and the multiple constituent analysis are provided in Tables B-12 through B-25 in Appendix B. Because of the large number of organic analytes, SAL comparisons for organic constituents, both noncarcinogenic and carcinogenic, are provided only for those analytical results greater than the sample EQL.

EDXRF analyses were obtained for 13 soil samples (including 2 duplicate samples) that were collected from 2 locations at each PRS. Six soil samples (including 3 duplicate samples) were analyzed for PCBs, VOCs, and SVOCs; these results are included in the carcinogenic constituent data set.

Constituents with one or more sample values exceeding a SAL and those that contribute greater than 5% to a SAL-normalized sum exceeding 1.0 in the multiple constituent analysis are considered to be potential COCs and are identified in Table 4-17. The sample locations where potential COCs were identified in Aggregate Y are shown in Figure 4-6.

TABLE 4-17

POTENTIAL COCs IDENTIFIED IN AGGREGATE Y

PRS No.	Radionuclides	Noncarcinogenic Constituents	Carcinogenic Constituents
48-007(b)	^{60}Co[a]	None identified	None identified
48-007(c)	^{60}Co[b] ^{106}Ru[b]	None identified	Benzo[a]pyrene[a] Benzo[b]fluoranthene[b] Benzo[a]anthracene[b]
48-007(f)	None identified	None identified	None identified

a. Potential COC that was detected above SAL value.
b. Identified as a potential COC in soil based on multiple constituent analysis.

The activity of ^{60}Co measured in the mobile laboratory facility exceeded the SAL value of 0.9 pCi/g in three samples collected at Location ID Nos. 48-2043 (0 to 0.5 ft) and 48-2044 (0 to 0.5 ft and 0.5 to 1.5 ft) at PRS No. 48-007(b). In addition, ^{60}Co and ^{106}Ru were identified as potential COCs based on a multiple constituent analysis for the sample from Location ID No. 48-2046 (0 to 0.5 ft) at PRS No. 48-007(c). No radionuclides were identified as potential COCs from the fixed-site laboratory analyses for alpha-emitting radionuclides.

In both soil samples (regular and duplicate) collected from Location ID No. 48-2046 at PRS No. 48-007(c), the carcinogenic PAH constituents benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, and chrysene were detected. Benzo[a]pyrene was measured above its SAL value of 0.1 mg/kg. Benzo[b]fluoranthene and benzo[a]anthracene were identified as potential COCs in the same sample based on the results of the multiple constituent analysis. Chrysene was present at a concentration two orders of magnitude less than its SAL value and was eliminated from further consideration.

No inorganic constituents (measured by either EDXRF or SW-846 methods) or organic noncarcinogenic constituents were identified as potential COCs in any of the soil samples. Two water samples collected from Location ID Nos. 48-2049 at PRS No. 48-007(b) and 48-2051 at PRS No. 48-007(f) were analyzed for inorganic constituents by SW-846 methods. No inorganic constituents were identified as potential COCs in the water samples.

Constituents Identified as Potential COCs

At PRS No. 48-007(b), ^{60}Co was measured above the SAL value in samples from Location ID Nos. 48-2043 (0 to 0.5 ft) and 48-2044 (0 to 0.5 ft and 0.5 to 1.5 ft) in the mobile laboratory analyses. At PRS No. 48-007(c), ^{60}Co and ^{106}Ru were identified as potential COCs based on the mobile laboratory analysis of the sample collected at Location ID No. 48-2046 (0 to 0.5 ft). Fixed-site laboratory gamma spectroscopy measurements were not performed for any of the samples collected in Aggregate Y. Comparison of mobile and fixed-site laboratory results for the radionuclide potential COCs identified in Aggregate Y is not possible. Therefore, ^{60}Co and ^{106}Ru are designated as COCs in Aggregate Y based solely on the mobile laboratory analyses.

Benzo[a]pyrene was detected above SAL in the sample collected from Location ID No. 48-2046 (0.5 to 1.5 ft) at PRS No. 48-007(c). Benzo[a]anthracene and benzo[b]fluoranthene were identified as potential COCs in the same sample based on the results of the multiple constituent analysis. Benzo[b]fluoranthene was measured at 0.99 mg/kg, which is very near the SAL value of 1 mg/kg. The SAL-normalized value for this sample is 1.6.

Constituents Not Identified as Potential COCs

Constituents for which a SAL value is not available or for which the SAL value is lower than the reporting limit require further evaluation as part of the screening assessment methodology (see Figure 3-1). The evaluation of these constituents is presented in this section.

Organic constituents with reporting limits exceeding their soil SAL values included benzo[a]pyrene, dibenz[a,h]anthracene, m-benzidine, bis(2-chloroethyl) ether, N-nitrosodi-n-propylamine, and N-nitroso-dimethylamine. Benzidine is used in the production of dyes, and the nitrosamine compounds are used as additives in gasoline and lubricants. Neither class of compounds is reasonably associated with the outfalls in Aggregate Y. The PAH compounds benzo[a]pyrene and dibenz[a,h]anthracene have SAL values of 0.1 mg/kg, which is approximately one-third the EQL value of 0.33 mg/kg for soil samples. These compounds are associated with petroleum products and combustion by-products and are often present at trace levels at industrial sites.

Benzo[a]pyrene was detected above the EQL in two (a regular sample and a duplicate sample) of the six soil samples collected in Aggregate Y. A range of other PAH compounds was also present in the samples; however, dibenz[a,h]anthracene was not detected above the EQL. It is possible that dibenz[a,h]anthracene is also present at concentrations below 0.33 mg/kg in the same samples, which were collected at PRS No. 48-007(c). The PAH compounds pyrene and fluoranthene were detected above EQL in a soil sample collected from PRS No. 48-007(f); no other PAH compounds were detected above the sample EQL. It is possible that both benzo[a]pyrene and dibenz[a,h]anthracene are present at concentrations less than the sample EQL. Although PAHs were not identified as potential COCs at any location other than Location ID No. 48-2046, insufficient data exist to conclude that PAHs are not present above SALs at PRS Nos. 48-007(b and f).

Approximately 132 individual organic constituents were analyzed for in Aggregate Y. Of this total, approximately 18 do not have SAL values. With the exception of two noncarcinogenic PAH compounds, none of the organic constituents lacking SAL values were detected above their EQL in any sample. Therefore, these constituents do not need further evaluation. Benzo[g,h,i]perylene and phenanthrene were detected at Location ID No. 48-2046 at PRS No. 48-007(c); both constituents were present at concentrations less than 1 mg/kg. These two PAH compounds are unlikely to pose a risk to human health at the levels detected; therefore, they do not need further evaluation at PRS No. 48-007(c).

Of the inorganic constituents present in the two soil samples from PRS No. 48-007(f) that were analyzed by SW-846 methods, the following do not have SAL values: arsenic, aluminum, calcium, iron, lithium, magnesium, potassium, and sodium. Of these, aluminum, calcium, iron, magnesium, potassium, and sodium are recognized by the US EPA as being essentially nontoxic under typical environmental exposure scenarios (EPA 1989, 8021) and do not warrant further evaluation for human health risk. Calcium was found above background in Aggregate Y but was eliminated from further evaluation for human health risk. A site-specific background UTL value is available for arsenic and is used for screening assessment purposes. The maximum lithium concentration measured in the two soil samples was 5.7 mg/kg. There is no evidence that lithium-containing compounds are associated with the noncontact cooling water discharged at PRS No. 48-007(f); therefore, lithium does not need further evaluation.

Of the inorganic constituents present in the water samples that were analyzed by SW-846 methods, excluding those regarded as nontoxic, cobalt and lithium do not have SAL values. The maximum lithium concentration measured in the two water samples collected at PRS Nos. 48-007(b and f) was 16 µg/L; therefore, lithium does not need further evaluation at PRS Nos. 48-007(b and f). The cobalt concentration was reported as <4 µg/L, which is less than the EDL of 7 µg/L listed in SW-846 Method 610 for water analysis (EPA 1986, 31732). Therefore, cobalt does not need further evaluation at PRS Nos. 48-007(b and f).

Inorganic constituents in soil measured by the EDXRF method were not compared to the UTL background values, for reasons discussed in Chapter 3, Section 3.1.1. Of the constituents measured by EDXRF (except the nontoxic analytes discussed above) the following do not have SAL values: arsenic, thorium, titanium, and uranium. Titanium, which is widespread in the environment, is generally recognized as being physiologically inert. The alpha-emitting isotopes of thorium and uranium were analyzed by alpha spectrometry, and the risk associated with the presence of thorium and uranium was evaluated on an isotopic basis.

Arsenic was not found above the background UTL in the two samples analyzed by SW-846 methods at PRS No. 48-007(f). Arsenic was not detected above the EDXRF detection limit of 10 mg/kg in Aggregate Y; no process is associated with Aggregate Y that would contribute to arsenic in the environment as this location. Therefore, further evaluation of arsenic is not needed. The following analytes analyzed in soil by SW-846 methods are not included in the EDXRF data set and therefore were not analyzed for at PRS Nos. 48-007(b and c): aluminum, beryllium, cobalt, magnesium, sodium, thallium, vanadium, silver, lithium, molybdenum, and strontium.

All radionuclides identified as potential COPCs by the background screening process had SAL values, and no reporting limits exceeded these values in any sample.

4.5.3.2 Data Interpretation

The presence of radionuclides and carcinogenic COCs in soil medium was established in the Phase I investigation of Aggregate Y. The sample locations where potential COCs have been identified are shown in Figure 4-6. The lateral extent of contamination was not established in the Phase I investigation. Further characterization of PRS Nos. 48-007(b and c) is required to confirm the presence of radionuclide COCs. Further characterization of the carcinogenic COCs identified at PRS No. 48-007(c) is not required, as explained in Section 4.5.4.

4.5.3.3 Risk Assessment

No human health or ecological risk assessment was performed for Aggregete Y.

4.5.3.4 Ecotoxicological Screening Assessment

The ecotoxicological screening assessment of the analytical results for samples collected at Aggregate Y was conducted according to the methodology outlined in Chapter 3, Section 3.2.3. The screening assessment data tables for ESAL comparisons are provided in Table C-5 in Appendix C.

Ranking of Habitat Condition and Receptor Accessibility to COPCs

Ecological characteristics of PRS Nos. 48-007(b, c, and f) at Aggregate Y were reviewed to estimate the likelihood that ecological receptors could come in contact with COPCs to a significant degree. The location of these PRSs (see Figure 1-3) and the frequency of human disturbance are such that ecological receptors use the site for some, but not all, portions of their life cycles. Therefore, these PRSs were given a landscape condition score of two. COPCs could be dispersed to the canyon area from the outfalls, so all three PRSs were given a receptor access score of three. These scores suggest that exposure is quite possible; therefore, a comparison to ESAL values is required for these PRSs (see Figure 3-3 to review the decision model).

Comparison to Ecotoxicological Screening Action Levels

Aggregate Y contains a habitat that is suitable for use by spotted bats, which are candidates for listing under the Federal Endangered Species Act and are classified as endangered by the state of New Mexico. Therefore, the COPCs carried forward to the human health SAL comparison (Table 4-16) were also carried forward to the ecotoxicological screening assessment. Uranium, because of its systemic toxicity, was the only radionuclide evaluated. Potential COCs with one or more values exceeding an ESAL are identified in Table 4-18.

TABLE 4-18

POTENTIAL COCs IDENTIFIED DURING ECOTOXICOLOGICAL SCREENING IN AGGREGATE Y

Radionuclides	Inorganic Constituents	Organic Constituents
Uranium[a]	None identified	None identified

a. Identified as a potential COC based on systemic toxicity.

The ecotoxicological screening assessment identified uranium as a potential COC. No organic or inorganic constituents were identified as potential COCs. One sample contained ^{238}U activities that were 0.05 pCi/g greater than the background UTL and the ESAL; these activities could adversely affect ecological receptors that make exclusive use of these sampling locations. When other uranium samples in the aggregate are averaged for a risk assessment, the value is below the uranium UTL. Any ecological receptors of concern (in this case, spotted bats) would use an area that is much larger than Aggregate Y, making it unlikely that uranium from this aggregate alone would cause significant adverse effects to the environment.

4.5.4 Conclusions and Recommendations for Aggregate Y

According to the decision process described in Chapter 5 of the work plan, the data collected during the Phase I investigation confirmed the presence of potential COCs in Aggregate Y at PRS Nos. 48-007(b, c, and f). The potential COCs identified in Aggregate Y are alpha- and gamma-emitting radionuclides and PAHs. No other hazardous constituents, inorganic or organic, were identified as potential COCs.

The carcinogenic PAH compound benzo[a]pyrene was detected at PRS No. 48-007(c) at a concentration (0.73 mg/kg) that exceeded the SAL (0.10 mg/kg); it was therefore considered a COC. Three other carcinogenic PAHs detected at this PRS were above the sample EQLs but below the SAL. Two of these compounds were identified as COCs based on the results of the multiple contstituent analysis.

Although PAHs were identified as potential COCs at PRS No. 48-007(c), they are eliminated from further consideration for the following reasons.

- The low-level concentrations detected at one PRS and the nondetect results of approximately 132 other SVOC compounds (some of which are indicators of a hydrocarbon release) confirms that no laboratory release is suspected at the outfalls.
- Non-laboratory-related sources for PAHs are identified (such as industrial runoff from the TA-48 complex) that can be attributable to these low-level PAHs.
- The purpose of collecting the six biased samples within the discharge areas of the outfall was to determine if an accumulation of contaminants has occurred from any historical releases. However, the fact that only one PAH compound at one PRS is above the SAL indicates that such releases have not impacted the environment.

Therefore, based on NFA criterion number 4 (the PRS has been characterized, and available data indicate that no source of contamination exists which would pose a risk to human health), a class III permit modification will be requested to remove PRS Nos. 48-007(b, c, and f) from the HSWA Module of the Laboratory's RCRA operating permit.

The potential radionuclide COCs identified with the mobile radiological van at PRS No. 48-007(b and c) must be confirmed using the fixed laboratory gamma spectroscopy method. A Phase II scope of work will be prepared if these COCs are confirmed to be above SALs.

One potential COC was identified by the ecological screening assessment; however, any ecological receptors of concern would use an area that is much larger than Aggregate Y, making it unlikely that uranium from this aggregate alone could cause significant adverse effects to the environment. Because exposure to these and other potential COCs around the Laboratory may be part of a process leading to cumulative adverse effects to ecological receptors, it is recommended that if a site-wide ecological risk assessment is conducted, this potential COC be included.

References for Chapter 4

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Appendix A

Data Quality Evaluation

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TABLE A-1

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE K

Part I. Regular Field Samples

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-001	K48-2001-A1	AAA3445	Soil	Reg	VOCs	15098	Accuracy	Due to poor surrogate recovery, all results and quantitation limits should be regarded as estimates.
					SW-846 metals	15106	Blank	Due to out-of-control preparation blank, the sample quantitation limit for the following analyte(s) should be regarded as estimates: Cr.
					EDXRF metals	15100	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba and Fe.
					Isotopic uranium	15102	Accuracy	Due to recovery from PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: U-235.
					Isotopic thorium	15102	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: Th-282, Th-230, and Th-232.
48-001	K48-2002-A1	AAA3448	Soil	Reg	VOCs	15098	Accuracy	Due to poor surrogate recovery, all results and quantitation limits should be regarded as estimates.
					EDXRF metals	15100	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cr, and Fe.
					Isotopic uranium	15102	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-243, U-235, and U-238.
					Isotopic thorium	15102	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: Th-282, Th-230, and Th-232.
					Gamma spec	15102	LIA	Lost in analysis.
48-001	K48-2002-A2	AAA3449	Soil	Reg	VOCs	15098	Accuracy	Due to poor surrogate recovery, all results and quantitation limits should be regarded as estimates.
					EDXRF metals	15100	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba and Fe.
					Isotopic uranium	15102	Accuracy	Due to recovery from PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: U-235.
					Isotopic thorium	15102	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: Th-282, Th-230, and Th-232.

BB = bottle blank
EQL = estimated quantitation limit
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = quality control

TABLE A-1 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE K

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-001	K48-2003-A1	AAA3451	Soil	Reg	VOCs	15098	Accuracy	Due to poor surrogate recovery, all results and quantitation limits should be regarded as estimates.
					EDXRF metals	15100	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cr, and Fe.
					Isotopic uranium	15102	Accuracy	Due to recovery from PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: U-235.
					Isotopic thorium	15102	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: Th-282, Th-230, and Th-232.
48-001	K48-2003-A2	AAA3452	Soil	Reg	VOCs	15098	Accuracy	Due to poor surrogate recovery, all results and quantitation limits should be regarded as estimates.
					EDXRF metals	15100	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cr, and Fe.
					Isotopic uranium	15102	Accuracy	Due to recovery from PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: U-235.
					Isotopic thorium	15102	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: Th-282, Th-230, and Th-232.
48-001	K48-2004-A1	AAA3454	Soil	Reg	VOCs	15098	Accuracy	Due to poor surrogate recovery, all results and quantitation limits should be regarded as estimates.
					SW-846 metals	15106	Blank	Due to out-of-control preparation blank, the sample quantitation limit for the following analyte(s) should be regarded as estimates: Cr.
					EDXRF metals	15100	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba and Fe.
					Isotopic uranium	15102	Accuracy	Due to recovery from PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: U-235.
48-001	K48-2005-A1	AAA3457	Soil	Reg	VOCs	15098	Accuracy	Due to poor surrogate recovery, all results and quantitation limits should be regarded as estimates.
					EDXRF metals	15100	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba and Fe.
					Isotopic uranium	15102	Accuracy	Due to recovery from PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: U-235.

BB = bottle blank
EQL = estimated quantitation limit
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = quality control

TABLE A-1 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE K

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
Part II. Field QC Samples								
SOIL SAMPLES								
48-001	K48-2002-A1	AAA3476	Soil	Dup	Isotopic uranium	15102	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-243, U-235, and U-238.
					Gamma spec	15102	LIA	Lost in analysis.
48-001	K48-2005-A2	AAA3473	Soil	Dup	VOCs	15098	Accuracy	Due to poor surrogate recovery, all results and quantitation limits should be regarded as estimates.
48-001	K48-2005-A2	AAA3474	Soil	Dup	EDXRF metals	15100	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cr, and Fe.
WATER SAMPLES								
48-001	K48	AAA3487	Liquid	BB	SW-846 metals	15111	Blank	Due to recovery from LCS outside criteria, the sample quantitation limit for the following analyte(s) should be regarded as estimates: Cd.
48-001	K48	AAA3486	Liquid	ERB	SW-846 metals	15111	Blank	Due to recovery from LCS outside criteria, the sample quantitation limit for the following analyte(s) should be regarded as estimates: Cd.
48-001	K48	AAA3485	Liquid	BB	SVOCs	15098	Accuracy	Due to poor surrogate recovery, sample quantitation limits should be regarded as estimates.
48-001	K48	AAA3484	Liquid	ERB	SVOCs	15098	Phthalates	Phthalate contamination in sample less than 5x EQL. Attributable to laboratory contamination.
48-001	K48	AAA3483	Liquid	BB	VOCs	15098	Accuracy	Due to poor surrogate recovery, all results and quantitation limits should be regarded as estimates.
48-001	K48	AAA3482	Liquid	ERB	VOCs	15098	Accuracy	Due to poor surrogate recovery, all results and quantitation limits should be regarded as estimates.
48-001	K48	AAA3481	Liquid	BB	Gamma spec	15120	LIA	Lost in analysis.
48-001	K48	AAA3480	Liquid	BB	Gamma spec	15120	LIA	Lost in analysis.
48-001	K48	AAA3479	Liquid	ERB	Gamma spec	15120	LIA	Lost in analysis.
48-001	K48	AAA3478	Liquid	ERB	Gamma spec	15120	LIA	Lost in analysis.
48-001	K48	AAA3488	Liquid	Trip	VOCs	15098	Accuracy	Due to poor surrogate recovery, all results and quantitation limits should be regarded as estimates.

BB = bottle blank
EQL = estimated quantitation limit
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = quality control

TABLE A-2

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE M

Part I. Regular Field Samples

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-003	M48-2010-B1	AAA3401	Soil	Reg	SW-846 metals	15157	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cr, Fe, K, Mo, and Ni.
					EDXRF metals	15154	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Ca, Fe, Mn, and Pb.
48-003	M48-2010-B2	AAA3402	Soil	Reg	EDXRF metals	15154	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Ca, Fe, Mn, and Pb.
					Gamma spec	15165	LIA	Lost in analysis.
48-003	M48-2010-B3	AAA3403	Soil	Reg	EDXRF metals	15154	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Ca, Fe, Mn, and Pb.
					Gamma spec	15165	LIA	Lost in analysis.
48-003	M48-2011-B1	AAA4449	Soil	Reg	EDXRF metals	15182	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Cr and Zn.
					Isotopic uranium	15185	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-243, U-235, and U-238.
48-003	M48-2011-B2	AAA4450	Soil	Reg	SW-846 metals	15179	Hold time	Holding time for ICPES analysis exceeded by 11 days. No impact on data quality.
					SW-846 metals	15179	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: As.
					EDXRF metals	15182	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Cr, Cu, and Zn.
					Isotopic uranium	15185	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-243, U-235, and U-238.
48-003	M48-2011-B3	AAA4451	Soil	Reg	EDXRF metals	15182	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Cr and Zn.
					Isotopic uranium	15185	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-243, U-235, and U-238.
48-003	M48-2011-B4	AAA3542	Soil	Reg	EDXRF metals	15182	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Cr and Zn.
					Isotopic uranium	15185	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-243, U-235, and U-238.
48-003	M48-2012-B1	AAA3404	Soil	Reg	EDXRF metals	15154	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Ca, Fe, Mn, and Pb.

BB = bottle blank
ERB = equipment rinsate blank
LIA = lost in analysis
LCS = laboratory control sample
PE = performance evaluation
QC = quality control

TABLE A-2 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE M

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-003	M48-2012-B2	AAA3405	Soil	Reg	EDXRF metals	15154	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Ca, Cu, Fe, Mn, and Pb.
					Gamma spec	15165	LIA	Lost in analysis.
48-003	M48-2012-B3	AAA3406	Soil	Reg	EDXRF metals	15154	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Ca, Fe, Mn, and Pb.
					Gamma spec	15165	LIA	Lost in analysis.
48-003	M48-2013-B1	AAA4452	Soil	Reg	EDXRF metals	15182	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Cr and Zn.
					Isotopic uranium	15185	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-243, U-235, and U-238.
48-003	M48-2013-B2	AAA4453	Soil	Reg	EDXRF metals	15182	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Cr, Cu, and Zn.
					Isotopic uranium	15185	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-243, U-235, and U-238.
48-003	M48-2013-B3	AAA4454	Soil	Reg	SW-846 metals	15179	Hold time	Holding time for ICPES analysis exceeded by 11 days. No impact on data quality.
					SW-846 metals	15179	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: As.
					EDXRF metals	15182	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Cr and Zn.
48-003	M48-2014-B1	AAA3407	Soil	Reg	EDXRF metals	15154	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Ca, Cu, Fe, Mn, and Pb.
48-003	M48-2014-B2	AAA3408	Soil	Reg	SW-846 metals	15157	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cr, Fe, K, Mo, and Ni.
					EDXRF metals	15154	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Ca, Fe, Mn, and Pb.
					Gamma spec	15165	LIA	Lost in analysis.
48-003	M48-2014-B3	AAA3409	Soil	Reg	EDXRF metals	15154	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Ca, Cu, Fe, Mn, and Pb.
					Gamma spec	15165	LIA	Lost in analysis.
48-003	M48-2014-B4	AAA4473	Soil	Reg	EDXRF metals	15154	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Ca, Fe, Mn, and Pb.
					Gamma spec	15165	LIA	Lost in analysis.

BB = bottle blank
ERB = equipment rinsate blank
LIA = lost in analysis
LCS = laboratory control sample
PE = performance evaluation
QC = quality control

TABLE A-2 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE M

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-003	M48-2015-B1	AAA4455	Soil	Reg	EDXRF metals	15182	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Cr and Zn.
					Isotopic uranium	15185	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-243, U-235, and U-238.

BB = bottle blank
ERB = equipment rinsate blank
LIA = lost in analysis

LCS = laboratory control sample
PE = performance evaluation
QC = quality control

TABLE A-2 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE M

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-003	M48-2015-B2	AAA4456	Soil	Reg	EDXRF metals	15182	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Cr and Zn.
					Isotopic uranium	15185	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-243, U-235, and U-238.
48-003	M48-2015-B3	AAA4457	Soil	Reg	EDXRF metals	15182	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Cr, Cu, and Zn.
					Isotopic uranium	15185	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-243, U-235, and U-238.
48-003	M48-2015-B4	AAA3543	Soil	Reg	EDXRF metals	15182	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Cr and Zn.
					Isotopic uranium	15185	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-243, U-235, and U-238.
48-003	M48-2016-S1	AAA3493	Soil	Reg	EDXRF metals	15122	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni, Pb, Th, and Zn.
					Isotopic thorium	15128	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-228, Th-230, and Th-232.
48-003	M48-2017-S1	AAA3494	Soil	Reg	SW-846 metals	15125	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: As, Cr, Pb, and Zn.
					EDXRF metals	15122	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni, Pb, Th, and Zn.
				Reg	Isotopic thorium	15128	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-228, Th-230, and Th-232.
48-003	M48-2018-S1	AAA3495	Soil	Reg	EDXRF metals	15122	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni, Pb, Th, and Zn.
					Isotopic thorium	15128	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-228, Th-230, and Th-232.
48-003	M48-2019-S1	AAA3496	Soil	Reg	EDXRF metals	15122	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni, Pb, Th, and Zn.
					Isotopic thorium	15128	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-228, Th-230, and Th-232.
48-003	M48-2020-S1	AAA3497	Soil	Reg	EDXRF metals	15122	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni, Pb, Th, and Zn.

BB = bottle blank
ERB = equipment rinsate blank
LIA = lost in analysis

LCS = laboratory control sample
PE = performance evaluation
QC = quality control

TABLE A-2 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE M

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
					Isotopic thorium	15128	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-228, Th-230, and Th-232.

BB = bottle blank
ERB = equipment rinsate blank
LIA = lost in analysis

LCS = laboratory control sample
PE = performance evaluation
QC = quality control

TABLE A-2 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE M

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-003	M48-2054-A1	AAA3512	Soil	Reg	SW-846 metals	15125	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: As, Cr, Pb, and Zn.
					EDXRF metals	15122	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni, Pb, Th, and Zn.
					Isotopic thorium	15128	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-228, Th-230, and Th-232.
					Gamma spec	15126	LIA	Lost in analysis.
48-003	M48-2054-A2	AAA3514	Soil	Reg	EDXRF metals	15122	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni, Pb, Th, and Zn.
					Isotopic thorium	15128	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-228, Th-230, and Th-232.
					Gamma spec	15126	LIA	Lost in analysis.
48-003	M48-2054-A3	AAA3515	Soil	Reg	EDXRF metals	15122	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni, Pb, Th, and Zn.
					Isotopic thorium	15128	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-228, Th-230, and Th-232.
48-003	M48-2055-A1	AAA3513	Soil	Reg	EDXRF metals	15122	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni, Pb, Th, and Zn.
					Isotopic thorium	15128	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-228, Th-230, and Th-232.
					Gamma spec	15126	LIA	Lost in analysis.
48-003	M48-2055-A2	AAA3516	Soil	Reg	EDXRF metals	15122	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni, Pb, Th, and Zn.
					Isotopic thorium	15128	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-228, Th-230, and Th-232.
48-003	M48-2055-A3	AAA3470	Soil	Reg	EDXRF metals	15122	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni, Pb, Th, and Zn.
					Isotopic thorium	15128	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-228, Th-230, and Th-232.
48-003	M48-2055-A4	AAA3471	Soil	Reg	EDXRF metals	15122	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni, Pb, Th, and Zn.

BB = bottle blank
ERB = equipment rinsate blank
LIA = lost in analysis
LCS = laboratory control sample
PE = performance evaluation
QC = quality control

TABLE A-2 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE M

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
					Isotopic thorium	15128	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-228, Th-230, and Th-232.

BB = bottle blank
ERB = equipment rinsate blank
LIA = lost in analysis

LCS = laboratory control sample
PE = performance evaluation
QC = quality control

TABLE A-2 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE M

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
Part II. Field QC Samples								
SOIL SAMPLES								
48-003	M48-2010-B1	AAA3416	Soil	Dup	SW-846 metals	15157	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cr, Fe, K, Mo, and Ni.
48-003	M48-2011-B1	AAA4459	Soil	Dup	Isotopic uranium	15185	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-243, U-235, and U-238.
48-003	M48-2011-B2	AAA4461	Soil	Dup	SW-846 metals	15179	Hold time	Holding time for ICPES analysis exceeded by 11 days. No impact on data quality.
						15179	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: As.
48-003	M48-2012-B3	AAA3412	Soil	Dup	EDXRF metals	15154	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Ca, Fe, Mn, and Pb.
48-003	M48-2013-B1	AAA4465	Soil	Dup	EDXRF metals	15182	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Cr, Cu, and Zn.
48-003	M48-2017-S1	AAA3502	Soil	Dup	SW-846 metals	15125	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: As, Cr, Pb, and Zn.
48-003	M48-2018-S1	AAA3501	Soil	Dup	Isotopic thorium	15128	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-228, Th-230, and Th-232.
48-003	M48-2020-S1	AAA3499	Soil	Dup	EDXRF metals	15122	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni, Pb, Th, and Zn.
WATER SAMPLES								
48-003	M48	AAA3417	Liquid	ERB	SW-846 metals	15157	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Fe, K, Mo, and Sb.
48-003	M48	AAA3418	Liquid	BB	SW-846 metals	15157	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Fe, K, Mo, and Sb.
48-003	M48	AAA3503	Liquid	ERB	Isotopic thorium	15128	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-228 and Th-232.
48-003	M48	AAA3504	Liquid	ERB	Isotopic thorium	15128	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: Th-282, Th-230, and Th-232.
48-003	M48	AAA3505	Liquid	BB	Isotopic thorium	15128	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: Th-282, Th-230, and Th-232.

BB = bottle blank
ERB = equipment rinsate blank
LIA = lost in analysis
LCS = laboratory control sample
PE = performance evaluation
QC = quality control

TABLE A-2 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE M

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-003	M48	AAA3506	Liquid	BB	Isotopic thorium	15128	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-228 and Th-232.
48-003	M48	AAA3507	Liquid	ERB	SVOCs	15118	Blank	No method blank sample data available. Results should be regarded as estimates. Phthalate contamination likely due to laboratory contamination.
48-003	M48	AAA3508	Liquid	BB	SVOCs	15118	Blank	No method blank sample data available. Results should be regarded as estimates. Phthalate contamination likely due to laboratory contamination.
48-003	M48	AAA3509	Liquid	ERB	SW-846 metals	15125	Hold time	Holding times for analysis of As, Se, Pb, Sb, and Tl exceeded. Sample results for these elements should be regarded as estimates.
48-003	M48	AAA3510	Liquid	BB	SW-846 metals	15125	Hold time	Holding times for analysis of As, Se, Pb, Sb, and Tl exceeded. Sample results for these elements should be regarded as estimates.
48-003	M48	AAA4477	Liquid	ERB	VOCs	15136	Accuracy	Due to poor surrogate recoveries, the reported quantitation limits should be regarded as estimates.
					SW-846 metals	15140	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Al, Cr, Fe, K, Mn, Na, and Zn.
					Isotopic uranium	15146	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-243, U-235, and U-238.
48-003	M48	AAA4478	Liquid	BB	VOCs	15136	Accuracy	Due to poor surrogate recoveries, the reported quantitation limits should be regarded as estimates.
					SW-846 metals	15140	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Al, Cr, Fe, K, Mn, Na, and Zn.
					Isotopic uranium	15146	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-243, U-235, and U-238.
48-003	M48	AAA4480	Liquid	BB	Isotopic uranium	15146	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-243, U-235, and U-238.
					Am-241 (Alpha)	15146	LIA	Lost in analysis.

BB = bottle blank
ERB = equipment rinsate blank
LIA = lost in analysis
LCS = laboratory control sample
PE = performance evaluation
QC = quality control

TABLE A-3

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE N

Part I. Regular Field Samples

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-005	N48-2021-B1	AAA3693	Soil	Reg	EDXRF metals	15194	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Th, and U.
48-005	N48-2021-B2	AAA3694	Soil	Reg	EDXRF metals	15194	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Th, and U.
48-005	N48-2021-B3	AAA3695	Soil	Reg	EDXRF metals	15194	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Th, and U.
48-005	N48-2022-B1	AAA3696	Soil	Reg	EDXRF metals	15194	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Th, and U.
48-005	N48-2022-B2	AAA3697	Soil	Reg	EDXRF metals	15194	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Th, and U.
48-005	N48-2022-B3	AAA3698	Soil	Reg	EDXRF metals	15194	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Th, and U.
48-005	N48-2023-B1	AAA3699	Soil	Reg	EDXRF metals	15194	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Th, and U.
					VOCs	15188	Acetone	Acetone contamination in sample less than 5x EQL. Attributable to laboratory contamination.
48-005	N48-2023-B2	AAA3700	Soil	Reg	EDXRF metals	15194	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Th, and U.
48-005	N48-2023-B3	AAA3701	Soil	Reg	EDXRF metals	15194	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Th, and U.
48-005	N48-2024-B1	AAA3717	Soil	Reg	Isotopic thorium	15213	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-228 and Th-230.
48-005	N48-2024-B2	AAA3718	Soil	Reg	Isotopic thorium	15213	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-228 and Th-230.
48-005	N48-2024-B3	AAA3719	Soil	Reg	Isotopic thorium	15213	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-228 and Th-230.
48-005	N48-2025-B1	AAA3720	Soil	Reg	SVOCs	15206	Phthalates	Phthalate contamination in sample less than 5x EQL. No blank data available. Attributable to laboratory contamination.
					VOCs	15206	Acetone	Acetone contamination in sample less than 5x EQL. Attributable to laboratory contamination.
					Isotopic thorium	15213	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-230.

BB = bottle blank
EQL = estimated quantitation limit
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = quality control

TABLE A-3 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE N

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-005	N48-2025-B2	AAA3721	Soil	Reg	SW-846 metals	15216	Blank	Due to preparation blank contamination, the results for the following analyte(s) should be regarded as estimates: Zn.
					SW-846 metals	15216	Accuracy	Due to recovery from matrix spike sample outside criteria, the results for the following analyte(s) should be regarded as estimates: As.
					SVOCs	15206	Phthalates	Phthalate contamination in sample exceeds 5x EQL. No blank data available.
					Isotopic thorium	15213	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-228 and Th-230.
48-005	N48-2025-B3	AAA3722	Soil	Reg	VOCs	15206	Acetone / 2-Butanone	Acetone contamination in sample exceeds 5x EQL. Initial and continuing calibrations for acetone outside criteria; sample results should be regarded as estimates. 2-Butanone contamination less than 5x EQL; attributable to laboratory contamination.
					Isotopic thorium	15213	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-228 and Th-230.
48-005	N48-2025-B4	AAA4475	Soil	Reg	VOCs	15206	Acetone	Acetone contamination in sample less than 5x EQL. Attributable to laboratory contamination.
					Isotopic thorium	15213	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-228 and Th-230.
48-005	N48-2025-B5	AAA4476	Soil	Reg	VOCs	15206	Acetone	Acetone contamination in sample less than 5x EQL. Attributable to laboratory contamination.
					Isotopic thorium	15213	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-228 and Th-230.
48-005	N48-2026-B1	AAA3723	Soil	Reg	SVOCs	15206	Phthalates	Phthalate contamination in sample less than 5x EQL. No blank data available. Attributable to laboratory contamination.
					VOCs	15206	Acetone	Acetone contamination in sample less than 5x EQL. Attributable to laboratory contamination.
					Isotopic thorium	15213	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-228 and Th-230.

BB = bottle blank
EQL = estimated quantitation limit
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = quality control

TABLE A-3 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE N

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-005	N48-2026-B2	AAA3724	Soil	Reg	SW-846 metals	15216	Blank	Due to preparation blank contamination, the results for the following analyte(s) should be regarded as estimates: Zn.
					SW-846 metals	15216	Accuracy	Due to recovery from matrix spike sample outside criteria, the results for the following analyte(s) should be regarded as estimates: As.
					VOCs	15206	Acetone	Acetone contamination in sample less than 5x EQL. Attributable to laboratory contamination.
					Isotopic thorium	15213	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-228 and Th-230.
48-005	N48-2026-B3	AAA4469	Soil	Reg	Isotopic thorium	15213	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-228 and Th-230.
48-005	N48-2027-S1	AAA3429	Soil	Reg	EDXRF metals	15103	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Fe, Mn, and Pb. Sample results for Ni should be regarded as unusable.
					Gamma spec	15120	LIA	Lost in analysis.
48-005	N48-2028-S1	AAA3430	Soil	Reg	EDXRF metals	15103	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Fe, Mn, Pb, and Th. Sample results for Ni should be regarded as unusable.
					Gamma spec	15120	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following isotopes should be regarded as estimates: Ce-144, Co-60, Cs-137, and Ru-106.
48-005	N48-2029-S1	AAA3431	Soil	Reg	EDXRF metals	15103	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Fe, Mn, and Pb. Sample results for Ni should be regarded as unusable.
					Gamma spec	15120	LIA	Lost in analysis.
48-005	N48-2030-S1	AAA3432	Soil	Reg	EDXRF metals	15103	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Fe, Mn, Pb, and Th. Sample results for Ni should be regarded as unusable.
					Gamma spec	15120	LIA	Lost in analysis.
48-005	N48-2031-S1	AAA3433	Soil	Reg	EDXRF metals	15103	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Fe, Mn, and Pb. Sample results for Ni should be regarded as unusable.
					Gamma spec	15120	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following isotopes should be regarded as estimates: Ce-144, Co-60, Cs-137, and Ru-106.

BB = bottle blank
EQL = estimated quantitation limit
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = quality control

TABLE A-3 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE N

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-005	N48-2032-S1	AAA3434	Soil	Reg	EDXRF metals	15103	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Fe, Mn, Pb, and Th. Sample results for Ni should be regarded as unusable.
					Gamma spec	15120	LIA	Lost in analysis.
48-005	N48-2033-S1	AAA3435	Soil	Reg	EDXRF metals	15103	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Fe, Mn, Pb, and Th. Sample results for Ni should be regarded as unusable.
					Gamma spec	15120	LIA	Lost in analysis.
48-005	N48-2034-S1	AAA3436	Soil	Reg	EDXRF metals	15103	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Fe, Mn, and Pb. Sample results for Ni should be regarded as unusable.
					Gamma spec	15120	LIA	Lost in analysis.
48-005	N48-2035-S1	AAA3437	Soil	Reg	EDXRF metals	15103	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Fe, Mn, and Pb. Sample results for Ni should be regarded as unusable.
					Gamma spec	15120	LIA	Lost in analysis.
48-005	N48-2036-S1	AAA3438	Soil	Reg	EDXRF metals	15103	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Fe, Mn, Pb, and Th. Sample results for Ni should be regarded as unusable.
					Gamma spec	15120	LIA	Lost in analysis.
48-005	N48-2067-B1	AAA3803	Soil	Reg	EDXRF metals	16191	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni and Zn.
					Isotopic thorium	16193	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-230.
					Am-241 (Alpha)	16193	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as unusable: Am-241.
48-005	N48-2067-B2	AAA3804	Soil	Reg	EDXRF metals	16191	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni and Zn.
					Isotopic thorium	16193	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-230.
					Am-241 (Alpha)	16193	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as unusable: Am-241.

BB = bottle blank
EQL = estimated quantitation limit
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = quality control

TABLE A-3 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE N

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-005	N48-2068-B1	AAA3806	Soil	Reg	EDXRF metals	16191	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni and Zn.
					Isotopic thorium	16193	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-230.
					Am-241 (Alpha)	16193	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as unusable: Am-241.
48-005	N48-2069-B1	AAA3810	Soil	Reg	EDXRF metals	16191	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni and Zn.
					Isotopic thorium	16193	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-230.
					Am-241 (Alpha)	16193	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: Am-241.
48-005	N48-2069-B2	AAA3811	Soil	Reg	EDXRF metals	16191	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni and Zn.
					Isotopic thorium	16193	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Th-230.
					Am-241 (Alpha)	16193	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: Am-241.
Part II. Field QC Samples								
SOIL SAMPLES								
48-005	N48-2021-B1	AAA3708	Soil	Dup	VOCs	15188	Acetone	Acetone contamination in sample less than 5x EQL. Attributable to laboratory contamination.
48-005	N48-2021-B2	AAA3709	Soil	Dup	EDXRF metals	15194	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Th, and U.
48-005	N48-2022-B2	AAA3703	Soil	Dup	VOCs	15188	Acetone	Acetone contamination in sample less than 5x EQL. Attributable to laboratory contamination.
48-005	N48-2024-B2	AAA4471	Soil	Dup	Isotopic thorium	15213	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-228 and Th-230.
48-005	N48-2025-B2	AAA4481	Soil	Dup	VOCs	15206	Acetone	Acetone contamination in sample less than 5x EQL. Attributable to laboratory contamination.

BB = bottle blank
EQL = estimated quantitation limit
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = quality control

TABLE A-3 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE N

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-005	N48-2025-B2	AAA4482	Soil	Dup	SW-846 metals	15216	Blank	Due to preparation blank contamination, the results for the following analyte(s) should be regarded as estimates: Zn.
					SW-846 metals	15216	Accuracy	Due to recovery from matrix spike sample outside criteria, the results for the following analyte(s) should be regarded as estimates: As.
48-005	N48-2028-S1	AAA3442	Soil	Dup	Gamma spec	15120	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following isotopes should be regarded as estimates: Ce-144, Co-60, Cs-137, and Ru-106.
WATER SAMPLES								
48-005	N48	AAA3467	Liquid	ERB	SW-846 metals	15111	Accuracy	Due to recovery from LCS or PE sample outside critera, results for the following analyte(s) should be regarded as estimates: Cd.
48-005	N48	AAA3468	Liquid	BB	SW-846 metals	15111	Accuracy	Due to recovery from LCS or PE sample outside critera, results for the following analyte(s) should be regarded as estimates: Cd.
48-005	N48	AAA3704	Liquid	ERB	SW-846 metals	15197	Accuracy	Due to recovery from LCS or PE sample outside critera, results for the following analyte(s) should be regarded as estimates: Zn.
					Gamma spec	15190	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following isotopes should be regarded as estimates: Ce-144, Co-60, Cs-137, and Ru-106.
48-005	N48	AAA3705	Liquid	BB	SW-846 metals	15197	Accuracy	Due to recovery from LCS or PE sample outside critera, results for the following analyte(s) should be regarded as estimates: Zn.
					SVOCs	15189	Phthalates	Phthalate contamination in sample less than 5 times the EQL. Attributable to laboratory contamination.
					Gamma spec	15190	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following isotopes should be regarded as estimates: Ce-144, Co-60, Cs-137, and Ru-106.
48-005	N48	AAA3706	Liquid	ERB	Gamma spec	15190	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following isotopes should be regarded as estimates: Ce-144, Co-60, Cs-137, and Ru-106.
48-005	N48	AAA3707	Liquid	BB	Gamma spec	15190	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following isotopes should be regarded as estimates: Ce-144, Co-60, Cs-137, and Ru-106.
48-005	N48	AAA3801	Liquid	ERB	SW-846 metals	16192	Precision	Due to poor duplicate sample precision, the results for the following analyte(s) should be regarded as estimates: Cu.
					SW-846 metals	16192	Accuracy	Due to poor recovery from matrix spike sample, the results for the following analyte(s) should be regarded as estimates: As, Pb, and Tl.
48-005	N48	AAA3802	Liquid	BB	SW-846 metals	16192	Precision	Due to poor duplicate sample precision, the results for the following analyte(s) should be regarded as estimates: Cu.
					SW-846 metals	16192	Accuracy	Due to poor recovery from matrix spike sample, the results for the following analyte(s) should be regarded as estimates: As, Pb, and Tl.

BB = bottle blank
EQL = estimated quantitation limit
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = quality control

TABLE A-3 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE N

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
					Isotopic uranium	16193	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for U-234, U-235 and U-238.

BB = bottle blank
EQL = estimated quantitation limit
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = quality control

TABLE A-3 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE N

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-005	N48	AAA4486	Liquid	ERB	SW-846 metals	15216	Blank	Due to preparation blank contamination, the results for the following analyte(s) should be regarded as estimates: Zn.
					Isotopic thorium	15213	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-228 and Th-230.
					Isotopic plutonium	15213	Accuracy	Internal tracer was not added. Sample results for Pu-238 and Pu-239 should be regarded as estimates.
48-005	N48	AAA4487	Liquid	BB	SW-846 metals	15216	Blank	Due to preparation blank contamination, the results for the following analyte(s) should be regarded as estimates: Zn.
					Isotopic thorium	15213	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-230 and Th-232.
48-005	N48	AAA4488	Liquid	ERB	Isotopic thorium	15213	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-230 and Th-232.
					Isotopic uranium	15215	Accuracy	Due to poor tracer recover, the results for U-234, U-235 and U-238 should be regarded as unusable.
					Isotopic plutonium	15213	Accuracy	Due to presence of interfering isotope, sample results for Pu-238 and Pu-239 may be biased high.
48-005	N48	AAA4489	Liquid	BB	Isotopic thorium	15213	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-230 and Th-232.

BB = bottle blank
EQL = estimated quantitation limit
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = quality control

TABLE A-4

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE X

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
Part I. Regular Field Samples								
48-002(e)	X48-2037-A1	AAA3545	Soil	Reg	PCBs	15292	Hold time	Holding times for analysis of PCBs exceeded by one month. Due to inherent chemical stability of PCBs, no impact on data quality.
					SVOCs	15292	Blank	Target analyte compounds detected in sample. No method blank sample data available.
					EDXRF metals	15331	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cr, Ni, Pb, Th, and Zn.
					Isotopic thorium	15333	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-230.
48-002(e)	X48-2037-A2	AAA3546	Soil	Reg	PCBs	15292	Hold time	Holding times for analysis of PCBs exceeded by one month. Due to inherent chemical stability of PCBs, no impact on data quality.
					EDXRF metals	15331	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cr, Ni, Pb, Th, and Zn.
					Isotopic thorium	15333	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-230.
					Gamma spec	15333	LIA	Lost in analysis.
48-002(e)	X48-2037-A3	AAA3547	Soil	Reg	PCBs	15292	Hold time	Holding times for analysis of PCBs exceeded by one month. Due to inherent chemical stability of PCBs, no impact on data quality.
					EDXRF metals	15331	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cr, Ni, Pb, Th, and Zn.
					Isotopic thorium	15333	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-230.
					Gamma spec	15333	LIA	Lost in analysis.
48-002(e)	X48-2057-S1	AAA3782	Soil	Reg	PCBs	15292	Hold time	Holding times for analysis of PCBs exceeded by one month. Due to inherent chemical stability of PCBs, no impact on data quality.
					SVOCs	15292	Blank	Target analyte compounds detected in sample. No method blank sample data available.
					EDXRF metals	15331	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cr, Ni, Pb, Th, and Zn.
					Isotopic thorium	15333	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-230.
					Gamma spec	15333	LIA	Lost in analysis.

BB = bottle blank
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = quality control

TABLE A-4 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE X

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-007 (a,d)	X48-2038-S1	AAA3548	Soil	Reg	EDXRF metals	15226	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni and Pb.
					EDXRF metals	15226	Precision	Due to poor precision of laboratory duplicate sample measurement, sample results for the following analyte(s) should be regarded as estimates: Fe, Mn, and Zn.
					Alpha spec	15230	LIA	Lost in analysis.
48-007 (a,d)	X48-2039-W1	AAA3549	Liquid	Reg	Am-241 (gamma)	15230	LIA	Lost in analysis.
48-007 (a,d)	X48-2053-W1	AAA4441	Liquid	Reg	Am-241 (gamma)	15230	LIA	Lost in analysis.
48-007 (a,d)	X48-2080-S1	0448-95-0001	Soil	Reg	SW-846 metals	224	Accuracy	Due to contamination present in the preparation blank, results for the following analyte(s) should be regarded as the estimated detection limit: Hg.
48-010	X48-2042-W1	AAA3552	Liquid	Reg	SW-846 metals	15225	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: As and Zn.
					SW-846 metals	15225	Accuracy	Due to recovery from matrix spike sample outside criteria, results for the following analyte(s) should be regarded as estimates: Pb.
48-010	X48-2041-S1	AAA3551	Soil	Reg	EDXRF metals	15226	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni and Pb.
					EDXRF metals	15226	Precision	Due to poor reproducibility of laboratory duplicate sample measurement, sample results for the following analyte(s) should be regarded as estimates: Fe, Mn, and Zn.
48-010	X48-2040-S1	AAA3550	Soil	Reg	EDXRF metals	15226	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni and Pb.
					EDXRF metals	15226	Precision	Due to poor reproducibility of laboratory duplicate sample measurement, sample results for the following analyte(s) should be regarded as estimates: Fe, Mn, and Zn.
48-010	X48-2082-S1	0448-95-0005	Soil	Reg	SW-846 metals	224	Accuracy	Due to contamination present in the preparation blank, results for the following analyte(s) should be regarded as the estimated detection limit: Hg.
Part II. Field QC Samples								
SOIL SAMPLES								
48-002(e)	X48-2037-A2	AAA4434	Soil	Dup	PCBs	15292	Hold time	Holding times for analysis of PCBs exceeded by one month. Due to inherent chemical stability of PCBs, no impact on data quality.
					PCBs	15292	Precision	PCBs detected at 260 µg/kg in duplicate sample; no PCBs detected above 50 µg/kg in regular sample.
48-007 (a,d)	X48-2080-S1	0448-95-0002	Soil	Dup	SW-846 metals	224	Accuracy	Due to contamination present in the preparation blank, results for the following analyte(s) should be regarded as the estimated detection limit: Hg.

BB = bottle blank
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = quality control

TABLE A-4 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE X

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-007 (a,d)	X48-2038-S1	AAA4430	Soil	Dup	EDXRF metals	15226	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ni and Pb.
					EDXRF metals	15226	Precision	Due to poor precision of laboratory duplicate sample measurement, sample results for the following analyte(s) should be regarded as estimates: Fe, Mn, and Zn.
48-010	X48-2042-W1	AAA4436	Liquid	Dup	SW-846 metals	15225	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: As and Zn.
					SW-846 metals	15225	Accuracy	Due to recovery from matrix spike sample outside criteria, results for the following analyte(s) should be regarded as estimates: Pb.
WATER SAMPLES								
48-010	X48	AAA4437	Liquid	ERB	SVOCs	15220	Accuracy	Due to poor surrogate recovery, sample quantitation limits should be regarded as estimates.
					SW-846 metals	15225	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: As and Zn.
					SW-846 metals	15225	Accuracy	Due to recovery from matrix spike sample outside criteria, results for the following analyte(s) should be regarded as estimates: Pb.
48-010	X48	AAA4438	Liquid	BB	SVOCs	15220	Accuracy	Due to poor surrogate recovery, sample quantitation limits should be regarded as estimates.
					SW-846 metals	15225	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: As and Zn.
					SW-846 metals	15225	Accuracy	Due to recovery from matrix spike sample outside criteria, results for the following analyte(s) should be regarded as estimates: Pb.
48-010	X48	AAA4439	Liquid	ERB	Isotopic thorium	15333	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-230 and Th-232.
48-010	X48	AAA4440	Liquid	BB	Isotopic thorium	15333	Blank	Due to contamination in method blank sample, sample results should be regarded as the estimated quantitation limit for Th-230 and Th-232.

BB = bottle blank
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = quality control

TABLE A-5

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE Y

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis ype	Request No.	QC Parameter	Comments
Part I. Regular Field Samples								
48-007(b)	Y48-2043-S1	AAA3517	Soil	Reg	EDXRF metals	15142	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cu, and Pb.
					Isotopic thorium	15146	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: Th-282, Th-230, and Th-232.
48-007(b)	Y48-2044-A1	AAA3518	Soil	Reg	EDXRF metals	15142	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cu, and Pb.
48-007(b)	Y48-2044-A2	AAA3519	Soil	Reg	EDXRF metals	15142	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cu, and Pb.
					Isotopic thorium	15146	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: Th-282, Th-230, and Th-232.
48-007(b)	Y48-2044-A3	AAA3520	Soil	Reg	EDXRF metals	15142	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cu, and Pb.
48-007(b)	Y48-2049-W1	AAA3529	Liquid	Reg	SW-846 metals	15138	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: K and Zn.
					SW-846 metals	15138	Precision	Due to recovery from laboratory duplicate sample outside criteria, results for the following analyte(s) should be regarded as estimates: Zn.
48-007(c)	Y48-2045-S1	AAA3521	Soil	Reg	EDXRF metals	15142	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cu, and Pb.
48-007(c)	Y48-2046-A1	AAA3522	Soil	Reg	EDXRF metals	15142	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cu, and Pb.
48-007(c)	Y48-2046-A2	AAA3523	Soil	Reg	EDXRF metals	15142	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cu, and Pb.
48-007(c)	Y48-2046-A3	AAA3524	Soil	Reg	EDXRF metals	15142	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cu, and Pb.
					Isotopic plutonium	15146	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: Pu-238 and Pu-239,240.
48-007(f)	Y48-2047-S1	AAA3525	Soil	Reg	EDXRF metals	15142	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cu, and Pb.

BB = bottle blank
EQL = estimated quantitation limit
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = quality control

TABLE A-5 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE Y

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
48-007(f)	Y48-2048-A1	AAA3526	Soil	Reg	EDXRF metals	15142	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cu, and Pb.
					SW-846 metals	15140	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Al, Ca, Cr, Fe, K, Mn, Mo, and Ni.
48-007(f)	Y48-2048-A2	AAA3527	Soil	Reg	VOCs	15136	Acetone	Acetone contamination in sample less than 5x EQL. Attributable to laboratory contamination. Acetone continuing calibration outside criteria; results are estimates.
					EDXRF metals	15142	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cu, and Pb.
					SW-846 metals	15140	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Al, Ca, Cr, Fe, K, Mn, Mo, and Ni.
48-007(f)	Y48-2051-W1	AAA3531	Liquid	Reg	SW-846 metals	15138	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: K and Zn.
					SW-846 metals	15138	Precision	Due to recovery from laboratory duplicate sample outside criteria, results for the following analyte(s) should be regarded as estimates: Zn.
Part II. Field QC Samples								
SOIL SAMPLES								
48-007(f)	Y48-2047-S1	AAA3534	Soil	Dup	EDXRF metals	15142	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Ba, Cu, and Pb.
48-007(f)	Y48-2048-A1	AAA3535	Soil	Dup	Isotopic thorium	15146	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: Th-282, Th-230, and Th-232.
48-007(f)	Y48-2048-A1	AAA3536	Soil	Dup	SW-846 metals	15140	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: Al, Ca, Cr, Fe, K, Mn, Mo, and Ni.
					SW-846 metals	15140	Precision	Target analyte Ca detected above UTL in regular sample; detected below UTL in duplicate sample. Ca results qualified as estimates for both samples.
48-007(f)	Y48-2048-A2	AAA3537	Soil	Dup	SVOCs	15136	Precision	Target analyte compounds detected above EQL in regular sample not detected above EQL in duplicate sample.

BB = bottle blank
EQL = estimated quantitation limit
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = Quality Control

TABLE A-5 (continued)

ANALYTICAL DATA QUALIFICATION SUMMARY TABLE FOR AGGREGATE Y

PRS No.	Location ID No.	Sample ID No.	Sample Matrix	Sample Type	Analysis Type	Request No.	QC Parameter	Comments
WATER SAMPLES								
48-007	Y48	AAA3538	Liquid	ERB	VOCs	15143	Accuracy	Due to low surrogate recoveries, the reported estimated quantitation limits should be regarded as estimates.
					SW-846 metals	15138	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: K and Zn.
					SW-846 metals	15138	Precision	Due to recovery from laboratory duplicate sample outside criteria, results for the following analyte(s) should be regarded as estimates: Zn.
					Isotopic uranium	15139	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-234, U-235, and U-238.
48-007	Y48	AAA3539	Liquid	BB	VOCs	15143	Accuracy	Due to low surrogate recoveries, the reported estimated quantitation limits should be regarded as estimates.
					SW-846 metals	15138	Accuracy	Due to recovery from LCS or PE sample outside criteria, results for the following analyte(s) should be regarded as estimates: K and Zn.
					SW-846 metals	15138	Precision	Due to recovery from laboratory duplicate sample outside criteria, results for the following analyte(s) should be regarded as estimates: Zn.
					Isotopic uranium	15139	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-234, U-235, and U-238.
48-007	Y48	AAA3540	Liquid	ERB	Isotopic uranium	15139	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-234, U-235, and U-238.
					Am-241 (Alpha)	15139	LIA	Lost in analysis.
48-007	Y48	AAA3541	Liquid	BB	Isotopic uranium	15139	Accuracy	Due to poor tracer recovery, results for the following analyte(s) should be regarded as estimates: U-234, U-235, and U-238.
					Am-241 (Alpha)	15139	LIA	Lost in analysis.

BB = bottle blank
EQL = estimated quantitation limit
ERB = equipment rinsate blank
LCS = laboratory control sample
LIA = lost in analysis
PE = performance evaluation
QC = Quality Control

Appendix B

Human Health Screening Assessment

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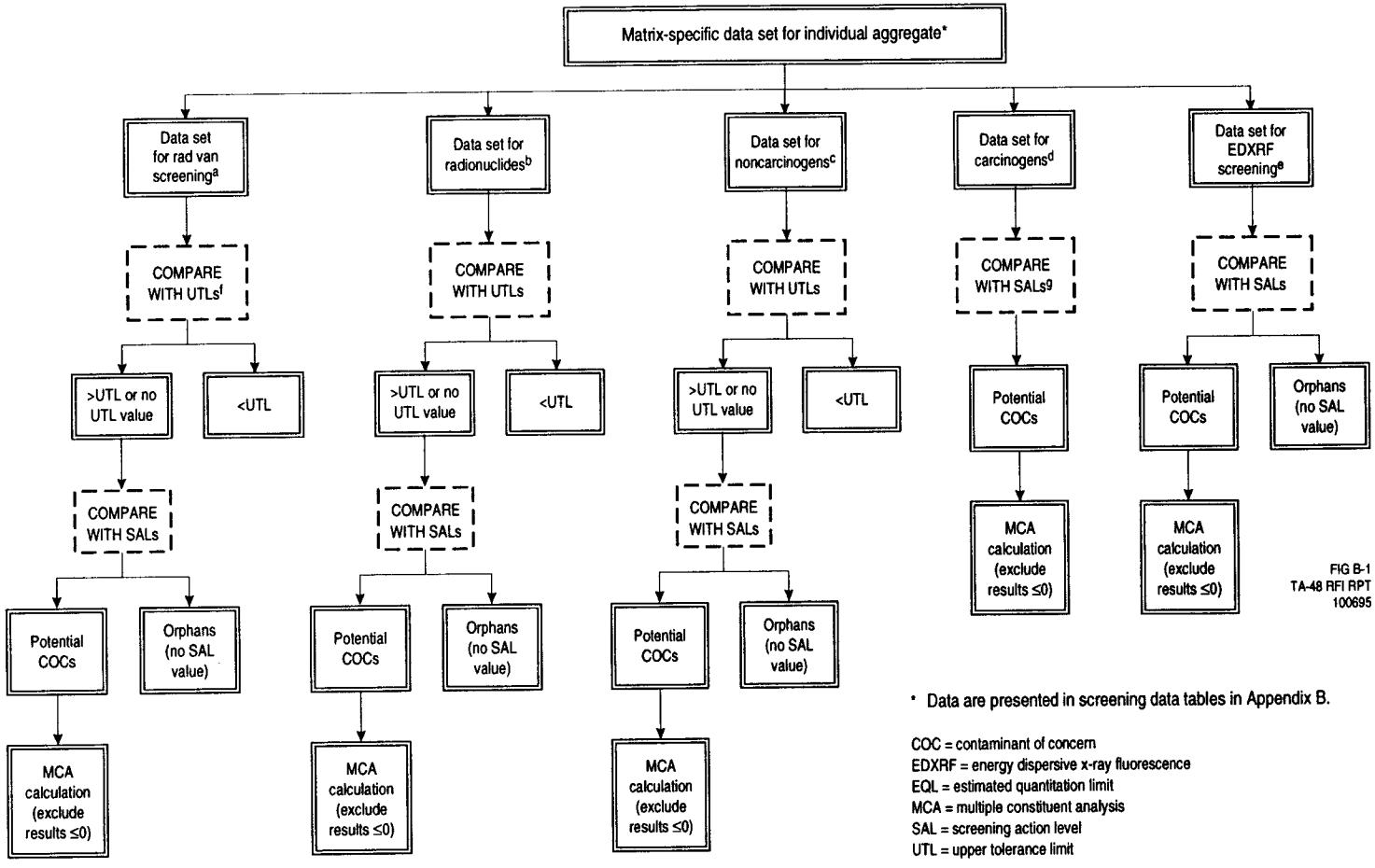

a. Data set for rad van screening consists of results for radionuclide analyses at the mobile laboratory facility.
b. Data set for radionuclides consists of results for radionuclide analyses at fixed-site laboratories.
c. Data set for noncarcinogens consists of noncarcinogenic inorganic constituents and noncarcinogenic organic constituents that are present above EQL.
d. Data set for carcinogens consists of carcinogenic organic constituents that are present above EQL.
e. Data set for EDXRF screening consists of results for inorganic constituents (trace elements) analyzed by EDXRF.
f. UTL values are not available for water samples. Screening assessment for water samples proceeds directly to SAL comparison.
g. SALs for inorganic constituents are based solely on noncarcinogenic endpoints.

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

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TABLE B-1

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT MOBILE LAB FACILITY IN AGGREGATE K

Greater than background or no background value[a,b]

Location ID No.	Matrix	Depth (ft)	Alpha	^{241}Am	Beta	^{144}Ce	^{60}Co	^{137}Cs	Gamma	^{106}Ru
K48-2001	Soil	0-0.5	–28.09	0.04	–16.22	1.72	0.37	0	1.2	0
K48-2002	Soil	0-0.5	–33.72	0.25	–13.56	3.85	0	1.38	–0.9	0
K48-2002	Soil	0.5-1	–33.72	0	–12.59	5.25	0	0.25	0.1	0
K48-2003	Soil	0-0.5	–22.48	1.04	–23.25	3.09	0.02	1.84	–0.8	1.15
K48-2003	Soil	0.5-1	–22.48	0.27	–13.08		0	0.09	–1.3	1.64
K48-2004	Soil	0-0.7	–11.24	0.11	–17.92	1.74	0	0.02	–0.5	0.97
K48-2005	Soil	0-0.2	–5.62	0.29	–0.97	1.77	0.11	0	0	0.29
Soil SAL				**17**		**64**	**0.9**	**4**		**14**
Background UTL								1.4		

Comparison with SALs and multiple constituent analysis[a,c,d]

Location ID No.	Matrix	Depth (ft)	^{241}Am	^{144}Ce	^{60}Co	^{137}Cs	^{106}Ru	MCA[e]
K48-2001	Soil	0-0.5	0.04	1.72	0.37			0.440
K48-2002	Soil	0-0.5	0.25	3.85		1.38		0.420
K48-2002	Soil	0.5-1		5.25		0.25		0.145
K48-2003	Soil	0-0.5	1.04	3.09	0.02	1.84	1.15	0.674
K48-2003	Soil	0.5-1	0.27			0.09	1.64	0.156
K48-2004	Soil	0-0.7	0.11	1.74		0.02	0.97	0.108
K48-2005	Soil	0-0.2	0.29	1.77	0.11		0.29	0.188
Soil SAL			**17**	**64**	**0.9**	**4**	**14**	
Background UTL						1.4		

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Gross-alpha, -beta, and -gamma radiation measurements are provided for information purposes only.
b. Shaded boxes indicate results that exceed UTL value.
c. Results less than or equal to zero are not shown.
d. No potential COCs were identified as a result of the comparison with SALs or the MCA calculation.
e. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
SAL = screening action level
UTL = upper tolerance limit

TABLE B-2

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT FIXED-SITE LAB IN AGGREGATE K

Greater than background or no background value[a,b]

Location ID No.	Matrix	Depth (ft)	^{241}Am	^{144}Ce	^{60}Co	^{137}Cs	^{238}Pu	$^{239,240}Pu$	^{106}Ru	^{230}Th	^{234}U	^{238}U
K48-2001	Soil	0–0.5	0.027	0.128	−0.317	0.401	0.019	0.078	−0.797	0.651	0.987	1.082
K48-2002	Soil	0–0.5	0.023	0.316	−0.323	0.202	0.018	0.455	−0.638	0.851	0.947	1.03
K48-2002	Soil	0.5–1	0.022	0.126	−0.296	0.048	0.011	0.046	−0.607	0.729	0.747	0.752
K48-2003	Soil	0–0.5	0.024	0.09	−0.365	0.054	0.003	0.992	−1.54	1.057	0.967	0.993
K48-2003	Soil	0.5–1	0.038	0.093	−0.327	0.649	0.034	0.096	−0.682	0.576	1.75	2.
K48-2004	Soil	0–0 .7	0.017	0.202	−0.354	0.087	0.019	0.943	−1.05	0.579	0.917	0.999
K48-2005	Soil	0–0.2	0.019	0.458	−0.327	1.62	0.017	0.106	−1.07	0.714	2.42	2.77
Soil SAL			**17**	**64**	**0.9**	**4**	**20**	**18**	**14**	**5**	**86**	**59**
BackgroundUTL						1.4	0.014	0.052			2.03	1.9

Less than background[a]

Location ID No.	Matrix	Depth (ft)	^{228}Th	^{232}Th	^{235}U
K48-2001	Soil	0–0.5	0.883	1.075	0.035
K48-2002	Soil	0–0.5	0.889	1.058	0.068
K48-2002	Soil	0.5–1	1.019	1.263	0.026
K48-2003	Soil	0–0.5	1.165	1.445	0.036
K48-2003	Soil	0.5–1	0.662	0.846	0.069
K48-2004	Soil	0–0 .7	0.957	0.921	0.044
K48-2005	Soil	0–0.2	0.918	1.01	0.077
Soil SAL			**1.5**	**5**	**18**
BackgroundUTL			2.67	2.68	0.088

a.Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g.
b.Shaded boxes indicate results that exceed UTL value.
SAL = screening action level
UTL = upper tolerance limit

TABLE B-2 (continued)

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT FIXED-SITE LAB IN AGGREGATE K

Comparison with SALs and multiple constituent analysis[a,b]

Location ID No.	Matrix	Depth (ft)	^{241}Am	^{144}Ce	^{137}Cs	^{238}Pu	$^{239,240}Pu$	^{230}Th	^{234}U	^{238}U	MCA[c]
K48-2001	Soil	0–0.5	0.027	0.128	0.401	0.019	0.078	0.651	0.987	1.082	0.269
K48-2002	Soil	0–0.5	0.023	0.316	0.202	0.018	0.455	0.851	0.947	1.03	0.282
K48-2002	Soil	0.5–1	0.022	0.126	0.048	0.011	0.046	0.729	0.747	0.752	0.186
K48-2003	Soil	0–0.5	0.024	0.09	0.054	0.003	0.992	1.057	0.967	0.993	0.311
K48-2003	Soil	0.5–1	0.038	0.093	0.649	0.034	0.096	0.576	1.75	2.	0.342
K48-2004	Soil	0–0.7	0.017	0.202	0.087	0.019	0.943	0.579	0.917	0.999	0.223
K48-2005	Soil	0–0.2	0.019	0.458	1.62	0.017	0.106	0.714	2.42	2.77	0.638
Soil SAL			**17**	**64**	**4**	**20**	**18**	**5**	**86**	**59**	
BackgroundUTL					1.4	0.014	0.052		2.03	1.9	

a.Reported results are the maximum results from the analysis of duplicate samples, where applicable.All values are reported in pCi/g.
b.No potential COCs were identified as a result of the comparison with SALs or the MCA calculation.
c.Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
SAL = screening action level
UTL = upper tolerancelimit

TABLE B-3

SCREENING ASSESSMENT FOR NONCARCINOGENS IN AGGREGATE K

Greater than background or no background value[a,b]

Location ID No.	Matrix	Depth (ft)	Ag	Li	Mo	Sr	Zn	4-Isopropyl-toluene
K48-2001	Soil	0-0.5	<1	4.4	3.2	6.6	36	
K48-2002	Soil	0.5-1						0.01
K48-2004	Soil	0-0.7	<1	3.9	1.8	6.2	140	
Soil SAL			**400**		**400**	**48000**	**24000**	
Background UTL							101	

Less than background[a]

Location ID No.	Matrix	Depth (ft)	Al	As	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe
K48-2001	Soil	0-0.5	3900	1.8	38	0.42	810	<0.4	1.5	<0.5	2.2	7700
K48-2004	Soil	0-0.7	3000	1.5	32	0.58	900	<0.4	0.7	<0.5	2.2	8000
Soil SAL					**5600**			**80**		**400**	**3000**	
Background UTL			58900	11.6	1140	3.31	54400	2.7	51.1	34.2	15.7	35600

Less than background (continued)[a]

Location ID No.	Matrix	Depth (ft)	K	Mg	Mn	Na	Ni	Pb	Se	Sb	Tl	V
K48-2001	Soil	0-0.5	530	570	240	75	<2	8	0.4	<0.04	0.02	6.5
K48-2004	Soil	0-0.7	480	500	260	89	<2	7	<0.2	<0.04	0.03	6.2
Soil SAL					**11000**		**1600**	**400**	**400**	**32**	**6.4**	**560**
Background UTL			6180	16100	1030	1880	26.7	39	1.7	2.5	0.9	66

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg. Values are not available for blank entries.
b. Shaded boxes indicate results that exceed UTL value.
SAL = screening action level
UTL = upper tolerance limit

TABLE B-3 (continued)

SCREENING ASSESSMENT FOR NONCARCINOGENS IN AGGREGATE K

Orphans[a,b]

Location ID No.	Matrix	Depth (ft)	Li	4-Isopropyl-toluene
K48-2001	Soil	0-0.5	4.4	
K48-2002	Soil	0.5-1		0.01
K48-2004	Soil	0-0.7	3.9	
Soil SAL				
Background UTL				

Comparison with SALs and multiple constituent analysis[a,c]

Location ID No.	Matrix	Depth (ft)	Ag	Mo	Sr	Zn	MCA[d]
K48-2001	Soil	0-0.5	<1	3.2	6.6	36	0.010
K48-2004	Soil	0-0.7	<1	1.8	6.2	140	0.010
Soil SAL			**400**	**400**	**48000**	**24000**	
Background UTL						101	

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg. Values are not available for blank entries.
b. Constituents for which a SAL value is not available.
c. No potential COCs were identified as a result of the comparison with SALs or the MCA calculation.
d. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
SAL = screening action level
UTL = upper tolerance limit

TABLE B-4

SCREENING ASSESSMENT FOR METAL CONSTITUENTS ANALYZED BY EDXRF IN AGGREGATE K

Orphans[a,b,c] Location ID No.	Matrix	Depth (ft)	As	Ca	Fe	K	Th	Ti	U
K48-2001	Soil	0-0.5	<10	5700	26300	53900	13	2300	<10
K48-2002	Soil	0-0.5	<10	10300	34600	43100	18	4500	<10
K48-2002	Soil	0.5-1	<10	3900	21200	53200	12	1600	<10
K48-2003	Soil	0-0.5	<10	10700	51000	38200	16	7000	<10
K48-2003	Soil	0.5-1	<10	9500	37900	45500	13	4300	<10
K48-2004	Soil	0-0.7	<10	5600	26600	55300	14	1800	<10
K48-2005	Soil	0-0.2	<10	5800	30300	51800	20	3200	18
Soil SAL									

Comparison to SALs and multiple constituent analysis[a,c]

Location ID No.	Matrix	Depth (ft)	Ba	Cd	Cr	Cu	Hg	Mn	Ni	Pb	Sb	Se	Zn	MCA[d]
K48-2001	Soil	0-0.5	268	<10	<10	<10	<10	787	<10	21	<10	<10	38	0.173
K48-2002	Soil	0-0.5	468	<10	16	<10	<10	1057	<10	33	<10	<10	42	0.304
K48-2002	Soil	0.5-1	224	<10	<10	<10	<10	678	<10	16	<10	<10	39	0.143
K48-2003	Soil	0-0.5	733	<10	48	10	<10	1253	<10	19	<10	<10	45	0.418
K48-2003	Soil	0.5-1	432	<10	28	<10	<10	1193	<10	17	<10	<10	34	0.300
K48-2004	Soil	0-0.7	258	<10	<10	<10	<10	935	<10	15	<10	<10	43	0.170
K48-2005	Soil	0-0.2	307	<10	14	21	<10	967	<10	26	<10	<10	58	0.252
Soil SAL			**5600**	**80**	**400**	**3000**	**24**	**11000**	**1600**	**400**	**32**	**400**	**24000**	

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg.
b. Constituents for which a SAL value is not available.
c. Measurements for As, Ni, and Se are estimates and potentially biased low. Measurements for Cd, Hg, Sb, Th, and U are estimates and potentially biased high. (Results for As are shown for information purposes only.)
d. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
SAL = screening action level
UTL = upper tolerance limit

TABLE B-5

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT MOBILE LAB FACILITY IN AGGREGATE M

Greater than background or no background value[a,b]

Location ID	No.	Matrix	Depth (ft)	Alpha	^{241}Am	Beta	^{144}Ce	^{60}Co	^{137}Cs	Gamma	^{106}Ru
M48-2010		Soil	4-5	–16.86	0.3	–15.5	0.24	0.24	0	0.8	0.43
M48-2010		Soil	8.5-9.5	–16.86	0.02	–27.61	0	0.35	0.31	0.2	2.85
M48-2010		Soil	14-15	–11.24	0.18	–13.56	0	0.65	0.27	0.8	0
M48-2011		Soil	1.7-3.7	–22.48	0.04	–20.8	0	0.93	0	–1.6	0.05
M48-2011		Soil	7-8	–16.86	0	–28.06	0	0	0	–0.5	0.34
M48-2011		Soil	11-12	–28.09	0.84	–32.	0	0	0	–0.6	4.25
M48-2011		Soil	14-15	–28.09	0	–17.5	0	0	0	–2	0
M48-2012		Soil	4-5	–5.62	0.3	–9.2	1.68	0.11	0.25	–0.6	0
M48-2012		Soil	9-10	–22.48	1.01	–15.5	2.87	0.67	0	0.2	0
M48-2012		Soil	14-15	–28.09	0.05	–22.77	0.15	0.07	0.11	–0.1	0
M48-2013		Soil	2.5-3.8	–28.09	0	–33.4	0	0	0	–1.5	1.06
M48-2013		Soil	9-10	–16.86	0	–24.7	0	0.56	0	–0.2	1.79
M48-2013		Soil	14-15	–11.2	0	–4.8	0.55	0.02	0.02	–0.1	0.1
M48-2014		Soil	4-5	–16.86	0.94	–16.95	0	0.79	1.06	–0.4	0
M48-2014		Soil	7-7.2	–28.09	1.06	–20.83	2.9	0.19	0.23	–0.3	0.24
M48-2014		Soil	9-10	–28.09	0.64	–26.15	1.56	0.14	1.2	0.5	0.14
M48-2014		Soil	14-15	–28.09	0.41	–15.5	0	0	0.72	–1.7	0
M48-2015		Soil	0.5-1.5	–16.86	0	–29.5	3.64	0.11	0	–1.5	2.85
M48-2015		Soil	4-5	–22.48	0	–21.8	0	0	0.18	–1.2	2.46
M48-2015		Soil	9-10	–22.48	0	–25.7	3.02	0.21	0.19	–0.2	2.61
M48-2015		Soil	14-15	–5.6	0.12	–19.4	0	0	0.14	–0.2	2.17
M48-2016		Soil	0-.5	–33.72	0	–17.92	0	0	0.83	–2.5	0
M48-2017		Soil	0-.5	–22.48	0	–13.08	0.52	0.16	0.81	–2.8	1.4
M48-2018		Soil	0-.5	–22.48	0	–17.92	0.03	0.39	1.4	–3.7	1.11
M48-2019		Soil	0-.5	–28.09	0	–4.36	0	0	0.62	0	1.4
M48-2020		Soil	0-.5	–16.86	0.16	–15.98	4.37	0.47	0	–3.4	0.39
M48-2054		Soil	0-.5	–33.72	0	–23.73	0	0.04	0	–4.3	0
M48-2054		Soil	.5-1.5	–28.09	0	–23.25	5.13	0.51	0.95	–1.6	1.35
M48-2054		Soil	1.5-2.5	–22.48	0.35	–16.47	0	0	0.82	–2.4	1.35
M48-2055		Soil	0-.5	–33.72	0	–18.89	1.41	0.3	0.07	–2.2	0
M48-2055		Soil	.5-1.5	–28.09	0	–21.8	4.58	0	1.22	–3.3	0
M48-2055		Soil	1.5-2.5	–33.72	0	–18.89	0.24	0	2.82	–2.5	0
M48-2055		Soil	2.5-3.5	–11.24	0	–8.23	3.51	0.19	2.38	–1.5	0.14
Soil SAL					**17**		**64**	**0.9**	**4**		**14**
Background UTL									1.4		

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Gross-alpha, -beta, and -gamma radiation measurements are provided for information purposes only.
b. Shaded boxes indicate results that exceed UTL.
SAL = screening action level
UTL = upper tolerance limit

TABLE B-5 (continued)

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT MOBILE LAB FACILITY IN AGGREGATE M

Comparison with SALs and multiple constituent analysis[a,b]

Location ID No.	Matrix	Depth (ft)	^{241}Am	^{144}Ce	^{60}Co	^{137}Cs	^{106}Ru	MCA[c]
M48-2010	Soil	4-5	0.3	0.24	0.24		0.43	0.319
M48-2010	Soil	8.5-9.5	0.02		0.35	0.31	2.85	0.671
M48-2010	Soil	14-15	0.18		0.65	0.27		0.800
M48-2011	Soil	1.7-3.7	0.04		**0.93**		0.05	0.006
M48-2011	Soil	7-8					0.34	0.024
M48-2011	Soil	11-12	0.84				4.25	0.353
M48-2011	Soil	14-15						0.000
M48-2012	Soil	4-5	0.3	1.68	0.11	0.25		0.229
M48-2012	Soil	9-10	1.01	2.87	0.67			0.849
M48-2012	Soil	14-15	0.05	0.15	0.07	0.11		0.111
M48-2013	Soil	2.5-3.8					1.06	0.076
M48-2013	Soil	9-10			0.56		1.79	0.750
M48-2013	Soil	14-15		0.55	0.02	0.02	0.1	0.043
M48-2014	Soil	4-5	0.94		0.79	1.06		1.198
M48-2014	Soil	7-7.2	1.06	2.9	0.19	0.23	0.24	0.393
M48-2014	Soil	9-10	0.64	1.56	0.14	1.2	0.14	0.528
M48-2014	Soil	14-15	0.41			0.72		0.204
M48-2015	Soil	0.5-1.5		3.64	0.11		2.85	0.383
M48-2015	Soil	4-5		0.		0.18	2.46	0.221
M48-2015	Soil	9-10		3.02	0.21	0.19	2.61	0.154
M48-2015	Soil	14-15	0.12			0.14	2.17	0.197
M48-2016	Soil	0-.5				0.83		0.208
M48-2017	Soil	0-.5		0.52	0.16	0.81	1.4	0.488
M48-2018	Soil	0-.5		0.03	0.39	1.4	1.11	0.863
M48-2019	Soil	0-.5				0.62	1.4	0.255
M48-2020	Soil	0-.5	0.16	4.37	0.47		0.39	0.628
M48-2054	Soil	0-.5			0.04			0.044
M48-2054	Soil	.5-1.5		5.13	0.51	0.95	1.35	0.981
M48-2054	Soil	1.5-2.5	0.35			0.82	1.35	0.322
M48-2055	Soil	0-.5		1.41	0.3	0.07		0.373
M48-2055	Soil	.5-1.5		4.58		1.22		0.377
M48-2055	Soil	1.5-2.5		0.24		2.82		0.709
M48-2055	Soil	2.5-3.5		3.51	0.19	2.38	0.14	0.871
Soil SAL			**17**	**64**	**0.9**	**4**	**14**	
Background UTL						1.4		

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Results less than or equal to zero are not shown.
b. Shaded boxes with bolded entries indicate results that exceed SAL. Results that exceed SAL are not included in MCA calculation. Shaded outlined boxes indicate results that contribute greater than 5% to MCA value greater than 1.0. Unshaded outlined boxes indicate MCA values greater than 1.0.
c. Value is the sum of SAL-normalized values.
MCA = multiple constituent analysis.
SAL = screening action level
UTL = upper tolerance limit

TABLE B-6

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT FIXED-SITE LAB IN AGGREGATE M

Greater than background or no background value[a,b]													
Location ID No.	Matrix	Depth (ft)	^{241}Am	^{144}Ce	^{60}Co	^{137}Cs	^{238}Pu	$^{239,240}Pu$	^{106}Ru	^{230}Th	^{234}U	^{235}U	^{238}U
M48-2010	Soil	4-5	0.148				0.009	0.005		0.631	0.676	0.036	0.599
M48-2010	Soil	8.5-9.5	–0.084				0.014	0.001		0.588	0.653	0.045	0.613
M48-2010	Soil	14-15	0.171	0.048	0.064	0.009	0.011	0.011	0.223	0.703	0.752	0.041	0.685
M48-2011	Soil	1.7-3.7	0.024	–0.56	0.0411	0.278	0.044	0.087	–0.894	0.616	0.629	0.031	0.733
M48-2011	Soil	7-8	0.007				0.096	0.103		0.652	0.443	0.031	0.491
M48-2011	Soil	11-12	0.005				0.055	0.326		0.616	0.608	0.031	0.597
M48-2011	Soil	14-15	0.002				0.027	0.292		0.596	0.608	–0.006	0.501
M48-2012	Soil	4-5	–0.092	0.16	–0.025	0.075	0.005	0.009	–0.074	0.586	0.685	0.032	0.689
M48-2012	Soil	9-10	–0.046				0.002	0.001		0.574	0.581	0.059	0.622
M48-2012	Soil	14-15	–0.019				0.002	0.005		0.581	0.631	0.036	0.761
M48-2013	Soil	2.5-3.8	0.008				0.058	0.069		0.586	0.633	–0.005	0.646
M48-2013	Soil	9-10	0.001	–1.1	0.0111	0.0874	0.114	0.09	–0.988	0.444	0.616	0.1	0.588
M48-2013	Soil	14-15	0.01				0.023	0.117		0.515	0.435	0.03	0.427
M48-2014	Soil	4-5	0.073				0.007	0.054		0.599	0.712	0.054	0.685
M48-2014	Soil	7-7.2	–0.085				0.092	0.001		0.568	0.658	0.063	0.716
M48-2014	Soil	9-10	0.001				0.277	0.002		0.568	0.77	0.041	0.752
M48-2014	Soil	14-15	0.025				0.002	0.002		0.604	0.667	0.045	0.739
M48-2015	Soil	0.5-1.5	0.009				0.081	0.059		0.52	0.587	0.011	0.552
M48-2015	Soil	4-5	0.003				0.021	0.008		0.543	0.508	0.023	0.487
M48-2015	Soil	9-10					0.006	0.1		0.625	0.535	0.013	0.506
M48-2015	Soil	14-15	0.011				0.006	0.1		0.625	0.57	0.013	0.547
M48-2016	Soil	0-.5	–0.03	<0.6115	<0.1947	0.4976	0.0204	0.0456	<1.217	0.685	1.33	0.105	1.46
M48-2017	Soil	0-.5	–0.021	<0.5268	<0.2677	0.6634	–0.0047	0.0234	<1.342	1.27	1.56	0.112	2.18
M48-2018	Soil	0-.5	0.022	<0.6492	<0.2364	0.9983	0.0314	0.0967	<1.519	1.04	1.95	0.147	1.96
M48-2019	Soil	0-.5	0.153	<0.8559	<0.3	2.549	0.0957	0.941	<2.034	1.69	3.48	0.167	3.97
M48-2020	Soil	0-.5	1.16	<0.4349	<0.1419	0.5148	0.162	6.4	<1.419	1.31	2.23	0.258	1.76
M48-2054	Soil	0-.5	0.545	<0.5688	<0.2368	0.2296	0.0594	2.08	<1.311	1.01	2.14	0.403	1.99
M48-2054	Soil	.5-1.5	0.292				0.053	1.74		1.05	3.02	0.32	2.93
M48-2054	Soil	1.5-2.5	0.601				0.0667	0.935		2.35	1.75	0.122	1.74
M48-2055	Soil	0-.5	0.213	<0.594	<0.1789	<0.2699	–0.126	0.339	<1.023	1.48	1.34	0.0548	1.19
M48-2055	Soil	.5-1.5	0.291				0.0815	3.15		1.35	2.1	0.1	1.53
M48-2055	Soil	1.5-2.5	0.713				0.0921	2.74		1.02	6.63	0.373	5.64
M48-2055	Soil	2.5-3.5	0.337				0.0081	1.16		1.23	1.95	0.105	1.62
Soil SAL			**17**	**64**	**0.9**	**4**	**20**	**18**	**14**	**5**	**86**	**18**	**59**
Background UTL						1.4	0.014	0.052			2.03	0.088	1.9

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Values are not available for blank entries.
b. Shaded boxes indicate results that exceed UTL value.
SAL = screening action level
UTL = upper tolerance limit

TABLE B-6 (continued)

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT FIXED-SITE LAB IN AGGREGATE M

Less than background[a]				
Location ID No.	Matrix	Depth (ft)	^{228}Th	^{232}Th
M48-2010	Soil	4-5	1.077	1.02
M48-2010	Soil	8.5-9.5	1.113	1.041
M48-2010	Soil	14-15	1.171	1.095
M48-2011	Soil	1.7-3.7	1.072	1.159
M48-2011	Soil	7-8	1.287	1.19
M48-2011	Soil	11-12	1.077	1.086
M48-2011	Soil	14-15	1.09	1.105
M48-2012	Soil	4-5	1.018	0.986
M48-2012	Soil	9-10	0.98	1.036
M48-2012	Soil	14-15	0.977	1.032
M48-2013	Soil	2.5-3.8	0.963	1.002
M48-2013	Soil	9-10	0.849	0.925
M48-2013	Soil	14-15	0.796	0.966
M48-2014	Soil	4-5	0.955	0.932
M48-2014	Soil	7-7.2	1.056	0.964
M48-2014	Soil	9-10	1.261	1.095
M48-2014	Soil	14-15	0.991	1.041
M48-2014	Soil	0.5-1.5	1.049	0.976
M48-2014	Soil	4-5	0.897	1.053
M48-2015	soil	9-10	0.918	1.067
M48-2015	Soil	14-15	0.918	1.067
M48-2016	Soil	0-.5	0.974	0.921
M48-2017	Soil	0-.5	1.52	1.15
M48-2018	Soil	0-.5	1.48	1.2
M48-2019	Soil	0-.5	1.44	1.37
M48-2020	Soil	0-.5	1.42	1.47
M48-2054	Soil	0-.5	1.49	1.25
M48-2054	Soil	.5-1.5	1.36	1.28
M48-2054	Soil	1.5-2.5	1.92	1.61
M48-2055	Soil	0-.5	1.44	1.28
M48-2055	Soil	.5-1.5	1.38	1.29
M48-2055	Soil	1.5-2.5	1.42	1.13
M48-2055	Soil	2.5-3.5	1.37	0.752
Soil SAL			**1.5**	**5**
Background UTL			2.67	2.68

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

TABLE B-6 (continued)

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT FIXED-SITE LAB IN AGGREGATE M

Comparison with SALs and multiple constituent analysis[a,b]

Location ID No.	Matrix	Depth (ft)	^{241}Am	^{144}Ce	^{60}Co	^{137}Cs	^{238}Pu	$^{239,240}Pu$	^{106}Ru	^{230}Th	^{234}U	^{235}U	^{238}U	MCA[c]
M48-2010	Soil	4-5	0.148				0.009	0.005		0.631	0.676	0.036	0.599	0.156
M48-2010	Soil	8.5-9.5					0.014	0.001		0.588	0.653	0.045	0.613	0.139
M48-2010	Soil	14-15	0.171	0.048	0.064	0.009	0.011	0.011	0.223	0.703	0.752	0.041	0.685	0.265
M48-2011	Soil	1.7-3.7	0.024		0.0411	0.278	0.044	0.087		0.616	0.629	0.031	0.733	0.268
M48-2011	Soil	7-8	0.007				0.096	0.103		0.652	0.443	0.031	0.491	0.157
M48-2011	Soil	11-12	0.005				0.055	0.326		0.616	0.608	0.031	0.597	0.163
M48-2011	Soil	14-15	0.002				0.027	0.292		0.596	0.608		0.501	0.153
M48-2012	Soil	4-5		0.16		0.075	0.005	0.009		0.586	0.685	0.032	0.689	0.161
M48-2012	Soil	9-10					0.002	0.001		0.574	0.581	0.059	0.622	0.136
M48-2012	Soil	14-15					0.002	0.005		0.581	0.631	0.036	0.761	0.139
M48-2013	Soil	2.5-3.8	0.008				0.058	0.069		0.586	0.633		0.646	0.143
M48-2013	Soil	9-10	0.001		0.0111	0.0874	0.114	0.09		0.444	0.616	0.1	0.588	0.156
M48-2013	Soil	14-15	0.01				0.023	0.117		0.515	0.435	0.03	0.427	0.125
M48-2014	Soil	4-5	0.073				0.007	0.054		0.599	0.712	0.054	0.685	0.150
M48-2014	Soil	7-7.2					0.092	0.001		0.568	0.658	0.063	0.716	0.142
M48-2014	Soil	9-10	0.001				0.277	0.002		0.568	0.77	0.041	0.752	0.152
M48-2014	Soil	14-15	0.025				0.002	0.002		0.604	0.667	0.045	0.739	0.145
M48-2015	Soil	0.5-1.5	0.009				0.081	0.059		0.52	0.587	0.011	0.552	0.129
M48-2015	Soil	4-5	0.003				0.021	0.008		0.543	0.508	0.023	0.487	0.126
M48-2015	Soil	9-10					0.006	0.1		0.625	0.535	0.013	0.506	0.146
M48-2015	Soil	14-15	0.011				0.006	0.1		0.625	0.57	0.013	0.547	0.148
M48-2016	Soil	0-.5		<0.6115	<0.1947	0.4976	0.0204	0.0456	<1.217	0.685	1.33	0.105	1.46	0.311
M48-2017	Soil	0-.5		<0.5268	<0.2677	0.6634		0.0234	<1.342	1.27	1.56	0.112	2.18	0.483
M48-2018	Soil	0-.5	0.022	<0.6492	<0.2364	0.9983	0.0314	0.0967	<1.519	1.04	1.95	0.147	1.96	0.530
M48-2019	Soil	0-.5	0.153	<0.8559	<0.3	2.549	0.0957	0.941	<2.034	1.69	3.48	0.167	3.97	1.158
M48-2020	Soil	0-.5	1.16	<0.4349	<0.1419	0.5148	0.162	6.4	<1.419	1.31	2.23	0.258	1.76	0.893
M48-2054	Soil	0-.5	0.545	<0.5688	<0.2368	0.2296	0.0594	2.08	<1.311	1.01	2.14	0.403	1.99	0.491
M48-2054	Soil	.5-1.5	0.292				0.053	1.74		1.05	3.02	0.32	2.93	0.429
M48-2054	Soil	1.5-2.5	0.601				0.0667	0.935		2.35	1.75	0.122	1.74	0.617
M48-2055	Soil	0-.5	0.213	<0.594	<0.1789	<0.2699		0.339	<1.023	1.48	1.34	0.0548	1.19	0.366
M48-2055	Soil	.5-1.5	0.291				0.0815	3.15		1.35	2.1	0.1	1.53	0.522
M48-2055	Soil	1.5-2.5	0.713				0.0921	2.74		1.02	6.63	0.373	5.64	0.596
M48-2055	Soil	2.5-3.5	0.337				0.0081	1.16		1.23	1.95	0.105	1.62	0.387
Soil SAL			**17**	**64**	**0.9**	**4**	**20**	**18**	**14**	**5**	**86**	**18**	**59**	
Background UTL						1.4	0.014	0.052			2.03	0.088	1.9	

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Results less than or equal to zero are not shown.
b. Shaded outlined boxes indicate results that contribute greater than 5% to MCA value greater than 1.0. Unshaded outlined boxes indicate MCA values greater than 1.0.
c. Value is the sum of the SAL-normalized values.
MCA = multiple consistent analysis
SAL = screen action level
UTL = upper tolerance limit

TABLE B-7

SCREENING ASSESSMENT FOR NONCARCINOGENS IN AGGREGATE M

Greater than background or no background value[a,b]

Location ID No.	Matrix	Depth (ft)	Ag	Cr	Li	Mo	Ni	Sr	Zn
M48-2010	Soil	4-5	<1	25	2.6	1.7	9.3	3	33
M48-2011	Soil	1.7-3.7	<1	14	20	<1	10	21	42
M48-2013	Soil	14-15	<1	2.5	1.4	<1	<2	2.4	26
M48-2014	Soil	7-7.2	<1	180	2.4	6.2	52	3.5	38
M48-2014	Soil	9-10	<1	24	3.1	2.1	10	4.8	47
M48-2017	Soil	0-.5	<1	6	4.1	<1	9	20	89
M48-2054	Soil	0-.5	<1	4.5	3	<1	9	8.3	160
Soil SAL			**400**	**400**		**400**	**1600**	**48000**	**24000**
Background UTL				34.2			26.7		101

Less than background[a]

Location ID No.	Matrix	Depth (ft)	Al	As	Ba	Be	Ca	Cd	Co	Cu	Fe
M48-2010	Soil	4-5	2100	0.6	18	0.84	570	<0.4	0.6	3	6300
M48-2011	Soil	1.7-3.7	28000	4.7	86	2.2	3600	<0.4	4	8.7	21000
M48-2013	Soil	14-15	970	0.7	22	0.31	390	<0.4	1.7	<0.6	5700
M48-2014	Soil	7-7.2	3100	1.4	34	0.68	660	<0.4	1	7.3	6300
M48-2014	Soil	9-10	4000		69	0.94	860	<.4	1.4	5.5	7200
M48-2017	Soil	0-.5	3700	2.5	60	0.47	3900	<0.4	1.4	4	6700
M48-2054	Soil	0-.5	1600	0.8	40	0.16	1900	<0.4	1.6	5.1	4900
Soil SAL					**5600**			**80**		**3000**	
UTL Background			58900	11.6	1140	3.31	54400	2.7	51.1	15.7	35600

Less than background (cont'd)[a]

Location ID No.	Matrix	Depth (ft)	K	Mg	Mn	Na	Pb	Se	Sb	Tl	V
M48-2010	Soil	4-5	270	380	240	57	7	<0.2	<0.06	<0.02	3.4
M48-2011	Soil	1.7-3.7	2300	3500	110	180	13	<0.2	<0.08	0.18	23
M48-2013	Soil	14-15	250	270	260	81	7	<0.2	<0.08	<0.06	2.5
M48-2014	Soil	7-7.2	280	450	250	73	9	<0.2	<0.06	0.08	5.1
M48-2014	Soil	9-10	400	590	520	86	7				6.1
M48-2017	Soil	0-.5	630	1000	350	65	11	<0.2	<0.08	<0.06	9
M48-2054	Soil	0-.5	280	970	100	69	6	<0.2	0.085	<0.06	11
Soil SAL					**11000**		**400**	**400**	**32**	**6.4**	**560**
Background UTL			6180	16100	1030	1880	39	1.7	2.5	0.9	66

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg. Values are not available for blank entries.
b. Shaded boxes indicate results that exceed UTL value.
SAL = screening action level
UTL = upper tolerance limit

TABLE B-8

SCREENING ASSESSMENT FOR METAL CONSTITUENTS ANALYZED BY EDXRF IN AGGREGATE M

Orphans[a,b,c] Location ID No.	Matrix	Depth (ft)	As	Ca	Fe	K	Th	Ti	U
M48-2010	Soil	4-5	<10	1900	9500	32200	14	569	<10
M48-2010	Soil	8.5-9.5	<10	2500	13200	29500	17	705	<10
M48-2010	Soil	14-15	<10	1700	9000	32500	18	560	<10
M48-2011	Soil	1.7-3.7	<10	3300	11200	29400	<10	781	<10
M48-2011	Soil	7-8	<10	6000	29900	22500	22	1556	<10
M48-2011	Soil	11-12	<10	4400	19000	28200	16	971	<10
M48-2011	Soil	14-15	<10	2100	10700	30900	16	668	<10
M48-2012	Soil	4-5	<10	2500	11700	31400	14	695	<10
M48-2012	Soil	9-10	<10	1800	8800	31800	17	542	<10
M48-2012	Soil	14-15	<10	1900	13600	32500	19	609	10
M48-2013	Soil	2.5-3.8	<10	4800	14300	31600	20	951	<10
M48-2013	Soil	9-10	<10	5100	22700	25100	18	1272	<10
M48-2013	Soil	14-15	<10	1700	8700	30800	13	552	<10
M48-2014	Soil	4-5	<10	3700	12000	30700	16	830	<10
M48-2014	Soil	7-7.2	<10	2200	12700	30900	20	696	<10
M48-2014	Soil	9-10	<10	1700	8500	32400	17	540	<10
M48-2014	Soil	14-15	<10	2000	10900	31900	15	684	<10
M48-2015	Soil	.5-1.5	<10	2000	10300	31300	11	631	<10
M48-2015	Soil	4-5	<10	2200	11100	31900	14	667	<10
M48-2015	Soil	9-10	<10	0.22	0.96	3.36	16	587	<10
M48-2015	Soil	14-15	<10	2200	9600	33600	21	587	<10
M48-2016	Soil	0-.5	<10	6100	19800	46200	<10	1596	<10
M48-2017	Soil	0-.5	<10	9000	19800	43300	11	1626	<10
M48-2018	Soil	0-.5	<10	11500	23400	41700	14	2017	<10
M48-2019	Soil	0-.5	<10	8100	21500	43900	<10	2132	13
M48-2020	Soil	0-.5	<10	10200	20900	34800	<10	2771	<10
M48-2054	Soil	0-.5	<10	13000	19100	31100	<10	2599	<10
M48-2054	Soil	.5-1.5	<10	10600	19600	36100	<10	2469	<10
M48-2054	Soil	1.5-2.5	<10	7800	19500	38200	<10	2006	<10
M48-2055	Soil	0-.5	<10	6500	18000	37900	14	1591	<10
M48-2055	Soil	.5-1.5	<10	8300	17500	33900	<10	2082	<10
M48-2055	Soil	1.5-2.5	<10	8700	18700	34600	<10	2225	<10
M48-2055	Soil	2.5-3.5	<10	7300	18700	37500	<10	2035	<10
Soil SAL									

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg.
b. Constituents for which a SAL value is not available.
c. Measurements for As are biased low and presented for information purposes only. Measurements for Th and U are estimates and potentially biased high.
SAL = screening action level

TABLE B-7 (continued)

SCREENING ASSESSMENT FOR NONCARCINOGENS IN AGGREGATE M

Orphans[a,b]

Location ID No.	Matrix	Depth (ft)	Li
M48-2010	Soil	4-5	2.6
M48-2011	Soil	1.7-3.7	20
M48-2013	Soil	14-15	1.4
M48-2014	Soil	7-7.2	2.4
M48-2014	Soil	9-10	3.1
M48-2017	Soil	0-.5	4.1
M48-2054	Soil	0-.5	3
Soil SAL			
UTL Background			

Comparison with SALs and multiple constituent analysis[a,c]

Location ID No.	Matrix	Depth (ft)	Ag	Cr	Mo	Ni	Sr	Zn	MCA[d]
M48-2010	Soil	4-5	<1	25	1.7	9.3	3	33	0.074
M48-2011	Soil	1.7-3.7	<1	14	<1	10	21	42	0.072
M48-2013	Soil	14-15	<1	2.5	<1	<2	2.4	26	0.007
M48-2014	Soil	7-7.2	<1	180	6.2	52	3.5	38	0.512
M48-2014	Soil	9-10	<1	24	2.1	10	4.8	47	0.074
M48-2017	Soil	0-.5	<1	6	<1	9	20	89	0.025
M48-2054	Soil	0-.5	<1	4.5	<1	9	8.3	160	0.026
Soil SAL			**400**	**400**	**400**	**1600**	**48000**	**24000**	
UTL Background				34.2		26.7		101	

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg.
b. Constituents for which a SAL value is not available.
c. No potential COCs were identified as a result of the comparison with SALs or the MCA calculation.
d. Number value is the sum of SAL-normalized values.
MCA = multiple constituent analysis
SAL = screening action level
UTL = upper tolerance limit

TABLE B-8 (continued)

SCREEING ASSESSMENT FOR METAL CONSTITUENTS ANALYZED BY EDXRF IN AGGREGATE M

Comparison with SALs and multiple constituent analysis[a,b,c]

Location ID No.	Matrix	Depth	Ba	Cd	Cr	Cu	Hg	Mn	Ni	Pb	Sb	Se	Zn	MCA[d]
M48-2010	Soil	4-5	159	<10	<10	<10	<10	365	<10	14	<10	<10	29	0.098
M48-2010	Soil	8.5-9.5	201	<10	<10	<10	<10	429	<10	15	<10	<10	65	0.115
M48-2010	Soil	14-15	161	<10	<10	<10	<10	330	<10	16	<10	<10	31	0.100
M48-2011	Soil	1.7-3.7	282	<10	<10	<10	<10	254	<10	<10	<10	<10	29	0.075
M48-2011	Soil	7-8	206	<10	22	16	<10	145	10	21	<10	<10	47	0.171
M48-2011	Soil	11-12	203	<10	23	<10	<10	616	<10	14	<10	<10	35	0.186
M48-2011	Soil	14-15	154	<10	17	<10	<10	245	<10	12	<10	<10	30	0.124
M48-2012	Soil	4-5	188	<10	<10	<10	<10	269	<10	11	<10	<10	34	0.087
M48-2012	Soil	9-10	147	<10	<10	11	<10	241	<10	14	<10	<10	28	0.088
M48-2012	Soil	14-15	159	<10	<10	<10	<10	212	<10	11	<10	<10	25	0.076
M48-2013	Soil	2.5-3.8	282	<10	15	14	<10	340	<10	16	<10	<10	51	0.166
M48-2013	Soil	9-10	317	<10	21	19	<10	481	<10	21	<10	<10	43	0.213
M48-2013	Soil	14-15	135	<10	<10	<10	<10	352	<10	11	<10	<10	24	0.085
M48-2014	Soil	4-5	235	<10	<10	13	<10	323	10	15	<10	<10	33	0.121
M48-2014	Soil	7-7.2	189	<10	<10	10	<10	604	<10	10	<10	<10	58	0.119
M48-2014	Soil	9-10	164	<10	<10	10	<10	294	<10	10	<10	<10	31	0.086
M48-2014	Soil	14-15	396	<10	<10	<10	<10	346	<10	<10	<10	<10	32	0.104
M48-2015	Soil	.5-1.5	146	<10	<10	<10	<10	341	<10	11	<10	<10	29	0.086
M48-2015	Soil	4-5	146	<10	17	<10	<10	349	<10	11	<10	<10	38	0.129
M48-2015	Soil	9-10	131	<10	<10	11	<10	354	<10	12	<10	<10	32	0.091
M48-2015	Soil	14-15	161	<10	10	11	<10	354	<10	18	<10	<10	32	0.136
M48-2016	Soil	0-.5	252	<10	<10	<10	<10	571	<10	24	<10	<10	44	0.159
M48-2017	Soil	0-.5	276	<10	<10	<10	<10	597	<10	19	<10	<10	35	0.153
M48-2018	Soil	0-.5	262	<10	<10	22	<10	951	<10	25	<10	<10	83	0.207
M48-2019	Soil	0-.5	219	<10	36	17	<10	666	<10	41	<10	<10	59	0.300
M48-2020	Soil	0-.5	599	<10	21	14	<10	473	16	17	<10	<10	90	0.263
M48-2054	Soil	0-.5	680	<10	<10	<10	<10	431	<10	17	<10	<10	34	0.205
M48-2054	Soil	.5-1.5	512	<10	30	15	<10	474	<10	20	<10	<10	45	0.266
M48-2054	Soil	1.5-2.5	433	<10	17	17	<10	477	<10	18	<10	<10	36	0.215
M48-2055	Soil	0-.5	326	<10	<10	<10	<10	448	11	18	<10	<10	37	0.152
M48-2055	Soil	.5-1.5	523	<10	<10	15	<10	369	<10	19	<10	<10	30	0.181
M48-2055	Soil	1.5-2.5	547	<10	<10	12	<10	431	<10	18	<10	<10	35	0.187
M48-2055	Soil	2.5-3.5	476	<10	21	17	<10	385	<10	17	<10	<10	31	0.222
Soil SAL			**5600**	**80**	**400**	**3000**	**24**	**11000**	**1600**	**400**	**32**	**400**	**24000**	

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg.
b. Measurements for Ni and Se are estimates and potentially biased low. Measurements for Cd, Hg, and Sb are estimates and potentially biased high.
c. No potential COCs were identified as a result of the comparison with SALs or the MCA calculation.
d. Value is the sum of SAL-normalized values.
MCA = multiple constituent analysis
SAL = screening action level

TABLE B-9

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT MOBILE LAB FACILITY IN AGGREGATE N

Greater than background or no background value[a,b]										
Location ID No.	Matrix	Depth (ft)	Alpha	^{241}Am	Beta	^{144}Ce	^{60}Co	^{137}Cs	Gamma	^{106}Ru
LINE 34										
N48-2021	Soil	2.5-3.7		0.59			0.12	3.73	1.5	2.46
N48-2021	Soil	9-10	–28.09	0	–33.42	0	0.14	2.85	1.5	0
N48-2021	Soil	14-15	–22.48	0.03	–32.45	0	0	3.57	2.4	1.5
N48-2022	Soil	4-5	–16.86	0	–24.7	0	0	2.95	0.7	0.58
N48-2022	Soil	9-10	–28.09	0.57	–31	0	0.58	3.85	–0.1	0
N48-2022	Soil	14-15	–5.62	0.59	–13.08	0	0.04	3.73	–1.5	2.46
N48-2023	Soil	4-5	–28.09	0	–34.39	0	0	4.13	–3.3	1.45
N48-2023	Soil	9-10	–28.09	0.06	–34.39	0	0	3.71	–2.8	0
N48-2023	Soil	14-15	–28.09	0.56	–31.97	0	0.18	3.64	–3.3	1.45
N48-2067	Soil	4.4-5	5.27	0	14.76	0.98	0.39	0	3.8	0
N48-2067	Soil	6.4-7	5.27	0	39.69	0.64	0.51	0	4.4	0
N48-2068	Soil	7-8	10.54	0	41.11	1.34	0.91	0	4.9	0
N48-2069	Soil	2.5-3	5.27	0	18.82	0	0	0	3.8	0.87
N48-2069	Soil	5.5-7	10.54	0	31.26	0	0.49	0	1.4	0
LINE 37										
N48-2024	Soil	4-5	–22.48	0	–31.5	0	0.19	2.04	–2.5	0
N48-2024	Soil	8-9	–22.48	0	–31.5	0	0.61	4.22	–2.3	1.35
N48-2024	Soil	14-15	–28.09	0	–24.7	0	0.4	6.94	–2.3	0.63
N48-2025	Soil	4-5	–22.48	0.27	–31	0	0.02	0.95	–1.5	0.82
N48-2025	Soil	5.5-6.5		0.13			0.67	0.52		1.21
N48-2025	Soil	7.5-8.5		0.05				0.05		
N48-2025	Soil	9-10					0.19			0.34
N48-2025	Soil	13-14		0.06			0.51			0.1
N48-2027	Soil	0-0.5	–16.9	0.85	–17.99	0	0	0.03	–1	0.58
N48-2028	Soil	0-0.5	–11.2	0.26	–15	0	0.04	0.44	0.8	0.26
N48-2029	Soil	0-0.5	0	0	–17.9	0	0	0.76	–1	1.64
N48-2030	Soil	0-0.5	–11.2	0	–11.1	0.86	0.29	0	1.2	0
N48-2031	Soil	0-0.5	–16.86	0.16	–12.6	0.06	0.02	0.22	0.8	0.69
N48-2032	Soil	0-0.5	–16.86	0.26	–19.4	0.35	0.33	0	2.1	1.85
N48-2033	Soil	0-0.5	–16.86	0	–9.2	0	0.06	0.11	2.9	1.38
N48-2034	Soil	0-0.5	–22.48	0	–5.3	0	0	0	4.2	1.16
N48-2035	Soil	0-0.5	–5.6	0.23	–5.3	1.71	0.31	1.06	3.9	1.27
N48-2036	Soil	0-0.5	–22.48	0.77	–20.3	7.47	0.08	0	2.6	1.06
LINE 38										
N48-2026	Soil	1.5-2.5	–22.48	0	–25.7	0	0.28	0	–4.3	1.74
N48-2026	Soil	6-7.4	–5.6	0	–26.6	0	1.35	2	–0.2	2.08
N48-2026	Soil	14-15	–28.09	0.12	–22.3	0	0.19	0	–4.2	1.74
Soil SAL				**17**		**64**	**0.9**	**4**		**14**
Background UTL								1.4		

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Values are not available for blank entries. Gross-alpha, -beta, and -gamma radiation measurements are provided for information purposes only.
b. Shaded boxes indicate results that exceed UTL value.
SAL = screening action level
UTL = upper tolerance limit

TABLE B-9 (continued)

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT MOBILE LAB FACILITY IN AGGREGATE N

Comparison with SALs and multiple constituent analysis[a,b]

Location ID No.	Matrix	Depth (ft)	^{241}Am	^{144}Ce	^{60}Co	^{137}Cs	^{106}Ru	MCA[c]
LINE 34								
N48-2021	Soil	2.5-3.7	0.59		0.12	3.73	2.46	1.276
N48-2021	Soil	9-10			0.14	2.85		0.868
N48-2021	Soil	14-15	0.03			3.57	1.5	1.001
N48-2022	Soil	4-5				2.95	0.58	0.779
N48-2022	Soil	9-10	0.57		0.58	3.85		1.640
N48-2022	Soil	14-15	0.59		0.04	3.73	2.46	1.187
N48-2023	Soil	4-5				4.13	1.45	0.104
N48-2023	Soil	9-10	0.06			3.71		0.931
N48-2023	Soil	14-15	0.56		0.18	3.64	1.45	1.247
N48-2067	Soil	4.4-5		0.98	0.39			0.449
N48-2067	Soil	6.4-7		0.64	0.51			0.577
N48-2068	Soil	7-8		1.34	**0.91**			0.021
N48-2069	Soil	2.5-3					0.87	0.062
N48-2069	Soil	5.5-7			0.49			0.544
LINE 37								
N48-2024	Soil	4-5			0.19	2.04		0.721
N48-2024	Soil	8-9			0.61	**4.22**	1.35	0.774
N48-2024	Soil	14-15			0.4	**6.94**	0.63	0.489
N48-2025	Soil	4-5	0.27		0.02	0.95	0.82	0.334
N48-2025	Soil	5.5-6.5	0.13		0.67	0.52	1.21	0.969
N48-2025	Soil	7.5-8.5	0.05			0.05		0.015
N48-2025	Soil	9-10			0.19		0.34	0.235
N48-2025	Soil	13-14	0.06		0.51		0.1	0.577
N48-2027	Soil	0-0.5	0.85			0.03	0.58	0.099
N48-2028	Soil	0-0.5	0.26		0.04	0.44	0.26	0.188
N48-2029	Soil	0-0.5				0.76	1.64	0.307
N48-2030	Soil	0-0.5		0.86	0.29			0.336
N48-2031	Soil	0-0.5	0.16	0.06	0.02	0.22	0.69	0.137
N48-2032	Soil	0-0.5	0.26	0.35	0.33		1.85	0.520
N48-2033	Soil	0-0.5			0.06	0.11	1.38	0.193
N48-2034	Soil	0-0.5					1.16	0.083
N48-2035	Soil	0-0.5	0.23	1.71	0.31	1.06	1.27	0.740
N48-2036	Soil	0-0.5	0.77	7.47	0.08		1.06	0.327
LINE 38								
N48-2026	Soil	1.5-2.5			0.28		1.74	0.435
N48-2026	Soil	6-7.4			**1.35**	2	2.08	0.649
N48-2026	Soil	14-15	0.12		0.19		1.74	0.343
Soil SAL			**17**	**64**	**0.9**	**4**	**14**	
Background UTL						1.4		

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Results less than or equal to zero are not shown.
b. Unshaded outlined boxes represent MCA values greater than 1.0. Shaded outlined boxes indicate results that contribute greater than 5% to MCA value greater than 1. Shaded boxes with bolded entries indicate results that exceed SAL. Results that exceed SAL are not included in MCA calculation.
c. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
SAL = screening action level
UTL = upper tolerance limit

TABLE B-10

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT FIXED-SITE LAB IN AGGREGATE N

Greater than background or no background value[a,b]													
Location ID No.	Matrix	Depth (ft)	^{241}Am	^{144}Ce	^{60}Co	^{238}Pu	$^{239,240}Pu$	^{106}Ru	^{228}Th	^{230}Th	^{234}U	^{235}U	^{238}U
LINE 34													
N48-2021	Soil	2.5-3.7	0.007	0.222	0.08	0.008	0.076	0.462	0.922	0.759	0.668	0.041	0.751
N48-2021	Soil	9-10	−0.002	0.	0.	0.005	0.081	0.	0.922	0.631	0.594	0.04	0.613
N48-2021	Soil	14-15	0.007	0.	0.	0.005	0.014	0.	0.804	0.587	0.474	0.02	0.497
N48-2022	Soil	4-5	0.004	0.	0.	−0.007	0.005	0.	0.791	0.549	0.501	0.014	0.491
N48-2022	Soil	9-10	0.005	0.	0.	0.	0.073	0.	0.746	0.493	0.454	0.043	0.48
N48-2022	Soil	14-15	−0.004	0.	0.	−0.001	0.041	0.	0.919	0.618	0.629	0.012	0.504
N48-2023	Soil	4-5	0.005	0.	0.	0.	0.136	0.	0.906	0.664	0.554	0.023	0.548
N48-2023	Soil	9-10	0.007	0.303	0.02	0.001	0.03	0.028	0.807	0.575	0.545	0.026	0.502
N48-2023	Soil	14-15	−0.011	0.	0.	0.002	0.029	0.	0.887	0.621	0.555	0.017	0.6
N48-2067	Soil	4.4-5	0.	0.	0.	0.019	0.004	0.	1.58	1.51	0.913	0.083	1.02
N48-2067	Soil	6.4-7	0.	0.	0.	0.072	0.002	0.	1.14	0.888	0.579	0.036	0.706
N48-2068	Soil	7-8	0.	0.	0.	0.035	0.006	0.	1.08	1.19	0.777	0.019	0.777
N48-2069	Soil	2.5-3	0.	0.	<0.0675	0.009	0.	0.	1.5	1.1	0.65	0.055	0.705
N48-2069	Soil	5.5-7	−0.019	0.	0.	0.011	0.001	0.	1.01	0.661	0.579	0.022	0.64
LINE 37													
N48-2024	Soil	4-5	0.			−0.275	−0.251		2.35 b	3.85	0.356	0.073	0.754
N48-2024	Soil	8-9	−0.046	<0.8399	<0.348	−0.021	0.052	<1.903	2.64	1.27	1.08	0.123	1.12
N48-2024	Soil	14-15	−0.043			−0.513	−0.476		1.81	1.51	0.659	0.012	0.973
N48-2025	Soil	4-5	−0.081			0.259	−0.542		1.03	2.32	1.26	0.093	0.767
N48-2025	Soil	5.5-6.5	0.12	<0.9852	<0.3449	0.102	0.079	<1.899	1.23	3.11	1.5	0.174	0.906
N48-2025	Soil	7.5-8.5	0.104			0.119	0.05		3.29	1.34	2.21	0.272	1.69
N48-2025	Soil	9-10				0.06	−0.006		1.62	1.76	0.593	−0.004	0.691
N38-2025	Soil	13-14	0.003			−0.4	−0.332		1.88	2.07	0.868	0.032	0.84
N48-2027	Soil	0-0.5	0.008			0.001	0.002		0.849	0.474	0.607	0.024	0.685
N48-2028	Soil	0-0.5	0.013	−7.65	0.08	0.02	0.056	3.	1.23	1.02	1.389	0.04	1.317
N48-2029	Soil	0-0.5	0.008			0.003	0.005		1.04	0.62	0.509	0.009	0.561
N48-2030	Soil	0-0.5	0.029			0.005	0.05		1.16	0.621	1.484	0.036	1.69
N48-2031	Soil	0-0.5	0.022	−8.63	−0.092	0.005	0.064	0.293	1.12	0.837	2.154	0.093	2.133
N48-2032	Soil	0-0.5	0.029			0.002	0.029		1.02	0.632	0.898	0.05	0.94
N48-2033	Soil	0-0.5	0.019			0.005	0.025			0.492	0.928	0.019	1.061
N48-2034	Soil	0-0.5	0.021			0.008	0.05		0.677	0.499	3.022	0.147	3.321
N48-2035	Soil	0-0.5	0.			0.015	0.023		0.526	0.77	0.797	0.04	0.867
N48-2036	Soil	0-0.5	0.024			0.006	0.013		0.776	0.401	0.855	0.045	0.879
LINE 38													
N48-2026	Soil	1.5-2.5	0.045			5.19	0.104		1.6	1.31	1.13	−0.112	1.04
N48-2026	Soil	6-7.4	5.27			223.	11.9		1.88	1.24	1.32	0.411	0.749
N48-2026	Soil	14-15	0.145			−0.024	0.03		1.29	1.08	2.04	0.067	1.19
Soil SAL			**17**	**64**	**0.9**	**20**	**18**	**14**	**1.5**	**5**	**86**	**18**	**59**
Background UTL						0.014	0.052		2.67		2.03	0.088	1.9

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Values are not available for blank entries.
b. Shaded boxes indicate results which exceed UTL value.
SAL = screening action level
UTL = upper tolerance limit

TABLE B-10 (continued)

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT FIXED-SITE LAB IN AGGREGATE N

Less than background[a]				
Location ID No.	Matrix	Depth (ft)	^{137}Cs	^{232}Th
LINE 34				
N48-2021	Soil	2.5-3.7	0.036	1.103
N48-2021	Soil	9-10		1.134
N48-2021	Soil	14-15		1.01
N48-2022	Soil	4-5		0.909
N48-2022	Soil	9-10		0.916
N48-2022	Soil	14-15		1.126
N48-2023	Soil	4-5		1.18
N48-2023	Soil	9-10	0.013	0.964
N48-2023	Soil	14-15		1.083
N48-2067	Soil	4.4-5		1.48
N48-2067	Soil	6.4-7		1.17
N48-2068	Soil	7-8		1.36
N48-2069	Soil	2.5-3	<0.0579	1.28
N48-2069	Soil	5.5-7		0.95
LINE 37				
N48-2024	Soil	4-5		1.6
N48-2024	Soil	8-9	<0.284	0.907
N48-2024	Soil	14-15		0.751
N48-2025	Soil	4-5		1.39
N48-2025	Soil	5.5-6.5	<0.29	2.07
N48-2025	Soil	7.5-8.5		1.26
N48-2025	Soil	9-10		1.26
N38-2025	Soil	13-14		1.62
N48-2027	Soil	0-0.5		0.851
N48-2028	Soil	0-0.5	0.902	1.18
N48-2029	Soil	0-0.5		1.02
N48-2030	Soil	0-0.5		0.84
N48-2031	Soil	0-0.5	1.05	1.09
N48-2032	Soil	0-0.5		0.974
N48-2033	Soil	0-0.5		0.737
N48-2034	Soil	0-0.5		0.683
N48-2035	Soil	0-0.5		0.741
N48-2036	Soil	0-0.5		0.654
LINE 38				
N48-2026	Soil	1.5-2.5		0.83
N48-2026	Soil	6-7.4		0.993
N48-2026	Soil	14-15		1.13
Soil SAL			**4**	**5**
Background UTL			1.4	2.68

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Values are not available for blank entries.
SAL = screening action level
UTL = upper tolerance limit

TABLE B-10 (continued)

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT FIXED-SITE LAB IN AGGREGATE N

Comparison with SALs and multiple constituent analysis[a,b]

Location ID No.	Matrix	Depth (ft)	^{241}Am	^{144}Ce	^{60}Co	^{238}Pu	$^{239,240}Pu$	^{106}Ru	^{228}Th	^{230}Th	^{234}U	^{235}U	^{238}U	MCA[c]
LINE 34														
N48-2021	Soil	2.5-3.7	0.007	0.222	0.08	0.008	0.076	0.462	0.922	0.759	0.668	0.041	0.751	0.919
N48-2021	Soil	9-10				0.005	0.081		0.922	0.631	0.594	0.04	0.613	0.765
N48-2021	Soil	14-15	0.007			0.005	0.014		0.804	0.587	0.474	0.02	0.497	0.670
N48-2022	Soil	4-5	0.004				0.005		0.791	0.549	0.501	0.014	0.491	0.653
N48-2022	Soil	9-10	0.005				0.073		0.746	0.493	0.454	0.043	0.48	0.616
N48-2022	Soil	14-15					0.041		0.919	0.618	0.629	0.012	0.504	0.755
N48-2023	Soil	4-5	0.005				0.136		0.906	0.664	0.554	0.023	0.548	0.762
N48-2023	Soil	9-10	0.007	0.303	0.02	0.001	0.03	0.028	0.807	0.575	0.545	0.026	0.502	0.701
N48-2023	Soil	14-15				0.002	0.029		0.887	0.621	0.555	0.017	0.6	0.735
N48-2067	Soil	4.4-5				0.019	0.004		**1.58**	1.51	0.913	0.083	1.02	0.336
N48-2067	Soil	6.4-7				0.072	0.002		1.14	0.888	0.579	0.036	0.706	0.962
N48-2068	Soil	7-8	0.049			0.035	0.006		1.08	1.19	0.777	0.019	0.777	0.986
N48-2069	Soil	2.5-3			<0.0675	0.009			**1.5**	1.1	0.65	0.055	0.705	0.243
N48-2069	Soil	5.5-7				0.011	0.001		1.01	0.661	0.579	0.022	0.64	0.825
LINE 37														
N48-2024	Soil	4-5							**2.35**	3.85	0.356	0.073	0.754	0.791
N48-2024	Soil	8-9		<0.8399	<0.348		0.052	<1.903	**2.64**	1.27	1.08	0.123	1.12	0.295
N48-2024	Soil	14-15							**1.81**	1.51	0.659	0.012	0.973	0.327
N48-2025	Soil	4-5				0.259			1.03	2.32	1.26	0.093	0.767	1.196
N48-2025	Soil	5.5-6.5	0.12	<0.9852	<0.3449	0.102	0.079	<1.899	**2.08**	3.11	1.5		0.906	0.671
N48-2025	Soil	7.5-8.5	0.104			0.119	0.05		**3.29**	1.34	2.21	0.272	1.69	0.354
N48-2025	Soil	9-10				0.06			**1.62**	1.76	0.593		0.691	0.374
N38-2025	Soil	13-14	0.003						**1.88**	2.07	0.868	0.032	0.84	0.440
N48-2027	Soil	0-0.5	0.008			0.001	0.002		0.849	0.474	0.607	0.024	0.685	0.681
N48-2028	Soil	0-0.5	0.013		0.08	0.02	0.056	3.	1.23	1.02	1.389	0.04	1.317	1.372
N48-2029	Soil	0-0.5	0.008			0.003	0.005		1.04	0.62	0.509	0.009	0.561	0.834
N48-2030	Soil	0-0.5	0.029			0.005	0.05		1.16	0.621	1.484	0.036	1.69	0.950
N48-2031	Soil	0-0.5	0.022			0.005	0.064	0.293	1.12	0.837	2.154	0.093	2.133	1.006
N48-2032	Soil	0-0.5	0.029			0.002	0.029		1.02	0.632	0.898	0.05	0.94	0.839
N48-2033	Soil	0-0.5	0.019			0.005	0.025			0.492	0.928	0.019	1.061	0.131
N48-2034	Soil	0-0.5	0.021			0.008	0.05		0.677	0.499	3.022	0.147	3.321	0.655
N48-2035	Soil	0-0.5				0.015	0.023		0.526	0.77	0.797	0.04	0.867	0.533
N48-2036	Soil	0-0.5	0.024			0.006	0.013		0.776	0.401	0.855	0.045	0.879	0.627
LINE 38														
N48-2026	Soil	1.5-2.5	0.045			5.19	0.104		**1.6**	1.31	1.13		1.04	0.561
N48-2026	Soil	6-7.4	5.27			**223.**	11.9		**1.88**	1.24	1.32	0.411	0.749	1.270
N48-2026	Soil	14-15	0.145				0.03		1.29	1.08	2.04	0.067	1.19	1.134
Soil SAL			**17**	**64**	**0.9**	**20**	**18**	**14**	**1.5**	**5**	**86**	**18**	**59**	
Background UTL						0.014	0.052		2.67		2.03	0.088	1.9	

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Results less than or equal to zero are not shown.
b. Unshaded outlined boxes represent MCA values greater than 1.0. Shaded outlined boxes indicate results that contribute greater than 5% to MCA value greater than 1. Shaded boxes with bolded entries indicate results that exceed SAL. Results that exceed SAL are not included in MCA calculation.
c. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
SAL = screening action level
UTL = upper tolerance limit

TABLE B-11

SCREENING ASSESSMENT FOR NONCARCINOGENS IN AGGREGATE N

Greater than background or no background value[a]

Location ID No.	Matrix	Depth (ft)	Ag	Li	Mo	Sr	Acetone	2-Butanone	Di-n-butyl phthalate
LINE 34									
N48-2021	Soil	2.5-3.7					0.047		
N48-2021	Soil	14-15	<1	2.8	<1	5.9			
N48-2022	Soil	9-10					0.029		
N48-2023	Soil	4-5	<1	7.3	<1	17.	0.032		
LINE 37									
N48-2025	Soil	4-5					0.042		0.85
N48-2025	Soil	5.5-6.5	<1	6.	<1	10.			1.8
N48-2025	Soil	7.5-8.5					0.2	0.053	
N48-2025	Soil	9-10					0.05		
N48-2025	Soil	13-14					0.025		
N48-2027	Soil	0-0.5	<1						
N48-2036	Soil	0-0.5	<1						
LINE 38									
N48-2026	Soil	1.5-2.5					0.056		0.47
N48-2026	Soil	6-7.4	<1	6.5	<1	18.	0.081		
Soil SAL			**400**				**401**		
Background UTL									

Less than background[a]

Location ID No.	Matrix	Depth (ft)	Al	As	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe
LINE 34												
N48-2021	Soil	2.5-3.7										
N48-2021	Soil	14-15	2700	0.8	20	0.49	610	<0.4	<1	2.8	1.2	5800
N48-2022	Soil	9-10										
N48-2023	Soil	4-5	10000	3.1	72	0.91	2200	<0.4	2.9	5.5	1.2	12000
LINE 37												
N48-2025	Soil	4-5										
N48-2025	Soil	5.5-6.5	5900	1.2	63	0.54	1100	<0.4	4	3.8	10	7100
N48-2025	Soil	7.5-8.5										
N48-2025	Soil	9-10										
N48-2025	Soil	13-14										
N48-2027	Soil	0-0.5	2200	1	26	0.47	970	<.4	0.9	<.5	2	5600
N48-2036	Soil	0-0.5	6700	2	75	0.66	1700	<.4	3.5	<.5	5.9	11000
LINE 38												
N48-2026	Soil	1.5-2.5										
N48-2026	Soil	6-7.4	7800	2	84	0.54	3700	<0.4	3.5	5.8	3	8500
Soil SAL					**5600**			**80**		**400**	**3000**	
Background UTL			58900	11.6	1140	3.31	54400	2.7	51.1	34.2	15.7	35600

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg. Values are not available for blank entries.
SAL = screening action level
UTL = upper tolerance limit

TABLE B-11 (continued)

SCREENING ASSESSMENT FOR NONCARCINOGENS IN AGGREGATE N

Less than background (continued)[a]

Location ID No.	Matrix	Depth (ft)	K	Mg	Mn	Na	Ni	Pb	Se	Sb	Tl	V	Zn
LINE 34													
N48-2021	Soil	2.5-3.7											
N48-2021	Soil	14-15	350	520	200	160	<2	<4	0.4	<0.08	<0.04	3.6	33
N48-2022	Soil	9-10											
N48-2023	Soil	4-5	1200	1700	270	170	7	12	0.6	<0.6	<0.2	11	34
LINE 37													
N48-2025	Soil	4-5											
N48-2025	Soil	5.5-6.5	700	900	510	110	4	8	<0.2	<0.06	0.08	8.6	40
N48-2025	Soil	7.5-8.5											
N48-2025	Soil	9-10											
N48-2025	Soil	13-14											
N48-2027	Soil	0-0.5	400	410	220	67	<2	<4	0.3	<.04	<.02	3.6	29
N48-2036	Soil	0-0.5	1000	1100	320	110	<2	20	<0	<.04	0.1	14	45
LINE 38													
N48-2026	Soil	1.5-2.5											
N48-2026	Soil	6-7.4	900	1300	230	110	5	9	<0.2	<0.06	0.09	13	29
Soil SAL					**11000**		**1600**	**400**	**400**	**32**	**6.4**	**560**	**24000**
Background UTL			6180	16100	1030	1880	26.7	39	1.7	2.5	0.9	66	101

Orphans[a,b]

Location ID No.	Matrix	Depth (ft)	Li
LINE 34			
N48-2021	Soil	2.5-3.7	
N48-2021	Soil	14-15	2.8
N48-2022	Soil	9-10	
N48-2023	Soil	4-5	7.3
LINE 37			
N48-2025	Soil	4-5	
N48-2025	Soil	5.5-6.5	6
N48-2025	Soil	7.5-8.5	
N48-2025	Soil	9-10	
N48-2025	Soil	13-14	
N48-2027	Soil	0-0.5	
N48-2036	Soil	0-0.5	
LINE 38			
N48-2026	Soil	1.5-2.5	
N48-2026	Soil	6-7.4	6.5
Soil SAL			
Background UTL			

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg. Values are not available for blank entries.
b. Constituents for which a SAL value is not available.
SAL = screening action level
UTL = upper tolerance limit

TABLE B-11 (continued)

SCREENING ASSESSMENT FOR NONCARCINOGENS IN AGGREGATE N

Comparison with SALs and multiple constituent analysis[a,b]

Location ID	No.	Matrix	Depth (ft)	Ag	Mo	Sr	Acetone	2-Butanone	Di-n-butyl phthalate	MCA[c]
LINE 34										
N48-2021		Soil	2.5-3.7				0.047			
N48-2021		Soil	14-15	<1	<1	5.9				0.0001
N48-2022		Soil	9-10				0.029			
N48-2023		Soil	4-5	<1	<1	17	0.032			0.0004
LINE 37										
N48-2025		Soil	4-5				0.042		0.85	0.0001
N48-2025		Soil	5.5-6.5	<1	<1	10			1.8	0.0004
N48-2025		Soil	7.5-8.5				0.2	0.053		0.0000
N48-2025		Soil	9-10				0.05			
N48-2025		Soil	13-14				0.025			
N48-2027		Soil	0-0.5	<1						
N48-2036		Soil	0-0.5	<1						
LINE 38										
N48-2026		Soil	1.5-2.5				0.056		0.47	0.0001
N48-2026		Soil	6-7.4	<1	<1	18	0.081			0.0004
Soil SAL				**400**	**400**	**48000**	**8000**	**4000**	**8000**	
Background UTL										

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg. Values are not available for blank entries.
b. No potential COCs were identified as a result of the comparison with SALs or the MCA calculation.
c. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
SAL = screening action level
UTL = upper tolerance limit

TABLE B-12

SCREENING ASSESSMENT FOR METAL CONSTITUENTS ANALYZED BY EDXRF IN AGGREGATE N

Orphans[a,b,c]

Location ID No.	Matrix	Depth (ft)	As	Ca	Fe	K	Th	Ti	U
LINE 34									
N48-2021	Soil	2.5-3.7	<10	4500	17200	25100	15	2389	<10
N48-2021	Soil	9-10	<10	2200	9700	33000	15	646	<10
N48-2021	Soil	14-15	<10	2300	11300	31600	<10	631	<10
N48-2022	Soil	4-5	<10	2500	13500	32400	21	839	<10
N48-2022	Soil	9-10	<10	1900	9400	32500	18	593	10
N48-2022	Soil	14-15	<10	2300	11100	32200	11	699	<10
N48-2023	Soil	4-5	<10	6200	23600	28900	16	1322	<10
N48-2023	Soil	9-10	<10	6700	14900	31100	18	821	<10
N48-2023	Soil	14-15	<10	2600	12000	31100	17	769	<10
N48-2067	Soil	4.4-5	<4	7100	23200	20500	11	3840	<8
N48-2067	Soil	6.4-7	<4	5300	14700	31500	14	<10	<8
N48-2068	Soil	7-8	<4	5100	16700	26000	10	2410	<8
N48-2069	Soil	2.5-3	<4	6100	18600	26600	14	2440	<8
N48-2069	Soil	5.5-7	<4	4600	11800	30500	<8	1110	<8
LINE 37									
N48-2024	Soil	4-5	<10	4600	15600	26600	27	1994	<10
N48-2024	Soil	8-9	<10	4400	14700	28800	23	1752	<10
N48-2024	Soil	14-15	<10	2100	10400	31700	18	596	<10
N48-2025	Soil	4-5	<10	4200	13700	28200	14	1553	<10
N48-2025	Soil	5.5-6.5	<10	3900	13600	30200	23	1359	10
N48-2025	Soil	7.5-8.5	<10	5100	17000	25700	21	2357	<10
N48-2025	Soil	9-10	<10	1900	11600	32500	27	667	<10
N48-2025	Soil	13-14	<10	2200	12600	32200	14	675	<10
N48-2027	Soil	0-0.5	<10	5900	20700	52200	<10	1397	<10
N48-2028	Soil	0-0.5	<10	58000	34600	32000	21	3737	15
N48-2029	Soil	0-0.5	<10	5900	25000	53400	<10	1843	<10
N48-2030	Soil	0-0.5	<10	10900	32400	46500	16	4431	<10
N48-2031	Soil	0-0.5	<10	9400	28200	48400	<10	3296	12
N48-2032	Soil	0-0.5	<10	6500	28200	51300	10	2477	<10
N48-2033	Soil	0-0.5	<10	7100	26900	50500	13	2399	<10
N48-2034	Soil	0-0.5	<10	6400	25600	49000	<10	2949	13
N48-2035	Soil	0-0.5	<10	7000	27900	48900	<10	3039	<10
N48-2036	Soil	0-0.5	<10	7600	30400	35600	12	4111	14
LINE 38									
N48-2026	Soil	1.5-2.5	<10	11100	16400	23200	14	2439	<10
N48-2026	Soil	6-7.4	<10	7700	16400	24700	16	2206	<10
N48-2026	Soil	14-15	<10	2000	12300	37200	22	668	<10
Soil SAL									

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg.
b. Constituents for which a SAL value is not available.
c. Measurements for As are biased low and shown for information purposes only. Measurements for Th and U are estimates and potentially biased high.
SAL = screening action level
UTL = upper tolerance limit

TABLE B-11 (continued)

SCREENING ASSESSMENT FOR NONCARCINOGENS IN AGGREGATE N

Comparison with SALs and multiple constituent analysis[a,b]

Location ID	No.	Matrix	Depth (ft)	Ag	Mo	Sr	Acetone	2-Butanone	Di-n-butyl phthalate	MCA[c]
LINE 34										
N48-2021		Soil	2.5-3.7				0.047			
N48-2021		Soil	14-15	<1	<1	5.9				0.0001
N48-2022		Soil	9-10				0.029			
N48-2023		Soil	4-5	<1	<1	17	0.032			0.0004
LINE 37										
N48-2025		Soil	4-5				0.042		0.85	0.0001
N48-2025		Soil	5.5-6.5	<1	<1	10			1.8	0.0004
N48-2025		Soil	7.5-8.5				0.2	0.053		0.0000
N48-2025		Soil	9-10				0.05			
N48-2025		Soil	13-14				0.025			
N48-2027		Soil	0-0.5	<1						
N48-2036		Soil	0-0.5	<1						
LINE 38										
N48-2026		Soil	1.5-2.5				0.056		0.47	0.0001
N48-2026		Soil	6-7.4	<1	<1	18	0.081			0.0004
Soil SAL				**400**	**400**	**48000**	**8000**	**4000**	**8000**	
Background UTL										

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg. Values are not available for blank entries.
b. No potential COCs were identified as a result of the comparison with SALs or the MCA calculation.
c. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
SAL = screening action level
UTL = upper tolerance limit

TABLE B-11 (continued)

SCREENING ASSESSMENT FOR NONCARCINOGENS IN AGGREGATE N

Comparison with SALs and multiple constituent analysis[a,b]

Location ID No.	Matrix	Depth (ft)	Ag	Mo	Sr	Acetone	2-Butanone	Di-n-butyl phthalate	MCA[c]
LINE 34									
N48-2021	Soil	2.5-3.7				0.047			
N48-2021	Soil	14-15	<1	<1	5.9				0.0001
N48-2022	Soil	9-10				0.029			
N48-2023	Soil	4-5	<1	<1	17	0.032			0.0004
LINE 37									
N48-2025	Soil	4-5				0.042		0.85	0.0001
N48-2025	Soil	5.5-6.5	<1	<1	10			1.8	0.0004
N48-2025	Soil	7.5-8.5				0.2	0.053		0.0000
N48-2025	Soil	9-10				0.05			
N48-2025	Soil	13-14				0.025			
N48-2027	Soil	0-0.5	<1						
N48-2036	Soil	0-0.5	<1						
LINE 38									
N48-2026	Soil	1.5-2.5				0.056		0.47	0.0001
N48-2026	Soil	6-7.4	<1	<1	18	0.081			0.0004
Soil SAL			**400**	**400**	**48000**	**8000**	**4000**	**8000**	
Background UTL									

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg. Values are not available for blank entries.
b. No potential COCs were identified as a result of the comparison with SALs or the MCA calculation.
c. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
SAL = screening action level
UTL = upper tolerance limit

TABLE B-12

SCREENING ASSESSMENT FOR METAL CONSTITUENTS ANALYZED BY EDXRF IN AGGREGATE N

Orphans[a,b,c]

Location ID No.	Matrix	Depth (ft)	As	Ca	Fe	K	Th	Ti	U
LINE 34									
N48-2021	Soil	2.5-3.7	<10	4500	17200	25100	15	2389	<10
N48-2021	Soil	9-10	<10	2200	9700	33000	15	646	<10
N48-2021	Soil	14-15	<10	2300	11300	31600	<10	631	<10
N48-2022	Soil	4-5	<10	2500	13500	32400	21	839	<10
N48-2022	Soil	9-10	<10	1900	9400	32500	18	593	10
N48-2022	Soil	14-15	<10	2300	11100	32200	11	699	<10
N48-2023	Soil	4-5	<10	6200	23600	28900	16	1322	<10
N48-2023	Soil	9-10	<10	6700	14900	31100	18	821	<10
N48-2023	Soil	14-15	<10	2600	12000	31100	17	769	<10
N48-2067	Soil	4.4-5	<4	7100	23200	20500	11	3840	<8
N48-2067	Soil	6.4-7	<4	5300	14700	31500	14	<10	<8
N48-2068	Soil	7-8	<4	5100	16700	26000	10	2410	<8
N48-2069	Soil	2.5-3	<4	6100	18600	26600	14	2440	<8
N48-2069	Soil	5.5-7	<4	4600	11800	30500	<8	1110	<8
LINE 37									
N48-2024	Soil	4-5	<10	4600	15600	26600	27	1994	<10
N48-2024	Soil	8-9	<10	4400	14700	28800	23	1752	<10
N48-2024	Soil	14-15	<10	2100	10400	31700	18	596	<10
N48-2025	Soil	4-5	<10	4200	13700	28200	14	1553	<10
N48-2025	Soil	5.5-6.5	<10	3900	13600	30200	23	1359	10
N48-2025	Soil	7.5-8.5	<10	5100	17000	25700	21	2357	<10
N48-2025	Soil	9-10	<10	1900	11600	32500	27	667	<10
N48-2025	Soil	13-14	<10	2200	12600	32200	14	675	<10
N48-2027	Soil	0-0.5	<10	5900	20700	52200	<10	1397	<10
N48-2028	Soil	0-0.5	<10	58000	34600	32000	21	3737	15
N48-2029	Soil	0-0.5	<10	5900	25000	53400	<10	1843	<10
N48-2030	Soil	0-0.5	<10	10900	32400	46500	16	4431	<10
N48-2031	Soil	0-0.5	<10	9400	28200	48400	<10	3296	12
N48-2032	Soil	0-0.5	<10	6500	28200	51300	10	2477	<10
N48-2033	Soil	0-0.5	<10	7100	26900	50500	13	2399	<10
N48-2034	Soil	0-0.5	<10	6400	25600	49000	<10	2949	13
N48-2035	Soil	0-0.5	<10	7000	27900	48900	<10	3039	<10
N48-2036	Soil	0-0.5	<10	7600	30400	35600	12	4111	14
LINE 38									
N48-2026	Soil	1.5-2.5	<10	11100	16400	23200	14	2439	<10
N48-2026	Soil	6-7.4	<10	7700	16400	24700	16	2206	<10
N48-2026	Soil	14-15	<10	2000	12300	37200	22	668	<10
Soil SAL									

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg.
b. Constituents for which a SAL value is not available.
c. Measurements for As are biased low and shown for information purposes only. Measurements for Th and U are estimates and potentially biased high.
SAL = screening action level
UTL = upper tolerance limit

TABLE B-12 (continued)

SCREENING ASSESSMENT FOR METAL CONSTITUENTS ANALYZED BY EDXRF IN AGGREGATE N

Comparison with SALs and multiple constituent analysis[a,b]

Location ID No.	Matrix	Depth (ft)	Ba	Cd	Cr	Cu	Hg	Mn	Ni	Pb	Se	Sb	Zn	MCA[c]
LINE 34														
N48-2021	Soil	2.5-3.7	504	<10	16	<10	<10	320	<10	22	<10	<10	30	0.215
N48-2021	Soil	9-10	153	<10	<10	<10	<10	334	<10	14	<10	<10	35	0.094
N48-2021	Soil	14-15	155	<10	10	<10	<10	322	<10	<10	<10	<10	41	0.084
N48-2022	Soil	4-5	186	<10	<10	<10	<10	363	<10	18	<10	<10	42	0.113
N48-2022	Soil	9-10	116	<10	<10	<10	<10	322	<10	13	<10	<10	34	0.084
N48-2022	Soil	14-15	156	<10	<10	<10	<10	333	<10	11	<10	<10	40	0.087
N48-2023	Soil	4-5	180	<10	<10	<10	<10	171	<10	17	<10	<10	34	0.092
N48-2023	Soil	9-10	203	<10	<10	<10	<10	485	<10	11	<10	<10	41	0.110
N48-2023	Soil	14-15	138	<10	<10	<10	<10	247	<10	17	<10	<10	32	0.091
N48-2067	Soil	4.4-5	702	<3	20	<8	<5	624	<13	22	<4	5	32	0.445
N48-2067	Soil	6.4-7	203	<3	<13	<8	<5	<16	<13	15	<4	<4	38	0.075
N48-2068	Soil	7-8	460	<3	<13	<8	<5	491	<13	14	<4	7	36	0.382
N48-2069	Soil	2.5-3	510	<3	<13	<8	<5	466	<13	18	<4	7	39	0.399
N48-2069	Soil	5.5-7	286	<3	<13	<8	<5	360	<13	15	<4	<4	33	0.123
LINE 37														
N48-2024	Soil	4-5	356	<10	12	13	<10	438	<10	22	<10	<10	35	0.194
N48-2024	Soil	8-9	332	<10	10	<10	<10	434	<10	20	<10	<10	36	0.175
N48-2024	Soil	14-15	143	<10	14	<10	<10	367	<10	14	<10	<10	33	0.130
N48-2025	Soil	4-5	290	<10	10	<10	<10	462	10	15	<10	<10	41	0.164
N48-2025	Soil	5.5-6.5	266	<10	12	16	<10	462	<10	22	<10	<10	49	0.182
N48-2025	Soil	7.5-8.5	425	<10	39	<10	<10	398	14	28	<10	<10	42	0.290
N48-2025	Soil	9-10	160	<10	25	10	<10	315	<10	17	<10	<10	40	0.167
N48-2025	Soil	13-14	139	<10	107	<10	<10	449	<10	14	<10	<10	49	0.370
N48-2027	Soil	0-0.5	204	<10	<10	10	<10	767	<10	10	<10	<10	26	0.136
N48-2028	Soil	0-0.5	454	<10	38	<10	<10	1103	<10	31	<10	<10	47	0.356
N48-2029	Soil	0-0.5	215	<10	10	<10	<10	876	<10	12	<10	<10	35	0.174
N48-2030	Soil	0-0.5	416	<10	22	<10	<10	1185	<10	24	<10	<10	42	0.299
N48-2031	Soil	0-0.5	346	<10	28	<10	<10	1121	<10	22	<10	<10	39	0.290
N48-2032	Soil	0-0.5	225	<10	<10	<10	<10	755	<10	19	<10	<10	35	0.158
N48-2033	Soil	0-0.5	231	<10	<10	<10	<10	830	<10	22	<10	<10	38	0.173
N48-2034	Soil	0-0.5	284	<10	<10	<10	<10	1195	<10	22	<10	<10	32	0.216
N48-2035	Soil	0-0.5	279	<10	<10	16	<10	1042	<10	15	<10	<10	29	0.189
N48-2036	Soil	0-0.5	400	<10	26	14	<10	998	<10	25	<10	<10	39	0.296
LINE 38														
N48-2026	Soil	1.5-2.5	638	<10	14	<10	<10	430	20	24	<10	<10	53	0.263
N48-2026	Soil	6-7.4	530	<10	27	12	<10	412	17	19	<10	<10	30	0.263
N48-2026	Soil	14-15	137	<10	10	<10	<10	333	<10	22	<10	<10	45	0.137
Soil SAL			**5600**	**80**	**400**	**3000**	**24**	**11000**	**1600**	**400**	**400**	**32**	**24000**	

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg.
b. Measurements for Ni and Se are estimates and potentially biased low. Measurements for Cd, Hg, and Sb are estimates and potentially biased high.
c. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
SAL = screening action level
UTL = upper tolerance limit

TABLE B-13

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT MOBILE LAB FACILITY IN AGGREGATE X

Greater than background or no background value[a,b,c]

Location ID No.	Matrix	Depth (ft)	Alpha	^{241}Am	^{140}Ba	Beta	^{144}Ce	^{60}Co	^{137}Cs	Gamma	^{22}Na	^{237}Np	^{106}Ru
PRS No. 48-002(e)													
X48-2037	Soil	0-0.5	−16.86	1.98		−12.11		0.	3.76	−4.8			0.05
X48-2037	Soil	0.5-1.5	−16.86	0.		−20.34		0.	4.59	−5.4			2.27
X48-2037	Soil	1.5-3	−5.62	0.47		−10.17		0.04	3.64	−5.9			0.
X48-2057	Soil	0-0.5	−11.24	0.25		− 20.83		0.07	3.79	−5.5			1.11
PRS Nos. 48-007(a,d)													
X48-2038	Soil	0-0.5	−28.09	0.		−29.5	0.	0.	0.	−3.7			0.33
X48-2052	Soil	0-0.5	−22.48	0.		−17		0.16	3.21	−2.3			0.63
X48-2080	Soil	0-0.5	6.26	− 0.25	3.83	18.93	3.99	1.33	0.44	1.95	0.68	3.65	
PRS No. 48-010													
X48-2040	Soil	0-0.5	−28.09	0.97		−32		0.65	0.	−0.8			1.98
X48-2041	Soil	0-0.5	−22.48	0.56		−26.6		0.	3.77	−2.5			1.5
X48-2082	Soil	0-0.5	−18.77	− 0.12	− 0.05	3.27	4.69	1.91	0.16	0.36	− 0.36	2.62	
Soil SAL				**17**				**0.9**	**4**		**1.3**		**14**
Background UTL									1.4				

Orphans[a,d]

Location ID No.	Matrix	Depth (ft)	^{140}Ba	^{237}Np
PRS No. 48-002(e)				
X48-2037	Soil	0-0.5		
X48-2037	Soil	0.5-1.5		
X48-2037	Soil	1.5-3		
X48-2057	Soil	0-0.5		
PRS Nos. 48-007(a,d)				
X48-2038	Soil	0-0.5		
X48-2052	Soil	0-0.5		
X48-2080	Soil	0-0.5	3.83	3.65
PRS No. 48-010				
X48-2040	Soil	0-0.5		
X48-2041	Soil	0-0.5		
X48-2082	Soil	0-0.5	−0.05	2.62
Soil SAL				
Background UTL				

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Values are not available for blank entries.
b. Shaded boxes indicate results that exceed UTL value.
c. Gross-alpha, -beta, and -gamma radiation measurements are presented for information purposes only.
d. Constituents for which a SAL value is not available.
PRS = potential release site
SAL = screening action level
UTL = upper tolerance limit

TABLE B-13 (continued)

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT MOBILE LAB FACILITY IN AGGREGATE X

Comparison with SALs and multiple constituent analysis[a,b]

Location ID No.	Matrix	Depth (ft)	^{241}Am	^{144}Ce	^{60}Co	^{137}Cs	^{22}Na	^{106}Ru	MCA[c]
PRS No. 48-002(e)									
X48-2037	Soil	0-0.5	1.98			3.76		0.05	1.06
X48-2037	Soil	0.5-1.5				**4.59**		2.27	0.162
X48-2037	Soil	1.5-3	0.47		0.04	3.64			0.982
X48-2057	Soil	0-0.5	0.25		0.07	3.79		1.11	1.119
PRS Nos. 48-007(a,d)									
X48-2038	Soil	0-0.5						0.33	0.023
X48-2052	Soil	0-0.5			0.16	3.21		0.63	1.025
X48-2080	Soil	0-0.5		3.99	**1.33**	0.44	0.68		0.695
PRS NO. 48-010									
X48-2040	Soil	0-0.5	0.97		0.65			1.98	0.921
X48-2041	Soil	0-0.5	0.56			3.77		1.5	1.083
X48-2082	Soil	0-0.5		4.69	**1.91**	0.16			0.113
Soil SAL			**17**	**64**	**0.9**	**4**	**1.3**	**14**	
Background UTL						1.4			

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Results less than or equal to zero are not shown.
b. Unshaded outlined boxes represent MCA values greater than 1.0. Shaded outlined boxes indicate results that contribute greater than 5% to MCA value greater than 1. Shaded boxes with bolded entries indicate results that exceed SAL. Results that exceed SAL are not included in MCA calculation.
c. Value is the sum of SAL-normalized values.
MCA = multiple constituent analysis
PRS = potential release site
SAL = screening action level
UTL = upper tolerance limit

TABLE B-14

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT FIXED-SITE LAB IN AGGREGATE X

Greater than background or no background value[a,b]

Location ID No.	Matrix	Depth (ft)	^{241}Am	^{144}Ce	^{60}Co	^{238}Pu	^{239,240}Pu	^{106}Ru	^{230}Th	^{235}U
PRS No. 48-002(e)										
X48-2037	Soil	0-.5	0.0238	<0.486	<0.209	0.169	0.39	<1.38	1.72	0.0927
X48-2037	Soil	.5-1.5	−0.0579			−0.0451	−0.148		1.75	0.199
X48-2037	Soil	1.5-3	−0.338			0.317	0.128		3.07	0.0775
X48-2057	Soil	0-.5	0.197			0.0754	0.258		1.8	0.111
PRS Nos. 48-007(a,d)										
X48-2038	Soil	0-.5		<0.76	<0.07			<1.5		
X48-2080	Soil	0-0.5				0.7	0.07			0.1
PRS No. 48-010										
X48-2040	Soil	0-.5	0.031			0.09	0.039		0.61	0.042
X48-2041	Soil	0-.5	0.038	<0.58	<0.11	0.087	0.049	<1.2	0.517	0.027
Soil SAL			**17**	**64**	**0.9**	**20**	**18**	**14**	**5**	**18**
Background UTL						0.014	0.052			0.088

Less than background[a]

Location ID No.	Matrix	Depth (ft)	^{137}Cs	^{228}Th	^{232}Th	^{234}U	^{238}U
PRS No. 48-002(e)							
X48-2037	Soil	0-.5	<0.257	1.09	1.58	1.46	1.5
X48-2037	Soil	.5-1.5		1.47	1.06	1.18	1.37
X48-2037	Soil	1.5-3		1.85	1.52	1.64	1.8
X48-2057	Soil	0-.5		1	1.03	1.21	1.35
PRS Nos. 48-007(a,d)							
X48-2038	Soil	0-.5	<0.08				
X48-2080	Soil	0-0.5		0.7	0.07	0.75	0.57
PRS No. 48-010							
X48-2040	Soil	0-.5		1.998	1.017	0.839	0.805
X48-2041	Soil	0-.5	<0.08	1.794	0.758	0.593	0.596
Soil SAL			**4**	**1.5**	**5**	**86**	**59**
Background UTL			1.4	2.67	2.68	2.03	1.9

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Values are not available for blank entries.
b. Shaded boxes indicate results that exceed UTL value.
PRS = potential release site
SAL = screening action level
UTL = upper tolerance limit

TABLE B-14 (continued)

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT FIXED-SITE LAB IN AGGREGATE X

Comparison with SALs and multiple constituent analysis[a,b]

Location ID No.	Matrix	Depth (ft)	^{241}Am	^{144}Ce	^{60}Co	^{238}Pu	$^{239.240}$Pu	^{106}Ru	^{230}Th	^{235}U	MCA[c]
PRS No. 48-002(e)											
X48-2037	Soil	0-.5	0.0238	<0.486	<0.209	0.169	0.39	<1.38	1.72	0.0927	0.381
X48-2037	Soil	.5-1.5							1.75	0.199	0.361
X48-2037	Soil	1.5-3				0.317	0.128		3.07	0.0775	0.641
X48-2057	Soil	0-.5	0.197			0.0754	0.258		1.8	0.111	0.396
PRS Nos. 48-007(a,d)											
X48-2038	Soil	0-.5		<0.76	<0.07			<1.5			
X48-2080	Soil	0-0.5					0.7	0.07			0.044
PRS No. 48-010											
X48-2040	Soil	0-.5	0.031			0.09	0.039		0.61	0.042	0.133
X48-2041	Soil	0-.5	0.038	<0.58	<0.11	0.087	0.049	<1.2	0.517	0.027	0.114
Soil SAL			**17**	**64**	**0.9**	**20**	**18**	**14**	**5**	**18**	
Background UTL						0.014	0.052			0.088	

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Results less than or equal to zero are not shown.
b. No potential COCs were identified as a result of the comparison with SALs or the MCA calculation.
c. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
PRS = potential release site
SAL = screening action level
UTL = upper tolerance limit

TABLE B-15

SCREENING ASSESSMENT FOR NONCARCINOGENS IN AGGREGATE X

Greater than background or no background value[a]

Location ID No.	Matrix	Depth (ft)	Ag	Li	Mo	Sr	Fluoranthene	Phenanthrene	Pyrene
PRS No. 48-002(e)									
X48-2037	Soil	0-.5					1.7	1.1	1.4
X48-2037	Soil	1.5-3	<1	28	<0.9	21			
X48-2057	Soil	0-.5					1.5	0.68	1.2
PRS Nos. 48-007(a,d)									
X48-2080	Soil	0-.5							
PRS No. 48-010									
X48-2082	Soil	0-.5							
Soil SAL			**400**		**400**	**48000**	**3200**		**2400**
Background UTL									

Less than background[a]

Location ID No.	Matrix	Depth (ft)	Al	As	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg
PRS No. 48-002(e)													
X48-2037	Soil	0-.5											
X48-2037	Soil	1.5-3	29000	3.7	200	1.5	2100	<0.4	5	13	4.6	15000	
X48-2057	Soil	0-.5											
PRS Nos. 48-007(a,d)													
X48-2080	Soil	0-.5											<0.07
PRS No. 48-010													
X48-2082	Soil	0-.5											<0.07
Soil SAL					**5600**			**80**		**400**	**3000**		**24**
Background UTL			58900	11.6	1140	3.31	54400	2.7	51.1	34.2	15.7	35600	0.1

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in µg/kg. Values are not available for blank entries.
PRS = potential release site
SAL = screening action level
UTL = upper tolerance limit

TABLE B-15 (continued)

SCREENING ASSESSMENT FOR NONCARCINOGENS IN AGGREGATE X

Less than background (continued)[a]

Location ID No.	Matrix	Depth (ft)	K	Mg	Mn	Na	Ni	Pb	Sb	Se	Tl	V	Zn
PRS No. 48-002(e)													
X48-2037	Soil	0-.5											
X48-2037	Soil	1.5-3	1900	2400	260	200	11	13.3	<0.3	0.5	<0.3	23	50
X48-2057	Soil	0-.5											
PRS Nos. 48-007(a,d)													
X48-2080	Soil	0-.5											
PRS No. 48-010													
X48-2082	Soil	0-.5											
Soil SAL					**11000**		**1600**	**400**	**32**	**400**	**6.4**	**560**	**24000**
Background UTL			6180	16100	1030	1880	26.7	39	2.5	1.7	0.9	66	101

Orphans[a,b]

Location ID No.	Matrix	Depth (ft)	Li	Phenanthrene
PRS No. 48-002(e)				
X48-2037	Soil	0-.5		1.1
X48-2037	Soil	1.5-3	28	
X48-2057	Soil	0-.5		0.68
PRS Nos. 48-007(a,d)				
X48-2080	Soil	0-.5		
PRS No. 48-010				
X48-2082	Soil	0-.5		
Soil SAL				
Background UTL				

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg. Values are not available for blank entries.
b. Constituents for which a SAL value is not available.
PRS = potential release site
SAL = screening action level
UTL = upper tolerance limit

TABLE B-15 (continued)

SCREENING ASSESSMENT FOR NONCARCINOGENS IN AGGREGATE X

Comparison with SALs and multiple constituent analysis[a,b]

Location ID No.	Matrix	Depth (ft)	Ag	Mo	Sr	Fluoranthene	Pyrene	MCA[c]
PRS No. 48-002(e)								
X48-2037	Soil	0-.5				1.7	1.4	0.0011
X48-2037	Soil	1.5-3	<1	<0.9	21			0.0004
X48-2057	Soil	0-.5				1.5	1.2	0.0010
PRS Nos. 48-007(a,d)								
X48-2080	Soil	0-.5						
PRS No. 48-010								
X48-2082	Soil	0-.5						
Soil SAL			**400**	**400**	**48000**	**3200**	**2400**	
Background UTL								

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg. Values are not available for blank entries.
b. No potential COCs were identified as a result of the comparison with SALs or the MCA calculation.
c. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
PRS = potential release site
SAL = screening action level
UTL = upper tolerance limit

TABLE B-16

SCREENING ASSESSMENT FOR CARCINOGENS IN AGGREGATE X

Comparison with SALs and multiple constituent analysis[a,b]

Location ID No.	Matrix	Depth (ft)	PCBs	Benzo[a]-anthracene	Benzo[a]-pyrene	Benzo[b]-fluoranthene	Chrysene	Indeno [1,2,3-cd]-pyrene	MCA[c]
PRS No. 48-002(e)									
X48-2037	Soil	0-0.5		0.64	**0.59**	0.74	0.64	0.39	1.78
X48-2037	Soil	0.5-1.5	**0.26**						
X48-2057	Soil	0-0.5	**0.15**	0.58	**0.57**	0.77	0.64	0.4	1.76
Soil SAL			**0.09**	**1**	**0.1**	**1**	**96**	**1**	

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg. Values are not available for blank entries.
b. Unshaded outlined boxes represent MCA values greater than 1.0. Shaded outlined boxes indicate results that contribute greater than 5% to MCA value greater than 1. Shaded boxes with bolded entries indicate results that exceed SAL. Results that exceed SAL are not included in MCA calculation.
c. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
PCB = polychlorinated biphenyl
PRS = potential release site
SAL = screening action level

TABLE B-17

SCREENING ASSESSMENT FOR METAL CONSTITUENTS IN SOILS ANALYZED BY EDXRF IN AGGREGATE X

Orphans[a,b,c]

Location ID No.	Matrix	Depth (ft)	As	Ca	Fe	K	Th	Ti	U
PRS No. 48-002(e)									
X48-2037	Soil	0-0.5	<10	6500	18700	24200	18	2634	<10
X48-2037	Soil	0.5-1.5	<10	6800	18800	21600	15	3509	<10
X48-2037	Soil	1.5-3	<10	7700	24500	19100	16	3067	<10
X48-2057	Soil	0-0.5	<10	5800	18000	24500	12	2602	<10
PRS Nos. 48-007(a,d)									
X48-2038	Soil	0-0.5	<10	5500	14100	32800	22	1133	<10
X48-2052	Soil	0-0.5	<10	3200	11500	31900	15	948	<10
PRS No. 48-010									
X48-2040	Soil	0-0.5	<10	2300	8800	32000	<10	849	<10
X48-2041	Soil	0-0.5	<10	4500	12600	27300	17	1701	<10
Soil SAL									

Comparison with SALs and multiple constituent analysis[a,c]

Location ID No.	Matrix	Depth (ft)	Ba	Cd	Cr	Cu	Hg	Mn	Ni	Pb	Sb	Se	Zn	MCA[d]
PRS No. 48-002(e)														
X48-2037	Soil	0-0.5	532	<10	20	17	<10	489	<10	47	<10	<10	125	0.318
X48-2037	Soil	0.5-1.5	619	<10	12	<10	<10	584	<10	16	<10	<10	61	0.236
X48-2037	Soil	1.5-3	602	<10	28	22	<10	452	<10	20	<10	<10	83	0.279
X48-2057	Soil	0-0.5	526	<10	17	15	<10	471	<10	30	<10	<10	720	0.289
PRS Nos. 48-007(a,d)														
X48-2038	Soil	0-0.5	367	<10	<10	16	<10	471	<10	27	<10	<10	54	0.183
X48-2052	Soil	0-0.5	241	<10	<10	16	<10	346	<10	21	<10	<10	50	0.134
PRS No. 48-010														
X48-2040	Soil	0-0.5	198	<10	<10	<10	<10	310	<10	14	<10	<10	33	0.100
X48-2041	Soil	0-0.5	409	<10	<10	<10	<10	328	<10	20	<10	<10	28	0.154
Soil SAL			**5600**	**80**	**400**	**3000**	**24**	**11000**	**1600**	**400**	**32**	**400**	**24000**	

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg.
b. Constituents for which a SAL value is not available.
c. Measurements for As, Ni, and Se are estimates and potentially biased low. Measurements for Cd, Hg, Sb, Th, and U are estimates and potentially biased high. (Results for As are shown for information purposes only.)
d. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
PRS = potential release site
SAL = screening action level

TABLE B-18

SCREENING ASSESSMENT FOR RADIONUCLIDES IN WATER ANALYZED AT MOBILE LAB FACILITY IN AGGREGATE X

Orphans[a,b] Location ID No.	Matrix	^{140}Ba	Beta	Gamma	^{237}Np
PRS Nos. 48-007(a,d)					
X48-2081	Water	1903.4	−70	0	2721.75
PRS No. 48-010					
X48-2083	Water	1703.05	−70	−40	2690.83
Water SAL					

Comparison with SALs[a,c] Location ID No.	Matrix	Alpha	^{241}Am	^{60}Co	^{22}Na
PRS Nos. 48-007(a,d)					
X48-2081	Water	**260**	**165.41**	**602.85**	**1162.77**
PRS No. 48-010					
X48-2083	Water	**260**	**571.43**	**614.23**	
Water SAL		**15**	**15**	**200**	**480**

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/L. Values are not available for blank entries.
b. Constituents for which a SAL value is not available.
c. Shaded boxes with bolded entries indicate results that exceed SAL.
PRS = potential release site
SAL = screening action level

TABLE B-19

SCREENING ASSESSMENT FOR RADIONUCLIDES IN WATER ANALYZED AT FIXED-SITE LAB IN AGGREGATE X

Orphans[a,b]

Location ID No.	Matrix	Beta	^{144}Ce	Gamma
PRS No. 48-007(a,d)				
X48-2039	Water	6.5	<340	40
PRS No. 48-010				
X48-2042	Water	2.4	<360	20
X48-2053	Water	4.8	<260	
Water SAL				

Comparison with SALs and multiple constituent analysis[a,c]

Location ID No.	Matrix	Alpha	^{60}Co	^{137}Cs	^{106}Ru	MCA[d]
PRS No. 48-007(a,d)						
X48-2039	Water	1.8	**276.2**	<32	**<600**	0.120
PRS No. 48-010						
X48-2042	Water	3.7	**267.8**	<19.6	**<920**	0.247
X48-2053	Water	3	**274.2**	<42	**<480**	0.200
Water SAL		**15**	**200**	**110**	**200**	

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/L. Values are not available for blank entries.
b. Constituents for which a SAL is not available.
c. Shaded boxes with bolded entries indicate results that exceed SAL. Results that exceed SAL are not included in MCA calculation.
d. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
PRS = potential release site
SAL = screening action level

TABLE B-20

SCREENING ASSESSMENT FOR NONCARCINOGENIC CONSTITUENTS IN WATER IN AGGREGATE X

Orphans[a,b] Location ID No.	Matrix	Al	Ca	Co	Fe	K	Li	Mg	Na
PRS No. 48-007(a,d)									
X48-2081	Water								
PRS No. 48-010									
X48-2042	Water	280	16000	<4	5000	1100	21	3500	13000
X48-2083	Water								
Water SAL									

Comparison with SALs and multiple constituent analysis[a,c] Location ID No.	Matrix	Ag	As	Ba	Be	Cd	Cr	Cu	Hg	Mn	Mo	Ni	Pb	Sb	Se	Sr	Tl	V	Zn	MCA[d]
PRS No. 48-007(a,d)																				
X48-2081	Water								0.1											0.05
PRS No. 48-010																				
X48-2042	Water	<10	4.1	87	<1	<3	<4	<7		**590**	<8	<10	3	<1	<2	68	<1	<4	70	0.196
X48-2083	Water								0.1											0.05
Water SAL		**400**	**50**	**2000**	**4**	**5**	**100**	**1300**	**2**	**180**	**400**	**100**	**50**	**6**	**50**	**21000**	**2**	**240**	**10000**	

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in µg/L. Values are not available for blank entries.
b. Constituents for which a SAL value is not available.
c. Shaded boxes with bolded entries indicate results that exceed SAL. Results that exceed SAL are not included in MCA calculation.
d. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
SAL = screening action level

TABLE B-21

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT MOBILE LAB FACILITY IN AGGREGATE Y

Greater than background or no background value[a]										
Location ID No.	Matrix	Depth (ft)	Alpha	^{241}Am	Beta	^{144}Ce	^{60}Co	^{137}Cs	Gamma	^{106}Ru
PRS No. 48-007(b)										
Y48-2043	Soil	0-.5	–28.09	0.01	– 9.2	0	1.03	0	– 3.3	0
Y48-2044	Soil	0-.5	–22.48	0.66	–14.05	0.86	1.07	0	– 3.4	0
Y48-2044	Soil	.5-1.5	–11.24	0.99	–12.11	0	0.96	0	– 0.9	0
Y48-2044	Soil	1.5-2.5	–22.48	0	–19.37	0	0.05	0	– 1.5	0
PRS No. 48-007(c)										
Y48-2045	Soil	0-.5	–28.09	0.02	–16.99	0	0.7	0	– 1.5	0.05
Y48-2046	Soil	0-.5	–28.09	0.17	6.3	0.86	0.89	0	– 2.4	2.85
Y48-2046	Soil	.5-1.5	–16.86	0.39	–12.11	0.12	0.63	0	– 0.9	1.93
Y48-2046	Soil	1.5-2	–22.48	0.15	–12.11	0	0.16	0	– 1.	0
PRS No. 48-007(f)										
Y48-2047	Soil	0-.5	–16.86	0	–19.37	1.19	0.39	0	– 2.2	0
Y48-2048	Soil	0-.5	–22.52	0	–20.8	0	0.12	0	– 1.9	0.58
Y48-2048	Soil	.5-1.5	–28.09	0.88	– 9.2	0	0.09	0	3.2	0
Soil SAL				**17**		**64**	**0.9**	**4**		**14**
Background UTL								1.4		

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Values are not available for blank entries. Gross-alpha, -beta, and -gamma radiation measurements are provided for information purposes only.
PRS = potential release site
SAL = screening action level
UTL = upper tolerance level

TABLE B-21 (continued)

SCREENING ASSESSMENT FOR RADIONUCLIDES ANALYZED AT MOBILE LAB FACILITY IN AGGREGATE Y

Comparison with SALs and multiple constituent analysis[a,b]

Location ID No.	Matrix	Depth (ft)	^{241}Am	^{144}Ce	^{60}Co	^{106}Ru	MCA[c]
PRS No. 48-007(b)							
Y48-2043	Soil	0-.5	0.01		**1.03**		0.001
Y48-2044	Soil	0-.5	0.66	0.86	**1.07**		0.052
Y48-2044	Soil	.5-1.5	0.99		**0.96**		0.058
Y48-2044	Soil	1.5-2.5			0.05		0.056
PRS No. 48-007(c)							
Y48-2045	Soil	0-.5	0.02		0.7	0.05	0.783
Y48-2046	Soil	0-.5	0.17	0.86	0.89	2.85	1.216
Y48-2046	Soil	.5-1.5	0.39	0.12	0.63	1.93	0.863
Y48-2046	Soil	1.5-2	0.15		0.16		0.187
PRS No. 48-007(f)							
Y48-2047	Soil	0-.5		1.19	0.39		0.452
Y48-2048	Soil	0-.5			0.12	0.58	0.175
Y48-2048	Soil	.5-1.5	0.88		0.09		0.152
Soil SAL			**17**	**64**	**0.9**	**14**	
Background UTL							

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Results less than or equal to zero are not shown.
b. Shaded boxes with bolded entries indicate results that exceed SAL. Results that exceed SAL are not included in MCA calculation. Shaded outlined boxes indicate results that contribute greater than 5% to MCA value greater than 1.0. Unshaded outlined boxes indicate MCA values greater than 1.0.
c. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
PRS = potential release site
SAL = screening action level
UTL = upper tolerance level

TABLE B-22

SCREENING ASSESSMENT FOR RADIONUCLIDES IN SOIL ANALYZED AT FIXED-SITE LAB IN AGGREGATE Y

Greater than background or no background value[a,b]

Location ID No.	Matrix	Depth (ft)	^{241}Am	^{238}Pu	$^{239,240}Pu$	^{230}Th	^{234}U	^{235}U	^{238}U
PRS No. 48-007(b)									
Y48-2043	Soil	0-.5		0.012	0.021	0.643	2.51	0.108	1.95
Y48-2044	Soil	0-.5		0.014	0.007	0.619	0.087	0.001	0.143
Y48-2044	Soil	.5-1.5		0	0.001	1.12	0.841	0.054	1.022
Y48-2044	Soil	1.5-2.5		0.007	0.001	1.11	0.025	0.003	0.026
PRS No. 48-007(c)									
Y48-2045	Soil	0-.5	0.047	0.044	0.041	0.791	1.332	0.148	1.162
Y48-2046	Soil	0-.5	0.0456	0.054	0.046	0.613	0.895	0.04	0.88
Y48-2046	Soil	.5-1.5	0.052	0.172	0.164	0.671	0.959	0.035	0.823
Y48-2046	Soil	1.5-2	0.024	0.064	0.035	0.692	0.803	0.049	0.43
PRS No. 48-007(f)									
Y48-2047	Soil	0-.5	0.004	0.001	0.003	0.834	0.791	0.042	0.712
Y48-2048	Soil	0-.5	0.0071	0.014	0.012	0.729	0.756	0.027	0.694
Y48-2048	Soil	.5-1.5	0.001	0.01	0.009	0.679	0.529	0.023	0.511
Soil SAL			**17**	**20**	**18**	**5**	**86**	**18**	**59**
Background UTL				0.014	0.052		2.03	0.088	1.9

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g. Values are not available for blank entries.
b. Shaded boxes indicate results that exceed UTL value.

Less than background[a]

Location ID No.	Matrix	Depth (ft)	^{228}Th	^{232}Th
PRS No. 48-007(b)				
Y48-2043	Soil	0-.5	1.17	1.2
Y48-2044	Soil	0-.5	0.91	0.891
Y48-2044	Soil	.5-1.5	1.43	1.51
Y48-2044	Soil	1.5-2.5	1.62	1.65
PRS No. 48-007(c)				
Y48-2045	Soil	0-.5	1.063	1.15
Y48-2046	Soil	0-.5	0.918	0.944
Y48-2046	Soil	.5-1.5	0.966	0.91
Y48-2046	Soil	1.5-2	1.31	1.35
PRS No. 48-007(f)				
Y48-2047	Soil	0-.5	1.36	1.37
Y48-2048	Soil	0-.5	0.948	0.913
Y48-2048	Soil	.5-1.5	0.756	0.72
Soil SAL			**1.5**	**5**
Background UTL			2.67	2.68

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in pCi/g.
PRS = potential release site
SAL = screening action level
UTL = upper tolerance level

TABLE B-22 (continued)

SCREENING ASSESSMENT FOR RADIONUCLIDES IN SOIL ANALYZED AT FIXED-SITE LAB IN AGGREGATE Y

Comparison with SALs and multiple constituent analysis[a,b]

Location ID No.	Matrix	Depth (ft)	^{241}Am	^{238}Pu	$^{239,240}Pu$	^{230}Th	^{234}U	^{235}U	^{238}U	MCA[c]
PRS No. 48-007(b)										
Y48-2043	Soil	0-.5		0.012	0.021	0.643	2.51	0.108	1.95	0.199
Y48-2044	Soil	0-.5		0.014	0.007	0.619	0.087	0.001	0.143	0.128
Y48-2044	Soil	.5-1.5			0.001	1.12	0.841	0.054	1.022	0.254
Y48-2044	Soil	1.5-2.5		0.007	0.001	1.11	0.025	0.003	0.026	0.223
PRS No. 48-007(c)										
Y48-2045	Soil	0-.5	0.047	0.044	0.041	0.791	1.332	0.148	1.162	0.209
Y48-2046	Soil	0-.5	0.046	0.054	0.046	0.613	0.895	0.04	0.88	0.158
Y48-2046	Soil	.5-1.5	0.052	0.172	0.164	0.671	0.959	0.035	0.823	0.182
Y48-2046	Soil	1.5-2	0.024	0.064	0.035	0.692	0.803	0.049	0.43	0.164
PRS No. 48-007(f)										
Y48-2047	Soil	0-.5	0.004	0.001	0.003	0.834	0.791	0.042	0.712	0.191
Y48-2048	Soil	0-.5	0.007	0.014	0.012	0.729	0.756	0.027	0.694	0.17
Y48-2048	Soil	.5-1.5	0.001	0.01	0.009	0.679	0.529	0.023	0.511	0.153
Soil SAL			**17**	**20**	**18**	**5**	**86**	**18**	**59**	
Background UTL				0.014	0.052		2.03	0.088	1.9	

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable.
All values are reported in pCi/g. Results less than or equal to zero are not shown.
b. No potential COCs were identified as a result of the comparison with SALs or MCA calculation.
c. Value is the sum of the SAL-normalized values.
MCA = multiple consistent analysis
PRS = potential release site
SAL = screening action level
UTL = upper tolerance level

TABLE B-23

SCREENING ASSESSMENT FOR NONCARCINOGENIC CONSTITUENTS IN SOIL IN AGGREGATE Y

Greater than background or no background value[a,b]

Location ID No.	Matrix	Depth (ft)	Ag	Ca	Li	Mo	Sr	Acetone	Benzo[g,h,i]-perylene	Fluoranthene	Phenanthrene	Pyrene
PRS No. 48-007(c)												
Y48-2046	soil	.5-1.5							0.41	1.4	0.9	1.4
PRS No. 48-007(f)												
Y48-2048	soil	0-.5	<1	57000	5.7	<1	140					
Y48-2048	soil	.5-1.5	<1	690	3.5	2	5.2	0.035		0.64		0.53
SOIL SAL			**400**			**400**	**48000**	**8000**		**3200**		**2400**
Background UTL				54400								

Less than background[a]

Location ID No.	Matrix	Depth (ft)	Al	As	Ba	Be	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Na	Ni	Pb	Sb	Se	Tl	V	Zn
PRS No. 48-007(f)																						
Y48-2048	soil	0-.5 F	3000	1	300	0.2	<0.4	1.7	25	7.9	5200	280	2000	190	61	11	10	<0.08	<0.2	<0.06	8.4	24
Y48-2048	soil	.5-1.5 F	3000	0.8	33	0.28	<0.4	1	26	4	5500	280	470	150	54	9	9	<0.08	<0.2	<0.06	5.6	26
SOIL SAL					**5600**		**80**		**400**	**3000**				**11000**		**1600**	**400**	**32**	**400**	**6.4**	**560**	**24000**
Background UTL			58900	11.6	1140	3.31	2.7	51.1	34.2	15.7	35600	6180	16100	1030	1880	26.7	39	2.5	1.7	0.9	66	101

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg. Values are not available for blank entries.
b. Shaded boxes represent values greater than UTL.
PRS = potential release site
SAL = screening action level
UTL = upper tolerance limit

TABLE B-23 (continued)

SCREENING ASSESSMENT FOR NONCARCINOGENIC CONSTITUENTS IN SOIL IN AGGREGATE Y

Orphans[a,b]

Location ID No.	Matrix	Depth (ft)	Ca	Li	Benzo[g,h,i]-perylene	Phenanthrene
PRS No. 48-007(c)						
Y48-2046	soil	.5-1.5 F			0.41	0.9
PRS No. 48-007(f)						
Y48-2048	soil	0-.5 F	57000	5.7		
Y48-2048	soil	.5-1.5 F	690	3.5		
SOIL SAL						
Background UTL			54400			

Comparison with SALs and multiple constituent analysis[a,c]

Location ID No.	Matrix	Depth(ft)	Ag	Mo	Sr	Acetone	Fluoranthene	Pyrene	MCA[d]
PRS No. 48-007(c)									
Y48-2046	soil	.5-1.5 F					1.4	1.4	0.001
PRS No. 48-007(f)									
Y48-2048	soil	0-.5 F	<1	<1	140				0.003
Y48-2048	soil	.5-1.5 F	<1	2	5.2	0.035	0.64	0.53	0.006
SOIL SAL			**400**	**400**	**48000**	**8000**	**3200**	**2400**	
Background UTL									

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg. Values are not available for blank entries.
b. Constituents for which a SAL value is not available.
c. No potential COCs were identified as a result of the comparison with SALs or MCA calculation.
d. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
PRS = potential release site
SAL = screening action level
UTL = upper tolerance limit

TABLE B-24

SCREENING ASSESSMENT FOR CARCINOGENS IN SOIL IN AGGREGATE Y

Comparison with SALs and multiple constituent analysis[a,b]

Location ID No.	Matrix	Depth (ft)	Benzo[a]-anthracene	Benzo[a]-pyrene	Benzo[b]-fluoranthene	Chrysene	MCA[c]
PRS No. 48-007(c)							
Y48-2046	Soil	.5-1.5	0.59	**0.73**	0.99	0.82	1.589
Soil SAL			**1**	**0.1**	**1**	**96**	

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg.
b. Shaded bolded entries indicate results that exceed SAL. Results that exceeded SAL are not included in MCA calculation.
Shaded outlined boxes indicate results that contribute greater than 5% to MCA value greater than 1.0.
Unshaded outlined box indicates MCA value greater than 1.0.
c. Value is the sum of SAL-normalized values.
MCA = multiple constituent analysis
PRS = potential release site
SAL = screening action level

TABLE B-25

SCREENING ASSESSMENT FOR METAL CONSTITUENTS ANALYZED BY EDXRF IN AGGREGATE Y

Orphans[a,b,c] Location ID No.	Matrix	Depth (ft)	As	Ca	Fe	K	Th	Ti	U
PRS No. 48-007(b)									
Y48-2043	Soil	0-.5	<10	4100	10200	28400	23	1437	13
Y48-2044	Soil	0-.5	<10	3400	8200	29400	<10	667	<10
Y48-2044	Soil	.5-1.5	<10	3500	12900	26300	15	1984	<10
Y48-2044	Soil	1.5-2.5	<10	4400	27700	22100	16	2888	<10
PRS No. 48-007(c)									
Y48-2045	Soil	0-.5	<10	5000	14800	25800	17	1966	<10
Y48-2046	Soil	0-.5	<10	5100	16100	25200	13	1972	<10
Y48-2046	Soil	.5-1.5	<10	4300	14900	30100	19	1677	10
Y48-2046	Soil	1.5-2	<10	1800	10200	32500	18	735	<10
PRS No. 48-007(f)									
Y48-2047	Soil	0-.5	<10	4200	15800	29000	21	1781	10
Y48-2048	Soil	0-.5	<10	4000	11600	29300	15	1230	<10
Y48-2048	Soil	.5-1.5	<10	3900	12700	28500	13	1360	<10
Soil SAL									

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg.
b. Constituents for which a SAL value is not available.
c. Measurements for As are biased low and presented for information purposes only. Measurements for Th and U are estimates and potentially baised high.
PRS = potential release site
SAL = screening action level

TABLE B-25 (continued)

SCREENING ASSESSMENT FOR METAL CONSTITUENTS ANALYZED BY EDXRF IN AGGREGATE Y

Comparison with SALs and multiple constituent analysis[a,b,c]

Location ID No.	Matrix	Depth (ft)	Ba	Cd	Cr	Cu	Hg	Mn	Ni	Pb	Sb	Se	Zn	MCA[d]
PRS No. 48-007(b)														
Y48-2043	Soil	0-.5	219	<10	12	24	<10	137	15	20	<10	<10	51	0.151
Y48-2044	Soil	0-.5	313	<10	<10	47	<10	277	<10	21	<10	<10	92	0.153
Y48-2044	Soil	.5-1.5	335	<10	<10	<10	<10	164	10	19	<10	<10	27	0.130
Y48-2044	Soil	1.5-2.5	372	<10	29	<10	<10	200	14	14	<10	<10	44	0.203
PRS No. 48-007(c)														
Y48-2045	Soil	0-.5	365	<10	18	48	<10	520	<10	23	<10	<10	282	0.243
Y48-2046	Soil	0-.5	326	<10	23	49	<10	733	<10	28	<10	<10	279	0.280
Y48-2046	Soil	.5-1.5	257	<10	19	55	<10	227	<10	31	<10	<10	160	0.217
Y48-2046	Soil	1.5-2	148	<10	<10	18	<10	164	<10	13	<10	<10	53	0.082
PRS No. 48-007(f)														
Y48-2047	Soil	0-.5	356	<10	<10	11	<10	406	<10	23	<10	<10	39	0.163
Y48-2048	Soil	0-.5	340	<10	<10	<10	<10	387	<10	20	<10	<10	41	0.148
Y48-2048	Soil	.5-1.5	328	<10	<10	<10	<10	377	<10	19	<10	<10	31	0.142
Soil SAL			**5600**	**80**	**400**	**3000**	**24**	**11000**	**1600**	**400**	**32**	**400**	**24000**	

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in mg/kg.
b. Measurements for Ni and Se are estimates and potentially biased low. Measurements for Cd, Hg, and Sb are estimates and potentially biased high.
c. No potential COCs were identified as a result of the comparison with SALs or the MCA calculation.
d. Value is the sum of SAL-normalized values.
MCA = multiple constituent analysis
PRS potential release site
SAL = screening action level

TABLE B-26

SCREENING ASSESSMENT FOR NONCARCINOGENIC CONSTITUENTS IN WATER IN AGGREGATE Y

Orphans[a,b]

Location ID No.	Matrix	Al	Ca	Co	Fe	K	Li	Mg	Na
PRS No. 48-007(b)									
Y48-2049	Water	<100	4600	<4	<100	1000	12	1300	4600
PRS No. 48-007(f)									
Y48-2051	Water	<100	6700	<4	<100	2000	16	2000	6800
WATER SAL									

Comparison with SALs and multiple constituent analysis[a]

Location ID No.	Matrix	Ag	As	Ba	Be	Cd	Cr	Cu	Mn	Mo	Ni	Pb	Sb	Se	Sr	Tl	V	Zn	MCA[c]
PRS No. 48-007(b)																			
Y48-2049	Water	13	<2	11	<1	<3	<4	10	<2	<8	<10	2.7	<1	<2	20	<1	<4	30	0.148
PRS No. 48-007(f)																			
Y48-2051	Water	11	<2	17	<1	<3	<4	10	10	<8	<10	2.9	<1	<2	30	<1	<4	<20	0.196
WATER SAL		**170**	**50**	**2000**	**4**	**5**	**100**	**1300**	**180**	**170**	**100**	**50**	**6**	**50**	**21000**	**2**	**240**	**10000**	

a. Reported results are the maximum results from the analysis of duplicate samples, where applicable. All values are reported in µg/L.
b. Constituents for which a SAL value is not available.
c. Value is the sum of the SAL-normalized values.
MCA = multiple constituent analysis
PRS = potential release site
SAL = screening action level

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Appendix C

Ecotoxicological Screening Assessment

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TABLE C-1

ECOTOXICOLOGICAL SCREENING ASSESSMENT SUMMARY TABLE FOR AGGREGATE K

Radionuclide constituents in Aggregate K

Location ID No.	Matrix	Depth	^{234}U	^{238}U
K48-2001	Soil	0–0.5 ft	0.987	1.082
K48-2002	Soil	0–5-1 ft	0.747	0.752
K48-2002	Soil	0–0.5 ft	0.947	1.03
K48-2003	Soil	0–5-1 ft	1.75	2
K48-2003	Soil	0–0.5 ft	0.967	0.993
K48-2004	Soil	0–0.7 ft	0.917	0.999
K48-2005	Soil	0–0.2 ft	2.42	2.77
Background UTL			2.03	1.9

Inorganic constituents in Aggregate K

Location ID No.	Matrix	Depth	Ag	Zn
K48-2001	Soil	0–0.5 ft	<1	36
K48-2004	Soil	0–0.7 ft	<1	140
Soil ESAL			**0.0006**	**0.0434**
Background UTL				101

Shaded boxes indicate values that are of ecological concern.

ESAL = ecotoxicological screening action level
UTL = upper tolerance limit

TABLE C-2

ECOTOXICOLOGICAL SCREENING ASSESSMENT SUMMARY TABLE FOR AGGREGATE M

Radionuclide constituents in Aggregate M

Location ID No.	Matrix	Depth	^{234}U	^{235}U	^{238}U
M48-2010	Soil	4–5 ft	0.676	0.036	0.599
M48-2011	Soil	1.7–3.7 ft	0.629	0.031	0.733
M48-2012	Soil	4–5 ft	0.685	0.032	0.689
M48-2013	Soil	2.5–3.8 ft	0.633		0.646
M48-2014	Soil	4–5 ft	0.712	0.054	0.685
M48-2015	Soil	0.5–1.5 ft	0.587	0.011	0.552
M48-2015	Soil	4–5 ft	0.508	0.023	0.487
M48-2016	Soil	0–0.5 ft	1.33	0.105	1.46
M48-2017	Soil	0–0.5 ft	1.56	0.112	2.18
M48-2018	Soil	0–0.5 ft	1.95	0.147	1.96
M48-2019	Soil	0–0.5 ft	3.48	0.167	3.97
M48-2020	Soil	0–0.5 ft	2.23	0.258	1.76
M48-2054	Soil	0–0.5 ft	2.14	0.403	1.99
M48-2054	Soil	0.5–1.5 ft	3.02	0.32	2.93
M48-2054	Soil	1.5–2.5 ft	1.75	0.122	1.74
M48-2055	Soil	0–0.5 ft	1.34	0.0548	1.19
M48-2055	Soil	0.5–1.5 ft	2.1	0.1	1.53
M48-2055	Soil	1.5–2.5 ft	6.63	0.373	5.64
M48-2055	Soil	2.5–3.5 ft	1.95	0.105	1.62
Background UTL			2.03	0.088	1.9

Inorganic constituents in Aggregate M

Location ID No.	Matrix	Depth	Ag	Zn
M48-2010	Soil	4–5 ft	<1	33
M48-2011	Soil	1.7–3.7 ft	<1	42
M48-2017	Soil	0–0.5 ft	<1	89
M48-2054	Soil	0–0.5 ft	<1	160
Soil ESAL			**0.0006**	
Background UTL				101

Shaded boxes indicate values that are of ecological concern.

ESAL = ecotoxicological screening action level
UTL = upper tolerance limit

TABLE C-3

ECOTOXICOLOGICAL SCREENING ASSESSMENT SUMMARY TABLE FOR AGGREGATE N

Radionuclide constituents in Aggregate N

Location ID No.	Matrix	Depth	^{234}U	^{235}U	^{238}U
N48-2021	Soil	2.5–3.7 ft	0.668	0.041	0.751
N48-2022	Soil	4–5 ft	0.501	0.014	0.491
N48-2023	Soil	4–5 ft	0.554	0.023	0.548
N48-2024	Soil	4–5 ft	0.356	0.0727	0.754
N48-2025	Soil	4–5 ft	1.26	0.0925	0.767
N48-2026	Soil	1.5–2.5 ft	1.13		1.04
N48-2027	Soil	0–0.5 ft	0.607	0.024	0.685
N48-2028	Soil	0–0.5 ft	1.389	0.04	1.317
N48-2029	Soil	0–0.5 ft	0.509	0.009	0.561
N48-2030	Soil	0–0.5 ft	1.484	0.036	1.69
N48-2031	Soil	0–0.5 ft	2.154	0.093	2.133
N48-2032	Soil	0–0.5 ft	0.898	0.05	0.94
N48-2033	Soil	0–0.5 ft	0.928	0.019	1.061
N48-2034	Soil	0–0.5 ft	3.022	0.147	3.321
N48-2035	Soil	0–0.5 ft	0.797	0.04	0.867
N48-2036	Soil	0–0.5 ft	0.855	0.045	0.879
N48-2067	Soil	4.4–5 ft	0.913	0.0829	1.02
N48-2069	Soil	2.5–3 ft	0.65	0.0547	0.705
Background UTL			2.03	0.088	1.9

Shaded boxes indicate values that are of ecological concern.

ESAL = ecotoxicological screening action level
UTL = upper tolerance limit

TABLE C-3 (continued)

ECOTOXICOLOGICAL SCREENING ASSESSMENT SUMMARY TABLE FOR AGGREGATE N

Inorganic constituents in Aggregate N

Location ID No.	Matrix	Depth	Ag
N48-2023	Soil	4–5 ft	<1
N48-2025	Soil	5.5–6.5 ft	<1
N48-2027	Soil	0–0.5 ft	<1
N48-2036	Soil	0–0.5 ft	<1
Soil ESAL			**0.0006**
Background UTL			

Organic constituents in Aggregate N

Location ID No.	Matrix	Depth	Acetone
N48-2021	Soil	2.5–3.7 ft	0.047
N48-2023	Soil	4–5 ft	0.032
N48-2025	Soil	4–5 ft	0.042
N48-2026	Soil	1.5–2.5 ft	0.056
Soil ESAL			**43**

No potential COCs were identified as a result of the comparison with ESAL(s).

COC = contaminant of concern
ESAL = ecotoxicological screening action level
UTL = upper tolerance limit

TABLE C-4

ECOTOXICOLOGICAL SCREENING ASSESSMENT SUMMARY TABLE FOR AGGREGATE X

Radionuclide constituents in Aggregate X

Location ID No.	Matrix	Depth	^{235}U
X48-2037	Soil	0–1.5 ft	0.199
X48-2037	Soil	0–0.5 ft	0.0927
X48-2037	Soil	1.5–3 ft	0.0775
X48-2040	Soil	0–0.5 ft	0.042
X48-2041	Soil	0–0.5 ft	0.027
X48-2057	Soil	0–0.5 ft	0.111
X48-2080	Soil	0–0.5 ft	0.1
Background UTL			0.088

Shaded boxes indicate values that are of ecological concern.

Inorganic constituents in Aggregate X

Location ID No.	Matrix	Depth	Ag
X48-2037	Soil	1.5–3 ft	<1
Soil ESAL			**0.0006**
Background UTL			

No potential COCs were identified as a result of the comparison with ESAL(s).

Organic constituents in Aggregate X

Location ID No.	Matrix	Depth	PCBs	Fluoranthene	Pyrene
X48-2037	Soil	0.5–1.5 ft	0.26		
X48-2037	Soil	0–0.5 ft		1.7	1.4
X48-2057	Soil	0–0.5 ft	0.15	1.5	1.2
Soil ESAL			**0.003**	**54.3**	**33**

No potential COCs were identified as a result of the comparison with ESAL(s).

COC = contaminant of concern
ESAL = ecotoxicological screening action level
PCB = polychlorinated biphenyl
UTL = upper tolerance limit

TABLE C-5

ECOTOXICOLOGICAL SCREENING ASSESSMENT SUMMARY TABLE FOR AGGREGATE Y

Radionuclide constituents in Aggregate Y

Location ID No.	Matrix	Depth	^{234}U	^{235}U	^{238}U
Y48-2043	Soil	0-0.5 ft	2.51	0.108	1.95
Y48-2044	Soil	0.5-1.5 ft	0.841	0.054	1.022
Y48-2044	Soil	0-0.5 ft	0.087	0.001	0.143
Y48-2044	Soil	1.5-2.5 ft	0.025	0.003	0.026
Y48-2045	Soil	0-0.5 ft	1.332	0.148	1.162
Y48-2046	Soil	0.5-1.5 ft	0.959	0.035	0.823
Y48-2046	Soil	0-0.5 ft	0.895	0.04	0.88
Y48-2046	Soil	1.5-2 ft	0.803	0.049	0.43
Y48-2047	Soil	0-0.5 ft	0.791	0.042	0.712
Y48-2048	Soil	0.5-1.5 ft	0.529	0.023	0.511
Y48-2048	Soil	0-0.5 ft	0.756	0.027	0.694
Background UTL			**2.03**	**0.088**	**1.9**

Shaded boxes indicate values that are of ecological concern.

Inorganic constituents in Aggregate Y

Location ID No.	Matrix	Depth	Ag	Ca
Y48-2048	Soil	0.5-1.5 ft	<1	690
Y48-2048	Soil	0-0.5 ft	<1	57000
Soil ESAL			**0.0006**	
Background UTL				54400

Shaded boxes indicate values that are of ecological concern.

Organic constituents in Aggregate Y

Location ID No.	Matrix	Depth	Acetone	Fluoranthene	Pyrene
Y48-2046	Soil	0.5-1.5 ft		1.4	1.4
Y48-2048	Soil	0.5-1.5 ft	0.035	0.64	0.53
Soil ESAL			**43**	**54**	**33**

No potential COCs were identified as a result of the comparison with ESAL(s).

COC = contaminant of concern
ESAL = ecotoxicological screening action level
UTL = upper tolerance limit

Appendix D

Geological Logs for Aggregates M and N

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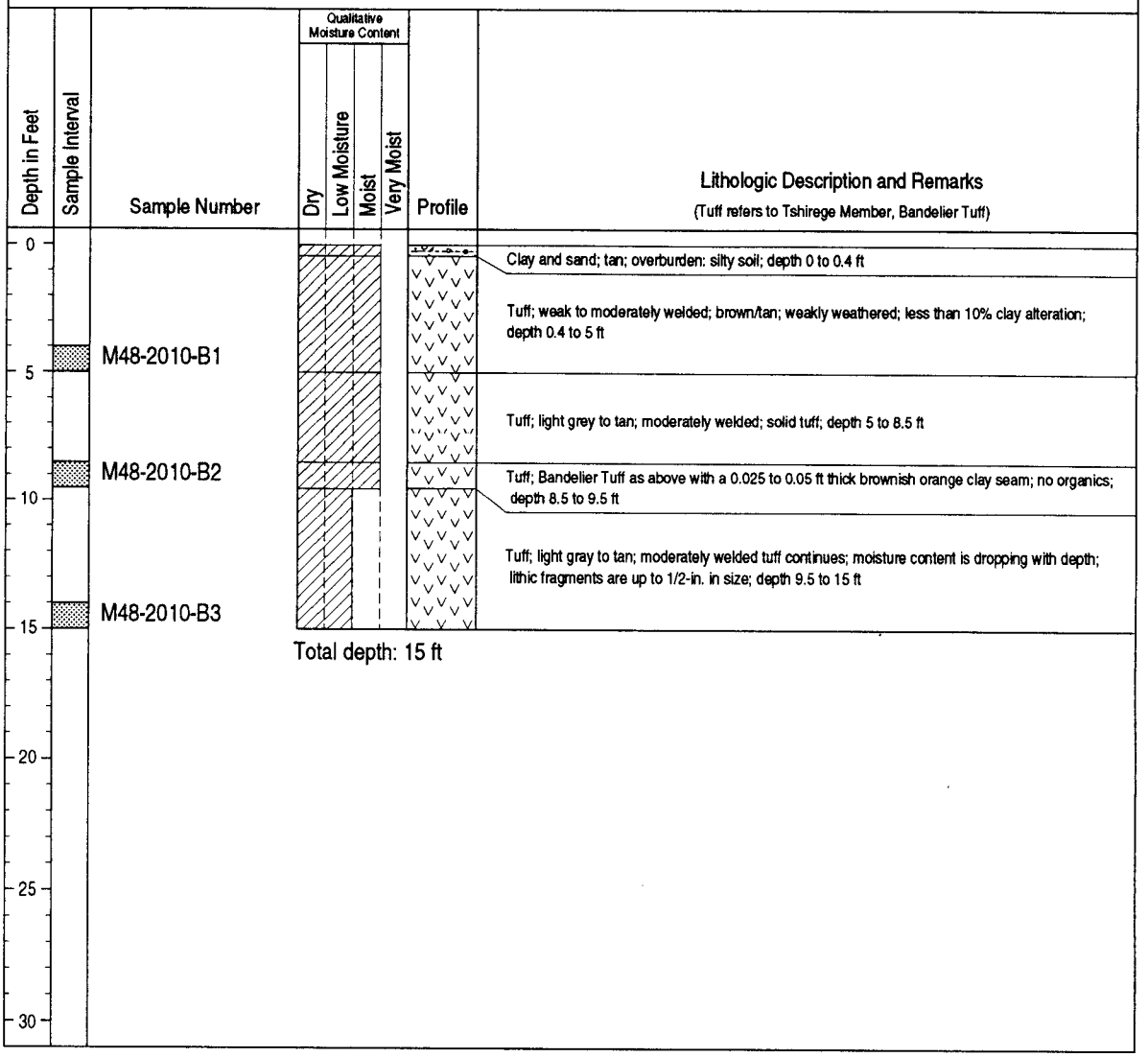
Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate M	Date Logged:	07-19-93
Location ID No.:	48-2010	Collar Elevation:	7294.6 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	15 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N 1624151.8890 E 1770601.7820		
PRS No.:	003				

NOTE: Drilling in former sand filter bed location. Up to 4 ft of tuff has been removed.



SAMPLE LOCATIONS: 4 to 5 ft, tuff; 8.5 to 9.5 ft, clay seam/tuff; 14 to 15 ft, tuff
NOTE: 5 ft core, two 2.5 split spoons.
0.4 to 15 ft is Tshriege Member of Bandelier Tuff.

F D-1GL TA-48 RFI RPT / 091295

Figure D-1. Geological log of borehole at Location ID No. 48-2010.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate M	Date Logged:	07-20-93
Location ID No.:	48-2011	Collar Elevation:	7392.5 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	15 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N1624185.5690 E1770612.7530		
PRS No.:	003				

NOTE: Drilling in former sand filter bed location. Up to 4 ft of tuff was removed from the area for TA-48-45.

Depth in Feet	Sample Interval	Sample Number	Qualitative Moisture Content: Dry	Low Moisture	Moist	Very Moist	Profile	Lithologic Description and Remarks (Tuff refers to Tshirege Member, Bandelier Tuff)
0								Clay and sand; overburden: tan, silty soil; sandy; depth 0 to 1.0 ft
								Fill material; tuff blocks in silty clay soil; tan; depth 1 to 1.8 ft
		M48-2011-B1						Fill material; silty sand with tuff (highly weathered tuff?); depth 1.8 to 3.7 ft
5								Tuff; tan to red, weak to moderately welded; weak to moderatedly welded at contact; depth 3.7 to 6.5 ft
		M48-2011-B2						Tuff; fracture (0.1 to 0.2 ft wide) filled with brownish/orange clay, angle of 60 to 70 degrees; moderately welded and dark red with depth; depth 6.5 to 8.7 ft
								Tuff; dark red; moderately welded; depth 8.7 to 10 ft
10		M48-2011-B3						Tuff; reddish brown; moderately welded tuff; grades into a brown color with depth; depth 10 to 12 ft
		M48-2011-B4						Tuff; brown; welded; moisture is dropping with depth; depth 12 to 15 ft
15								
20								
25								
30								

Total depth: 15 ft

SAMPLE LOCATIONS: 1.8 to 3.7 ft, sand/tuff; 7 to 8 ft, clay/tuff; 11 to 12 ft, clay/tuff; 14 to 15 ft, tuff.
NOTE: 5 ft core runs, two 2.5 ft spoons; 3.7 to 12 ft is Tshirege Member of Bandelier Tuff.
NOTE: dark red tuff; weathering, cooling unit or possible early post-tuff vapor-phase deterioration.

F D-2GL TA-48 RFI RPT / 091295

Figure D-2. Geological log of borehole at Location ID No. 48-2011.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate M	Date Logged:	07-20-93
Location ID No.:	48-2013	Collar Elevation:	7293.0 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	15 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N1624179.6980 E1770639.2190		
PRS No.:	003				

NOTE: Former filter location. Up to 4 ft of material has been removed for building TA-48-45.

Depth in Feet	Sample Interval	Sample Number	Qualitative Moisture Content: Dry	Low Moisture	Moist	Very Moist	Profile	Lithologic Description and Remarks (Tuff refers to Tshirege Member, Bandelier Tuff)
0								Clay and sand; overburden: silty soil; tan; depth 0 to 0.8 ft
								Backfill; clayey soil/ tuff with tuff blocks; depth 0.8 to 2.5 ft
		M48-2013-B1						Backfill; sand with less than or equal 5% pea gravel; depth 2.5 to 3.8 ft
								Tuff; salmon colored (color is not as red as in hole 48-2011); weakly welded (fragile); depth 3.8 to 5 ft
5								Tuff; light reddish tan; moderately welded; weak clay alteration; depth 5 to 9 ft
		M48-2013-B2						Tuff; broken up (fractured area) with high clay seam; cannot orient fracture; 35% clay; off brown; depth 9 to 10 ft
10								Tuff; moderately welded; grading into a brown (very solid) color; Less moisture at depth; still moist (no dust); depth 10 to 15 ft
		M48-2013-B3						
15								
20								
25								
30								

Total depth: 15 ft

SAMPLE LOCATIONS: 2.5 to 3.8 ft, sand; 9 to 10 ft, tuff (clay); 14 to 15 ft, tuff.
NOTE: 5 ft core runs, two 2.5 ft split spoons.
0.8 to 3.8 ft is backfill material. 3.8 to 15 ft is Tshirege Member of Bandelier tuff.

F D-3GL TA-48 RFI RPT / 091295

Figure D-3. Geological log of borehole at Location ID No. 48-2013.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate M	Date Logged:	07-19-93
Location ID No.:	48-2014	Collar Elevation:	7294.1 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	15 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N1624157.3150 E1770648.1750		
PRS No.:	003				

NOTE: Drilling in the former location of the sand filter beds. The tuff was excavated up to 4 ft when TA-48-45 was built.

Depth in Feet	Sample Interval	Sample Number	Qualitative Moisture Content: Dry	Low Moisture	Moist	Very Moist	Profile	Lithologic Description and Remarks (Tuff refers to Tshirege Member, Bandelier Tuff)
0								Clay and sand; overburden: sandy silty clay; brown; depth 0 to 0.9 ft
								Tuff; weathered; lightly welded; clay alteration along fractures; brown; depth 0.9 to 2.3 ft
								Tuff; gray; non-weathered (fresh); moderately welded; depth 2.3 to 3.0 ft
5		M48-2014-B1						Tuff; brown; weakly weathered; less than or equal to 10% clay; depth 3.0 to 5.5 ft
		M48-2014-B2						Tuff; gray/brown; welded (hard); weak weathering; orange/brown clay with black organics between 7.1 and 7.2 ft; depth 5.5 to 10 ft
10		M48-2014-B3						
								Tuff; brown/tan; moderately welded; non-weathered tuff; no visible clay alteration; moisture content decreased with depth; depth 10 to 15 ft
15		M48-2014-B4						
20								
25								
30								

Total depth: 15 ft

SAMPLE LOCATIONS: 4 to 5 f,t tuff; 7 to 7.3 ft, clay seam; 9 to 10 ft, tuff; 14 to 15 ft, tuff.
NOTE: 5 ft core runs, two 2.5 ft split spoons.
0.9 to 15 ft is Tshirege Member of Bandelier Tuff

F D-4GL TA-48 RFI RPT / 091295

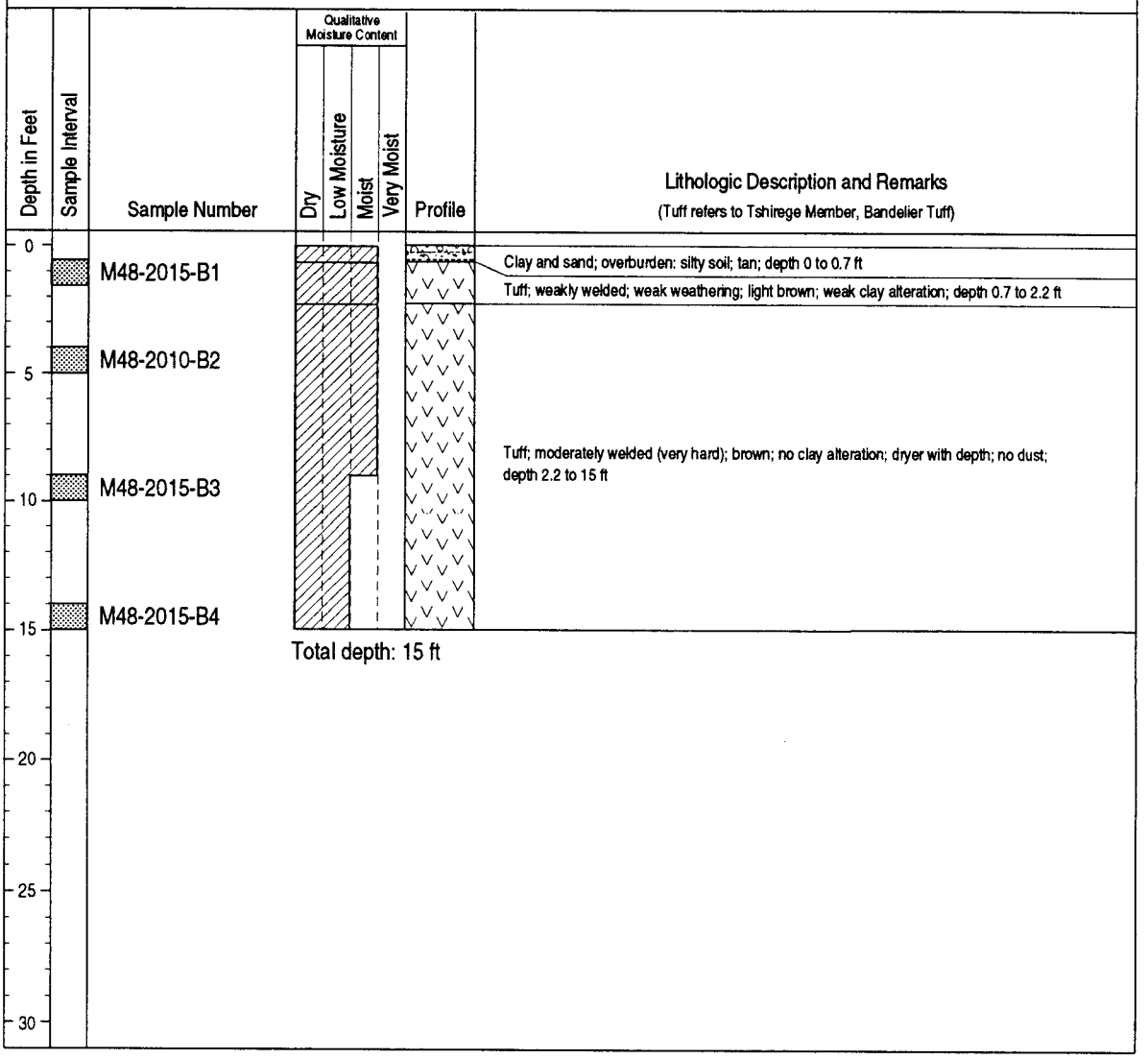
Figure D-4. Geological log of borehole at Location ID No. 48-2014.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate M	Date Logged:	07-20-93
Location ID No.:	48-2015	Collar Elevation:	7292.2 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	15 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N1624185.0240 E1770671.7870		
PRS No.:	003				

NOTE: Sand filter bed. Approximately 4 ft of material (tuff, sand?) has been previously removed.



SAMPLE LOCATIONS: 0.5 to 1.5 ft, tuff; 4 to 5 ft, tuff; 9 to 10 ft, tuff; 14 to 15 ft, tuff.
NOTE: Core barrel = 5 ft; split spoons =two at 2.5 ft.
0.7 to 15 ft is Tshirege Member of Bandelier Tuff

F D-5GL TA-48 RFI RPT / 091295

Figure D-5. Geological log of borehole at Location ID No 48-2015.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate N	Date Logged:	07-21-93
Location ID No.:	48-2021	Collar Elevation:	7320.8 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	15 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N1623487.5180 E1770353.5210		
PRS No.:	005				

NOTE: Did not drill into trench. Drilled four probed holes with auger and did not locate trench in the as-built drawing, Engineering Drawing C-43943.

Depth in Feet	Sample Interval	Sample Number	Qualitative Moisture Content: Dry	Low Moisture	Moist	Very Moist	Profile	Lithologic Description and Remarks (Tuff refers to Tshirege Member, Bandelier Tuff)
0								Clay and sand; overburden: clay/sand; depth 0 to 0.7 ft
								Fill material; dry silty sand, fine to medium grain; trace clay, some fine grained; tan to brown; depth 0.7 to 2.8 ft
		N48-2021-B1						Tuff; highly weathered; dry; tan; weak clay; depth 2.8 to 3.6 ft
5								Tuff; light to moderately welded; clay in hairline fractures; dark brown; depth 3.6 to 6 ft
								Tuff; dark brown grading to tan colored tuff; moderately welded with dropping moisture (although still moist); depth 6 to 10 ft; hard welded tuff, continuous core; depth 10 to15 ft
10		N48-2021-B2						
15		N48-2021-B3						
20								
25								

Total depth: 15 ft

SAMPLE LOCATIONS: 2.5 to 3.7 ft, silt-sand/tuff; 9 to 10 ft, tuff; 14 to 15 ft, tuff.
NOTE: Core barrel = 5 ft, split spoons = two 2.5 ft.
2.8 to 15 ft is Tshirege Member of Bandelier Tuff.
Drilling in the as-built location for the removed acid waste line no. 34. Cannot confirm location of trench using a small hand-held drill probe.

F D-6GL TA-48 RFI RPT / 091295

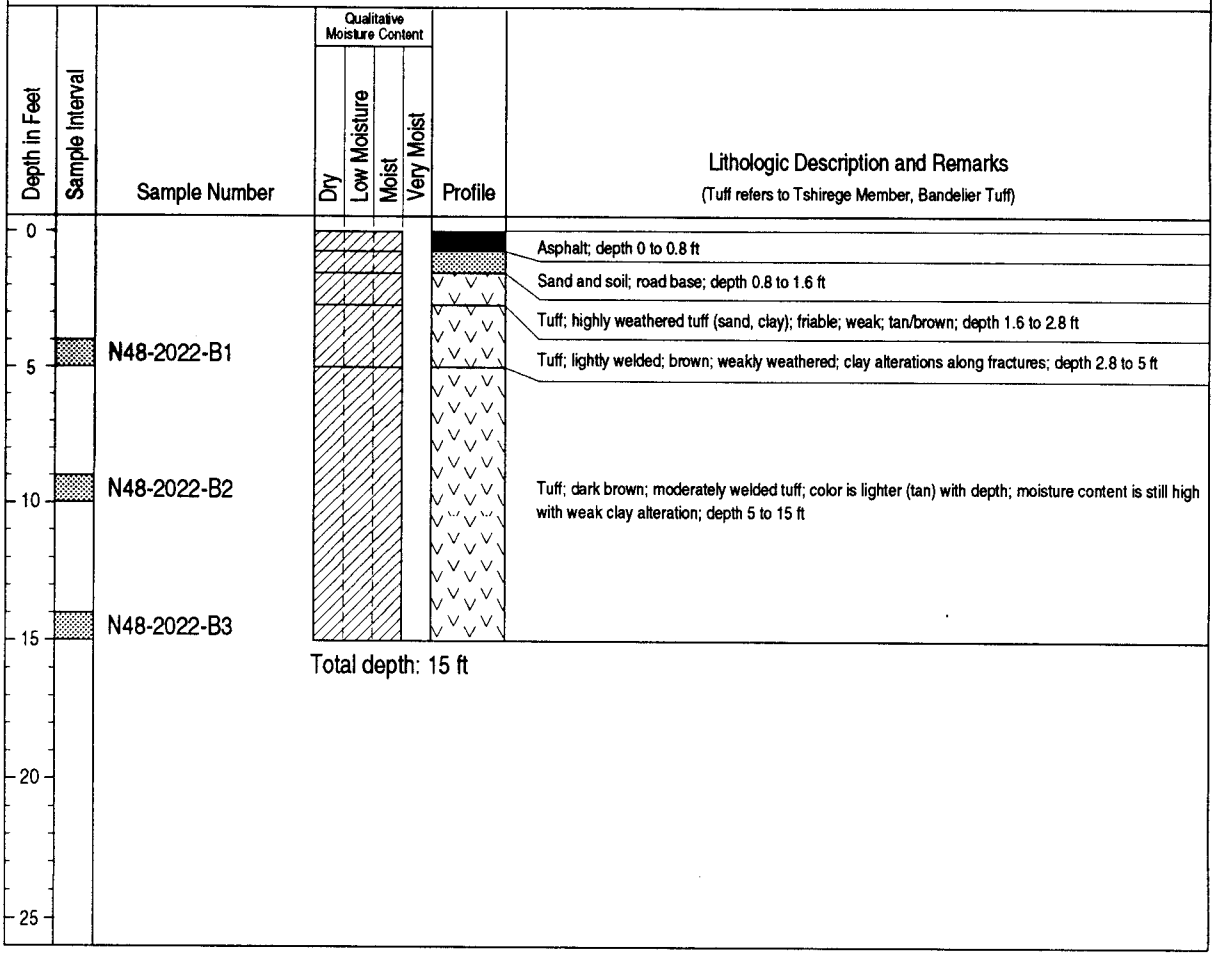
Figure D-6. Geological log of borehole at Location ID No. 48-2021.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate N	Date Logged:	07-20-93
Location ID No.:	48-2022	Collar Elevation:	7321.3 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	15 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N1623469.4670 E1770353.8680		
PRS No.:	005				

NOTE: Drilling along the as-built location for acid waste line trench, Line No. 34. JCI utility department picked up possible utilities along the map trace of the trench. Hole location was moved approximately 3 ft south of the possible utility line.



SAMPLE LOCATIONS: 4 to 5 ft, tuff; 9 to 10 ft, tuff; 14 to 15 ft, tuff.
NOTE: Core barrel = 5 ft, split spoons = two 2.5 ft.
2.8 to 15 ft is Tshirege Member of Bandelier Tuff.

F D-7GL TA-48 RFI RPT / 091295

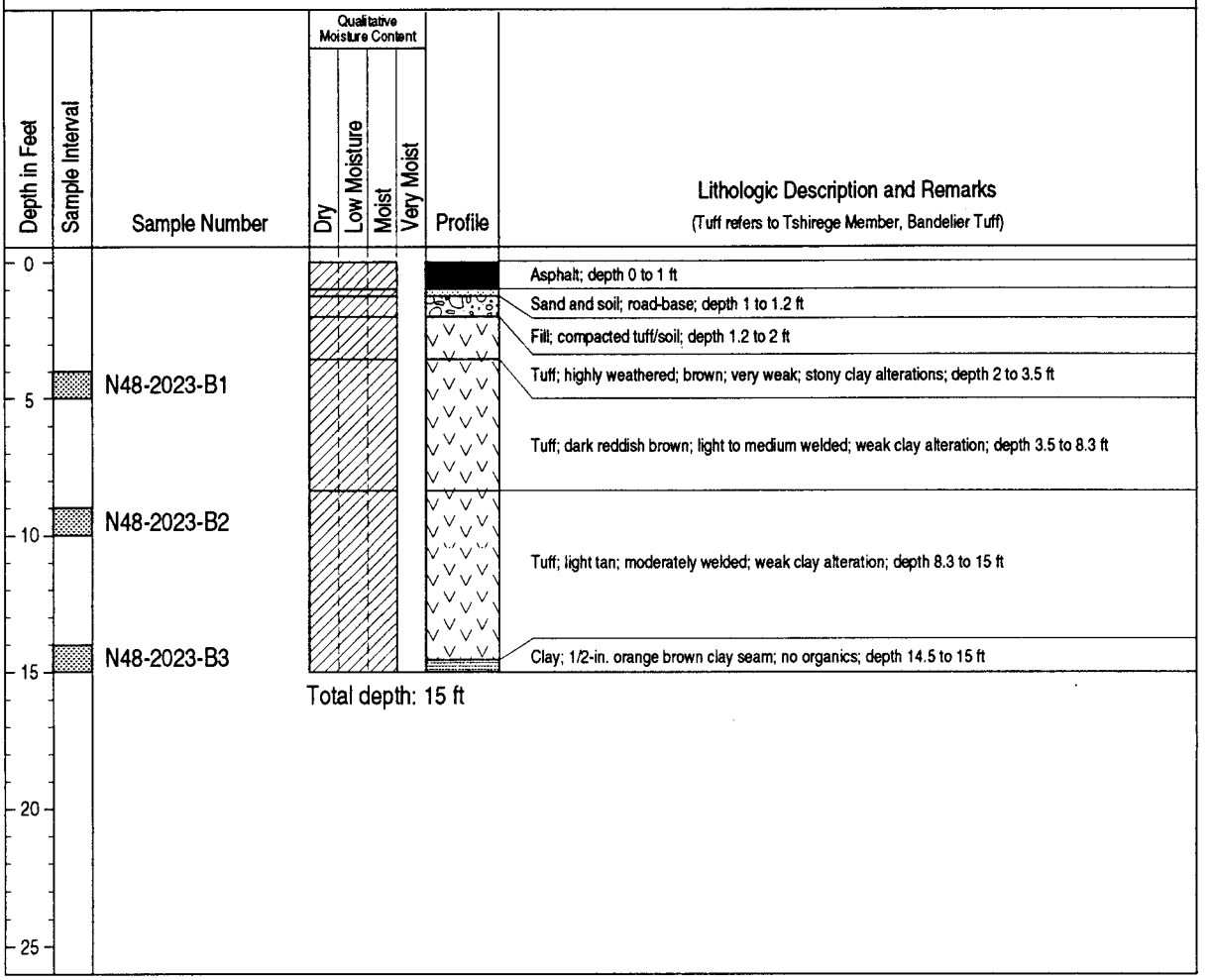
Figure D-7. Geological log of borehole at Location ID No. 48-2022.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate N	Date Logged:	07-21-93
Location ID No.:	48-2023	Collar Elevation:	7322.8 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	15 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N1623442.0270 E1770348.4690		
PRS No.:	005				

NOTE: Drilling for acid waste line trench, Line No. 34. Line was removed in the mid-1980's as part of the Lab-wide removal project. See Report LA-10821-MS.



SAMPLE LOCATIONS: 4 to 5 ft, tuff; 9 to 10 ft, tuff; 14 to 15 ft, tuff/clay.
NOTE: 5 ft core, two 2.5 ft split spoons.
3.5 to 15 ft is Tshirege Member of Bandelier Tuff.
Did not drill into trench.

F D-8GL TA-48 RFI RPT / 091295

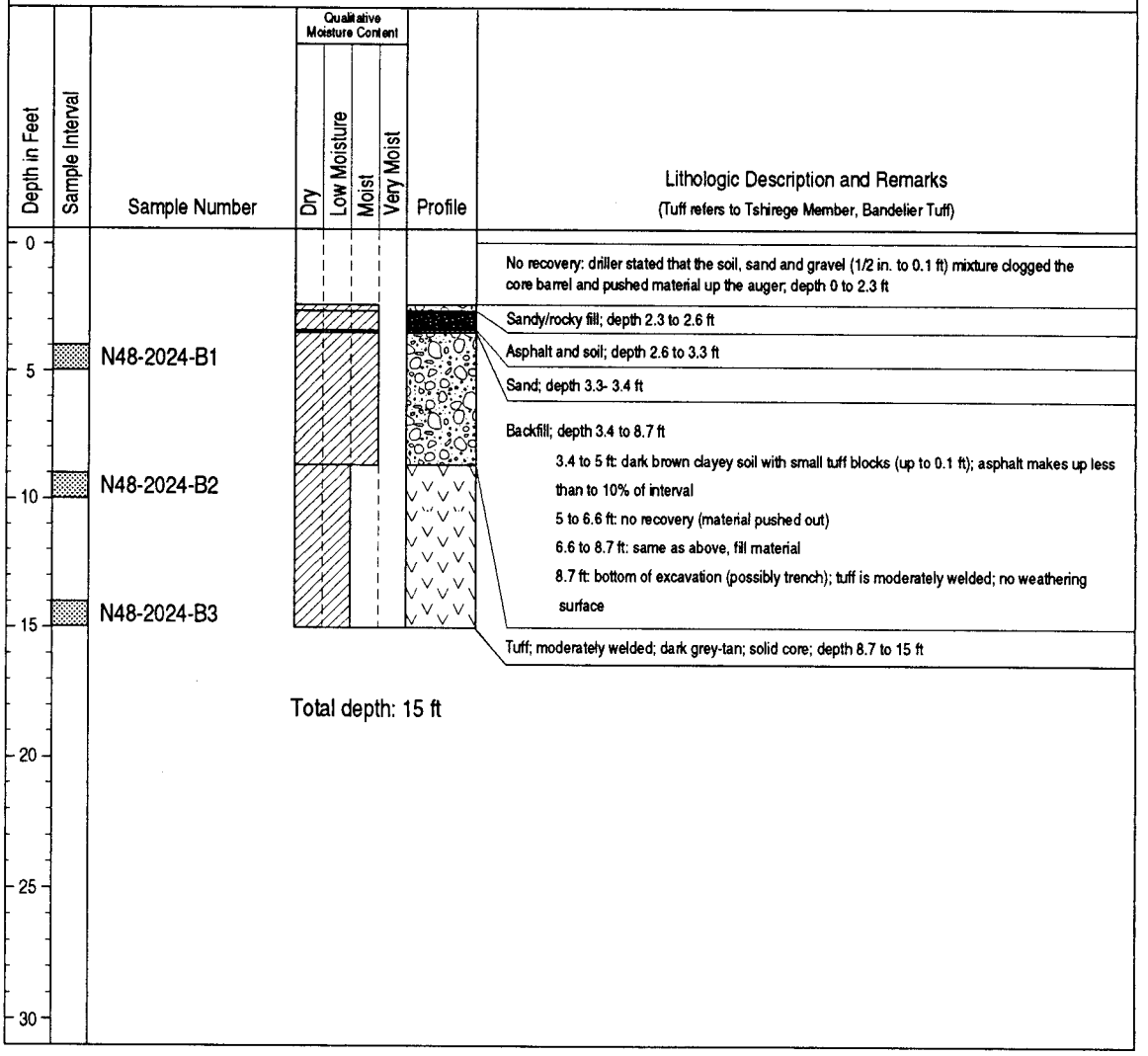
Figure D-8. Geological log of borehole at Location ID No. 48-2023.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate N	Date Logged:	07-22-943
Location ID No.:	48-2024	Collar Elevation:	7306.7 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	15 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N1623585.6220 E1770717.2660		
PRS No.:	005				

NOTE: Drilling along as-built trace of former acid waste line trench, Line No. 34.



SAMPLE LOCATIONS: 4 to 5 ft fill; 8 to 9 ft fill-tuff contact; 14 to 15 ft tuff.
NOTE: Core barrel barrel = 5 ft, split spoon = (2) 2.5 ft
3.4 to 8.7 ft backfill material

F D-9GL TA-48 RFI RPT / 091295

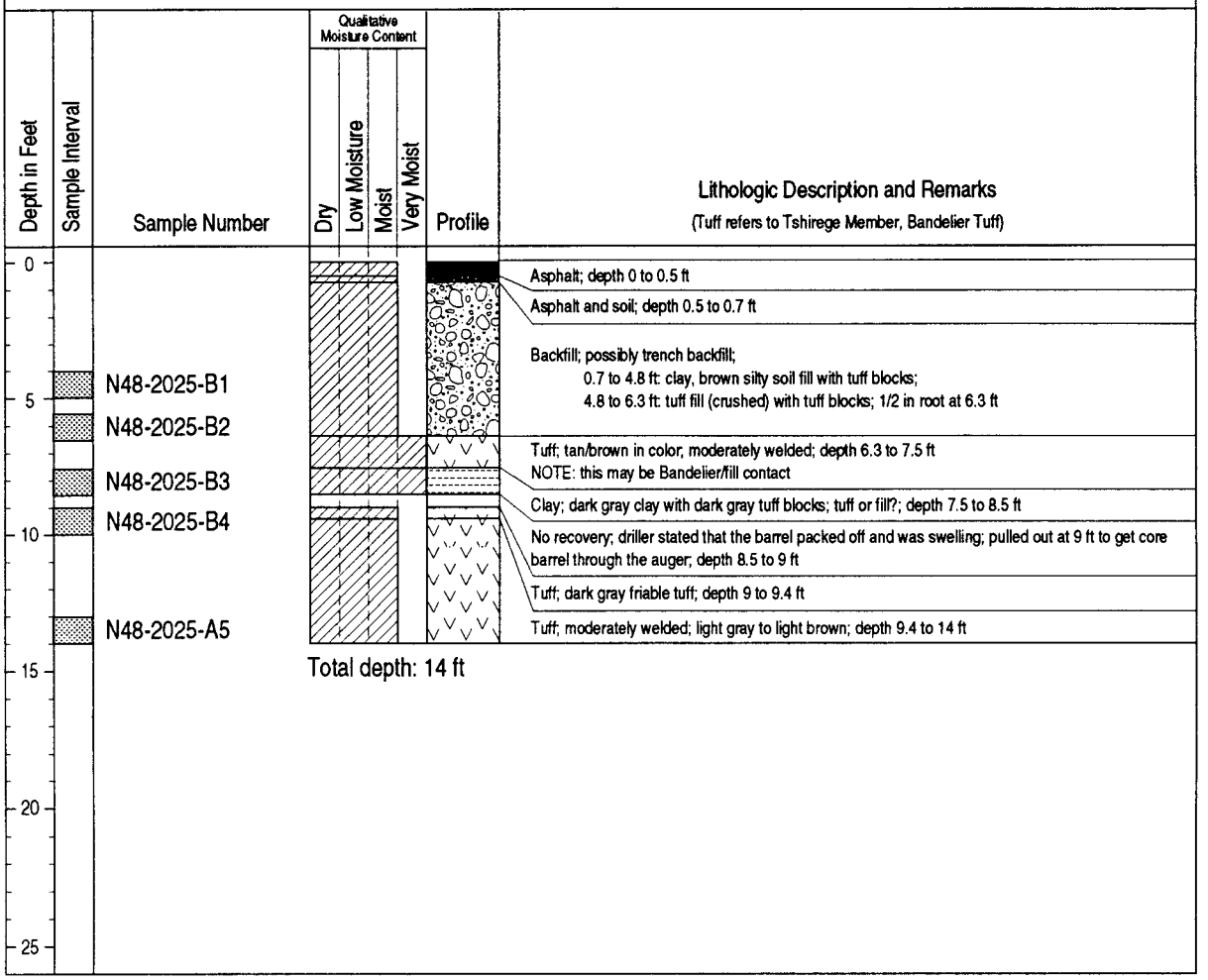
Figure D-9. Geological log of borehole at Location ID No. 48-2024.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate N	Date Logged:	07-22-93
Location ID:	48-2025	Collar Elevation:	7307.5 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	14 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. Hollow-stem auger	Coordinates:	N1623586.4810 E1770735		
PRS No.:	005				

NOTE: Drilling into former acid waste line trench, Line No. 37. Sanitary sewer line approx. 3 to 4 ft north of the borehole. Radioactive waste line approx. 7 ft east.



SAMPLE LOCATIONS: 4 to 5 ft, clay/tuff fill; 5.5 to 6.5 ft, possible tuff contact; 7.5 to 8.5 ft, dark gray clay/tuff; 9 to 10 ft, last of gray clay/tuff; 13 to 14 ft, tuff.
NOTE: 5 ft core, two 2.5 ft split spoons.
8.5 ft: 5.5 ppm OVA.

F D-10GL TA-48 RFI RPT / 091495

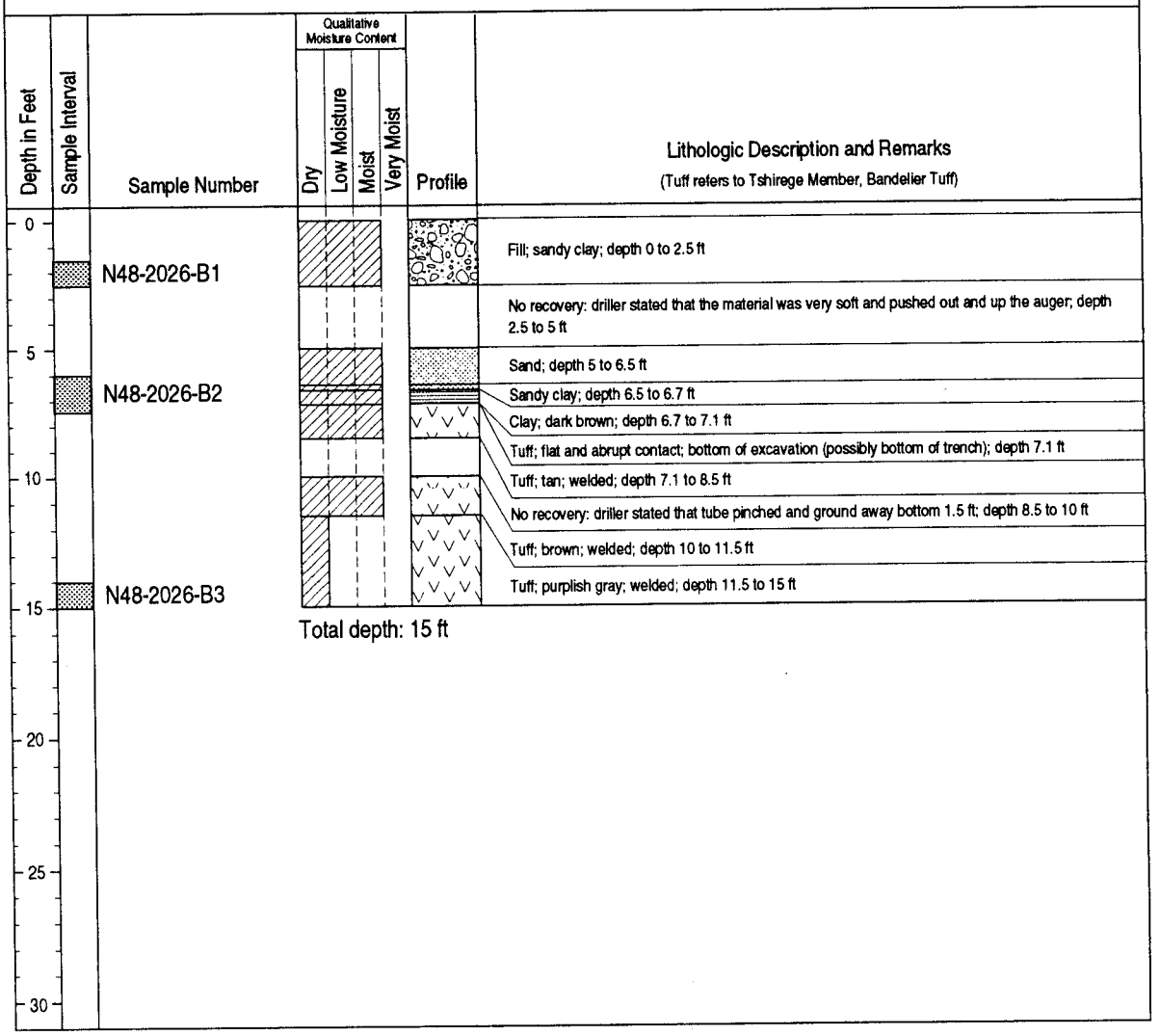
Figure D-10. Geological log of borehole at Location ID No. 48-2025.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate N	Date Logged:	07-23-93
Location ID:	48-2026	Collar Elevation:	7320.69 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	15 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N1770147.8550 E1623612.4470		
PRS No.:	005				

NOTE: Drilling at south end of TA-48 (outside the fence) to sample the former acid waste line trench, Line No. 38. For safety reasons (fence, guardrail locationand utility) the hole is positioned approx. 3 ft east of the as-built placement on Engineering Drawing C-43943.



SAMPLE LOCATIONS: 1.5 to 2.5 ft, sandy clay fill; 6 to 7.4 ft, sand, clay, tuff; 14 to 15 ft, tuff.

F D-11GL / TA-48 RFI RPT / 091295

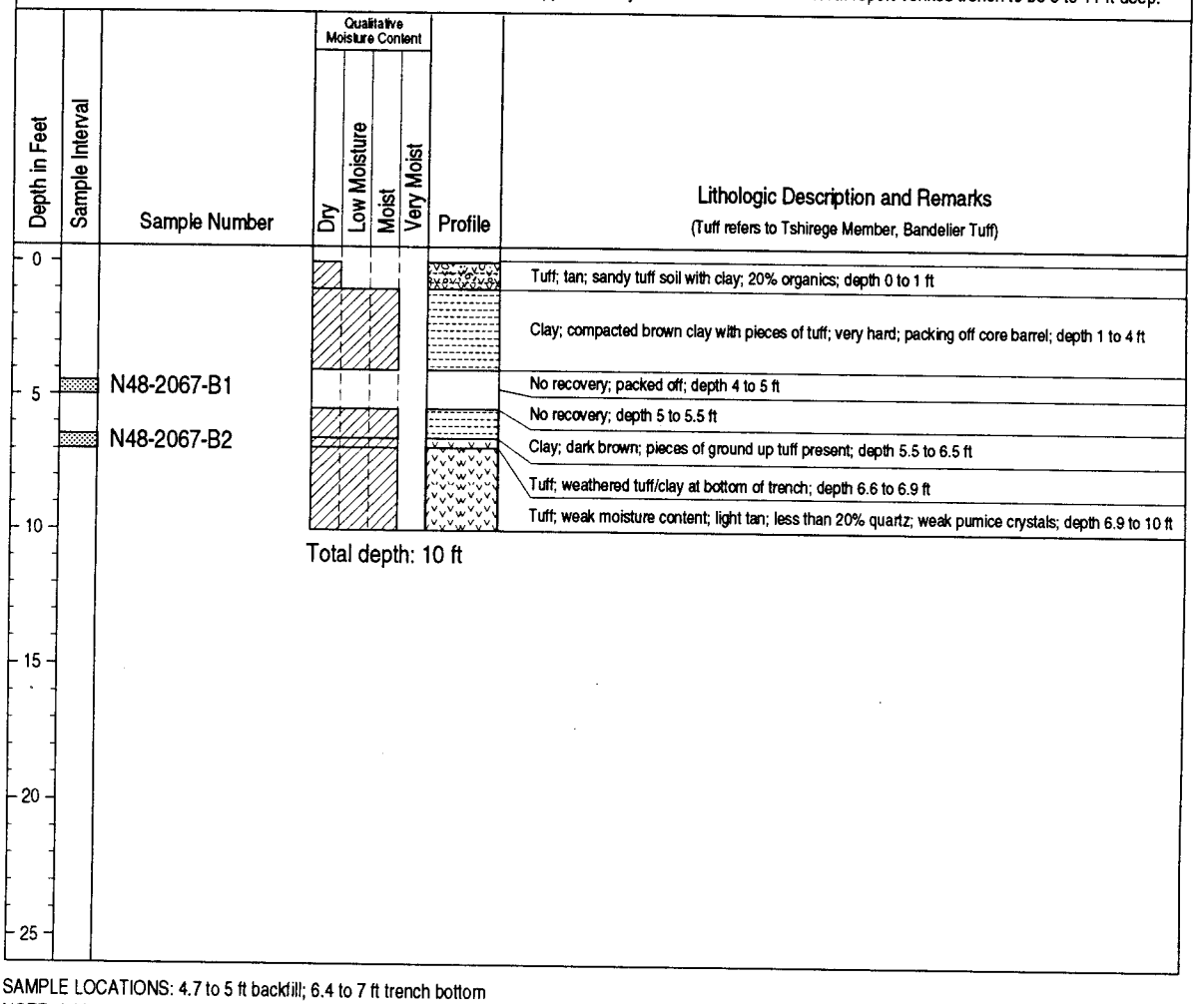
Figure D-11. Geological log of borehole at Location ID No. 48-2026.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate N	Date Logged:	10-28-93
Location ID:	48-2067	Collar Elevation:	7322.00 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	10 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. Hollow-stem auger	Coordinates:	N1770340.2000 E1623506.1000		
PRS No.:	005				

NOTE: Additional drilling in area confirmed tuff/soil contact to be at approximately 3 ft. Acid waste line removal report verifies trench to be 6 to 11 ft deep.



SAMPLE LOCATIONS: 4.7 to 5 ft backfill; 6.4 to 7 ft trench bottom
NOTE: Additional drilling to find former waste line no. 34 trench
Core barrel = 5 ft; split spoon = (2) 2.5 ft
0 to 6.6 ft backfill into trench
Very cold ≈ 25°F

F D-12GL TA-48 RFI RPT / 091295

Figure D-12. Geological log of borehole at Location ID No. 48-2067.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate N	Date Logged:	10-28-93
Location ID:	48-2068	Collar Elevation:	7321.10 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	8.5 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. Hollow-stem auger	Coordinates:	N1770340.5000 E1623497.3000		
PRS No.:	005				

NOTE: Drilling into trench for the former acid waste line, Line No. 34.

Depth in Feet	Sample Interval	Sample Number	Qualitative Moisture Content: Dry	Low Moisture	Moist	Very Moist	Profile	Lithologic Description and Remarks (Tuff refers to Tshirege Member, Bandelier Tuff)
0								Sand /clay/tuff; surface soil; weathered tuff; 20% organic; depth 0 to 1 ft
								Clay; brown; weathered tuff (small pieces); very hard to drill; depth 1 to 2 ft
								No recovery: barrel packed off in clay; depth 2 to 3.5 ft
								No recovery; depth 3.5 to 4.5 ft
5								Clay; brown; hard drilling; small pieces of tuff; depth 4.5 to 7.6 ft
		N48-2068-B1						Bottom of trench; depth 7.6 ft
								Tuff; dry; depth 7.6 to 8.5 ft
10								
15								
20								
25								
30								

Total depth: 8.5 ft

SAMPLE LOCATION: 7 to 8 ft backfill/tuff contact.
NOTE: 0 to 7.6 ft backfill consisting of moist, dark brown clay/tuff.
Drill rig: CME45BH. Core barrel: two 2.5 ft stems.

F D-13GL TA-48 RFI RPT / 091295

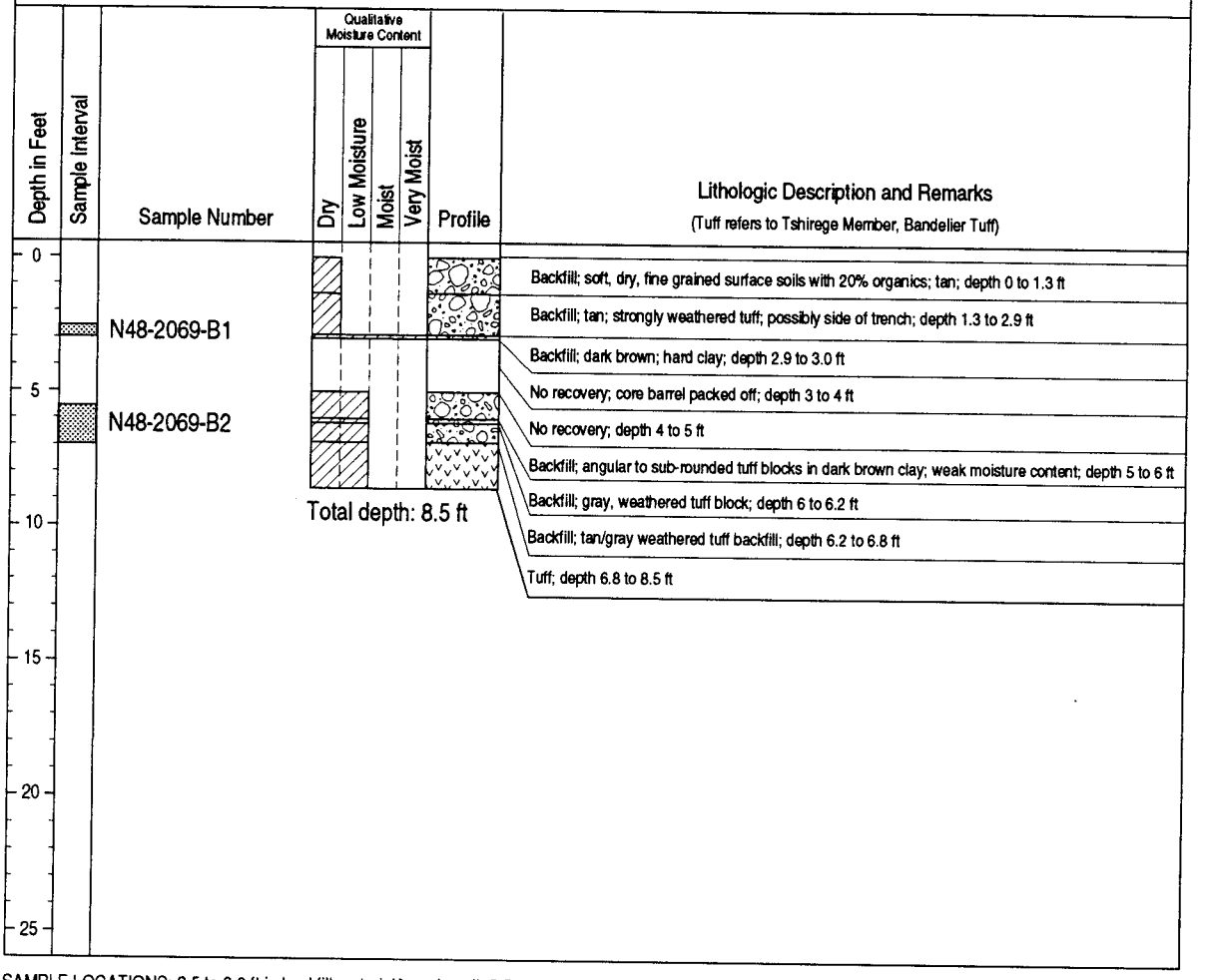
Figure D-13. Geological log of borehole at Location ID No. 48-2068.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate N	Date Logged:	10-28-93
Location ID:	48-2069	Collar Elevation:	7320.90 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	8.5 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N1770341 E1623477.2000		
PRS No.:	005				

NOTE: Drilling into trench for former waste line, Line No. 34.



SAMPLE LOCATIONS: 2.5 to 3.0 ft in backfill material/trench wall; 5.5 to 7.0 ft, pieces of tuff, backfill/tuff contact.
NOTE: Drill rig: CME45BH. Core barrel: two 2.5 ft stems.
6.8 ft trench/tuff contact.
Possibly drilled down side of trench wall.

F D-14GL TA-48 RFI RPT / 091295

Figure D-14. Geological log of borehole at Location ID No. 48-2069.

Appendix D

Geological Logs for Aggregates M and N

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Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate M	Date Logged:	07-19-93
Location ID No.:	48-2010	Collar Elevation:	7294.6 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	15 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N 1624151.8890 E 1770601.7820		
PRS No.:	003				

NOTE: Drilling in former sand filter bed location. Up to 4 ft of tuff has been removed.

Depth in Feet	Sample Interval	Sample Number	Qualitative Moisture Content: Dry	Low Moisture	Moist	Very Moist	Profile	Lithologic Description and Remarks (Tuff refers to Tshirege Member, Bandelier Tuff)
0								Clay and sand; tan; overburden: silty soil; depth 0 to 0.4 ft
								Tuff; weak to moderately welded; brown/tan; weakly weathered; less than 10% clay alteration; depth 0.4 to 5 ft
		M48-2010-B1						
5								Tuff; light grey to tan; moderately welded; solid tuff; depth 5 to 8.5 ft
		M48-2010-B2						Tuff; Bandelier Tuff as above with a 0.025 to 0.05 ft thick brownish orange clay seam; no organics; depth 8.5 to 9.5 ft
10								Tuff; light gray to tan; moderately welded tuff continues; moisture content is dropping with depth; lithic fragments are up to 1/2-in. in size; depth 9.5 to 15 ft
		M48-2010-B3						
15								
20								
25								
30								

Total depth: 15 ft

SAMPLE LOCATIONS: 4 to 5 ft, tuff; 8.5 to 9.5 ft, clay seam/tuff; 14 to 15 ft, tuff
NOTE: 5 ft core, two 2.5 split spoons.
0.4 to 15 ft is Tshriege Member of Bandelier Tuff.

F D-1GL TA-48 RFI RPT / 091295

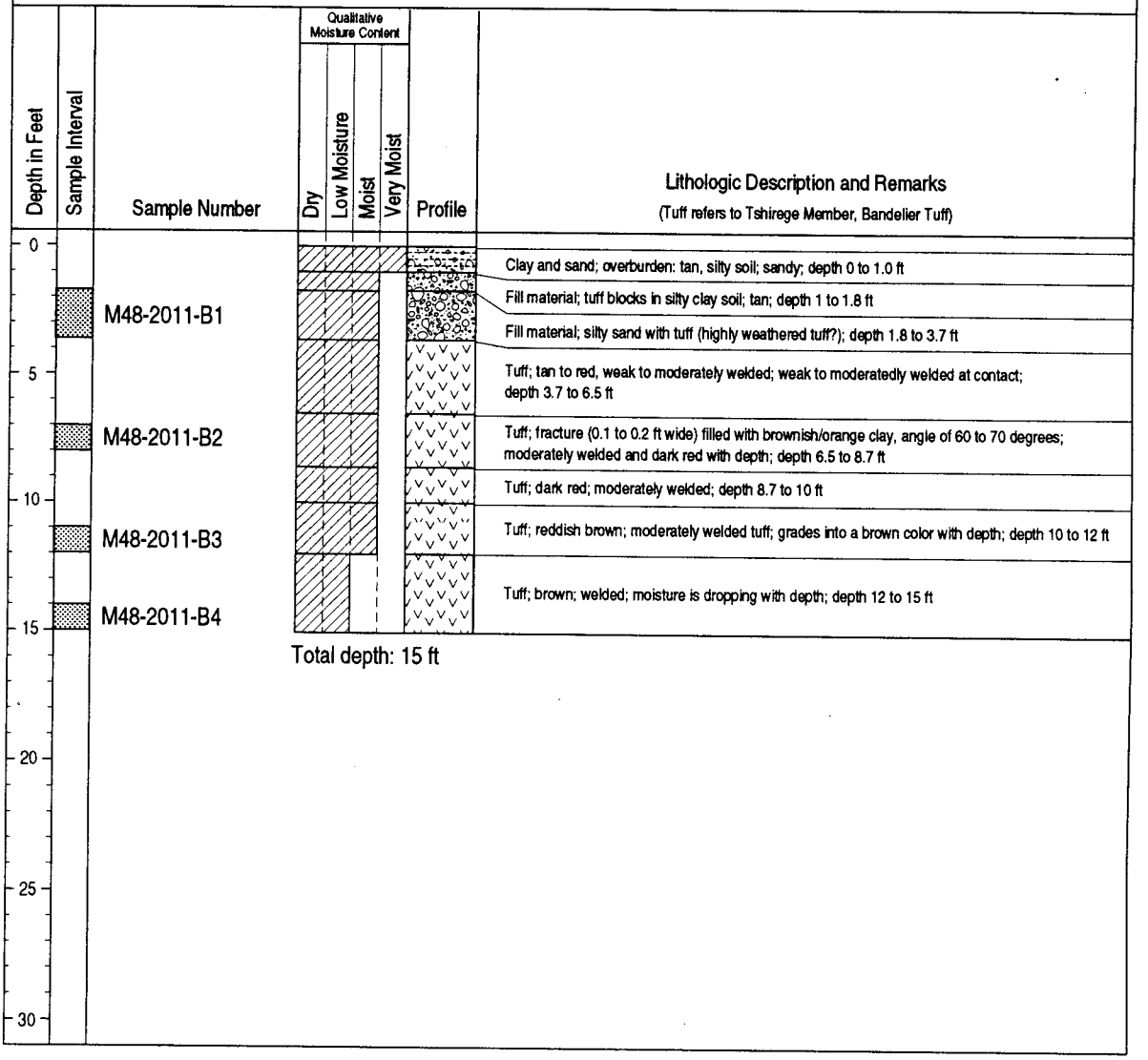
Figure D-1. Geological log of borehole at Location ID No. 48-2010.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate M	Date Logged:	07-20-93
Location ID No.:	48-2011	Collar Elevation:	7392.5 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	15 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N1624185.5690 E1770612.7530		
PRS No.:	003				

NOTE: Drilling in former sand filter bed location. Up to 4 ft of tuff was removed from the area for TA-48-45.



SAMPLE LOCATIONS: 1.8 to 3.7 ft, sand/tuff; 7 to 8 ft, clay/tuff; 11 to 12 ft, clay/tuff; 14 to 15 ft, tuff.
NOTE: 5 ft core runs, two 2.5 ft spoons; 3.7 to 12 ft is Tshirege Member of Bandelier Tuff.
NOTE: dark red tuff; weathering, cooling unit or possible early post-tuff vapor-phase deterioration.

F D-2GL TA-48 RFI RPT / 091295

Figure D-2. Geological log of borehole at Location ID No. 48-2011.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate M	Date Logged:	07-20-93
Location ID No.:	48-2013	Collar Elevation:	7293.0 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	15 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N1624179.6980 E1770639.2190		
PRS No.:	003				

NOTE: Former filter location. Up to 4 ft of material has been removed for building TA-48-45.

Depth in Feet	Sample Interval	Sample Number	Qualitative Moisture Content: Dry	Low Moisture	Moist	Very Moist	Profile	Lithologic Description and Remarks (Tuff refers to Tshirege Member, Bandelier Tuff)
0								Clay and sand; overburden: silty soil; tan; depth 0 to 0.8 ft
								Backfill; clayey soil/ tuff with tuff blocks; depth 0.8 to 2.5 ft
		M48-2013-B1						Backfill; sand with less than or equal 5% pea gravel; depth 2.5 to 3.8 ft
								Tuff; salmon colored (color is not as red as in hole 48-2011); weakly welded (fragile); depth 3.8 to 5 ft
5								Tuff; light reddish tan; moderately welded; weak clay alteration; depth 5 to 9 ft
		M48-2013-B2						Tuff; broken up (fractured area) with high clay seam; cannot orient fracture; 35% clay; off brown; depth 9 to 10 ft
10								Tuff; moderately welded; grading into a brown (very solid) color; Less moisture at depth; still moist (no dust); depth 10 to 15 ft
		M48-2013-B3						
15								
20								
25								
30								

Total depth: 15 ft

SAMPLE LOCATIONS: 2.5 to 3.8 ft, sand; 9 to 10 ft, tuff (clay); 14 to 15 ft, tuff.
NOTE: 5 ft core runs, two 2.5 ft split spoons.
0.8 to 3.8 ft is backfill material. 3.8 to 15 ft is Tshirege Member of Bandelier tuff.

F D-3GL TA-48 RFI RPT / 091295

Figure D-3. Geological log of borehole at Location ID No. 48-2013.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate M	Date Logged:	07-19-93
Location ID No.:	48-2014	Collar Elevation:	7294.1 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	15 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N1624157.3150 E1770648.1750		
PRS No.:	003				

NOTE: Drilling in the former location of the sand filter beds. The tuff was excavated up to 4 ft when TA-48-45 was built.

Depth in Feet	Sample Interval	Sample Number	Qualitative Moisture Content: Dry	Low Moisture	Moist	Very Moist	Profile	Lithologic Description and Remarks (Tuff refers to Tshirege Member, Bandelier Tuff)
0								Clay and sand; overburden: sandy silty clay; brown; depth 0 to 0.9 ft
								Tuff; weathered; lightly welded; clay alteration along fractures; brown; depth 0.9 to 2.3 ft
								Tuff; gray; non-weathered (fresh); moderately welded; depth 2.3 to 3.0 ft
5		M48-2014-B1						Tuff; brown; weakly weathered; less than or equal to 10% clay; depth 3.0 to 5.5 ft
		M48-2014-B2						Tuff; gray/brown; welded (hard); weak weathering; orange/brown clay with black organics between 7.1 and 7.2 ft; depth 5.5 to 10 ft
10		M48-2014-B3						
								Tuff; brown/tan; moderately welded; non-weathered tuff; no visible clay alteration; moisture content decreased with depth; depth 10 to 15 ft
15		M48-2014-B4						
20								
25								
30								

Total depth: 15 ft

SAMPLE LOCATIONS: 4 to 5 f,t tuff; 7 to 7.3 ft, clay seam; 9 to 10 ft, tuff; 14 to 15 ft, tuff.
NOTE: 5 ft core runs, two 2.5 ft split spoons.
0.9 to 15 ft is Tshirege Member of Bandelier Tuff

F D-4GL TA-48 RFI RPT / 091295

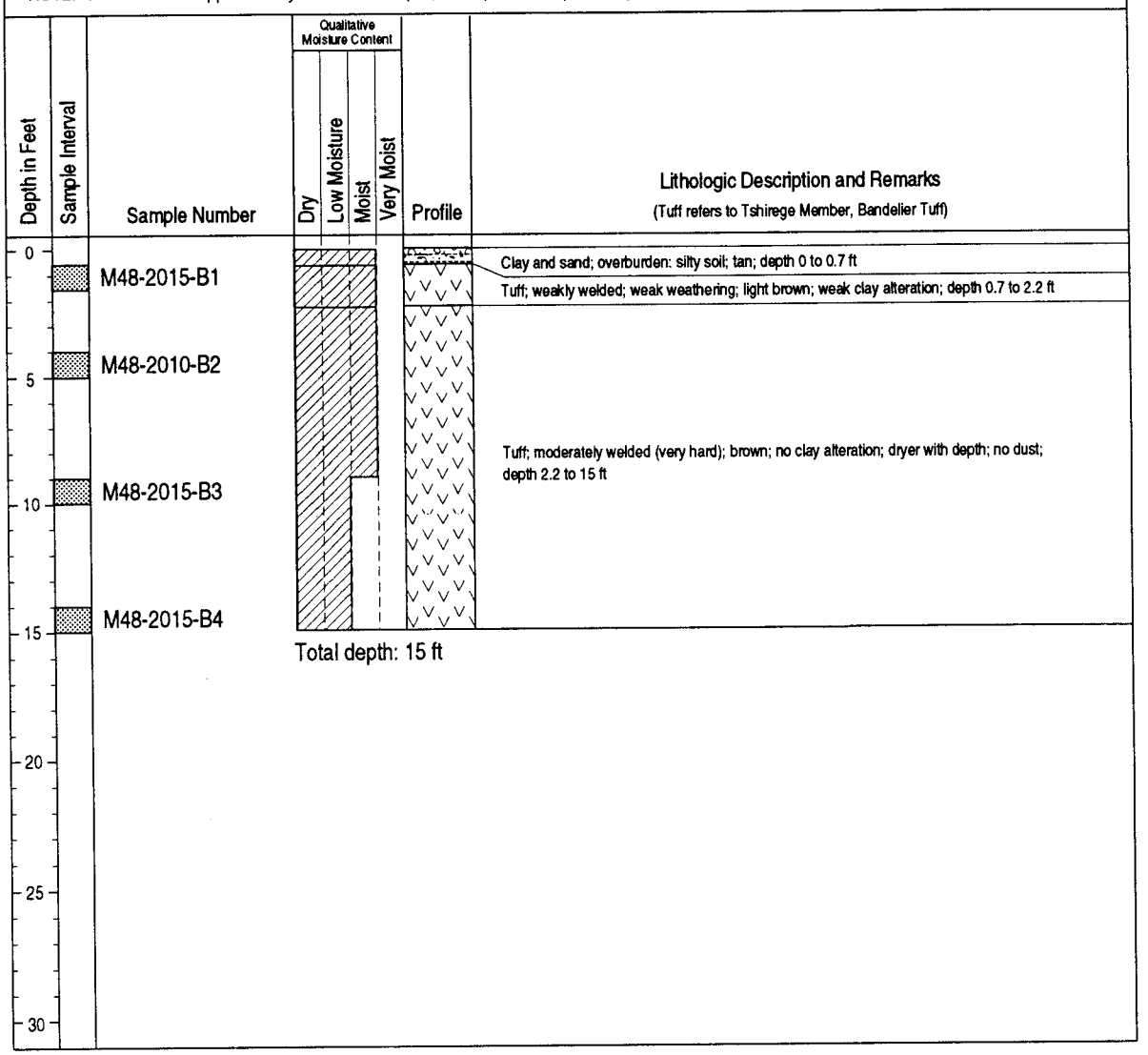
Figure D-4. Geological log of borehole at Location ID No. 48-2014.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate M	Date Logged:	07-20-93
Location ID No.:	48-2015	Collar Elevation:	7292.2 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	15 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N1624185.0240 E1770671.7870		
PRS No.:	003				

NOTE: Sand filter bed. Approximately 4 ft of material (tuff, sand?) has been previously removed.



SAMPLE LOCATIONS: 0.5 to 1.5 ft, tuff; 4 to 5 ft, tuff; 9 to 10 ft, tuff; 14 to 15 ft, tuff.
NOTE: Core barrel = 5 ft; split spoons =two at 2.5 ft.
0.7 to 15 ft is Tshirege Member of Bandelier Tuff

F D-5GL TA-48 RFI RPT / 091295

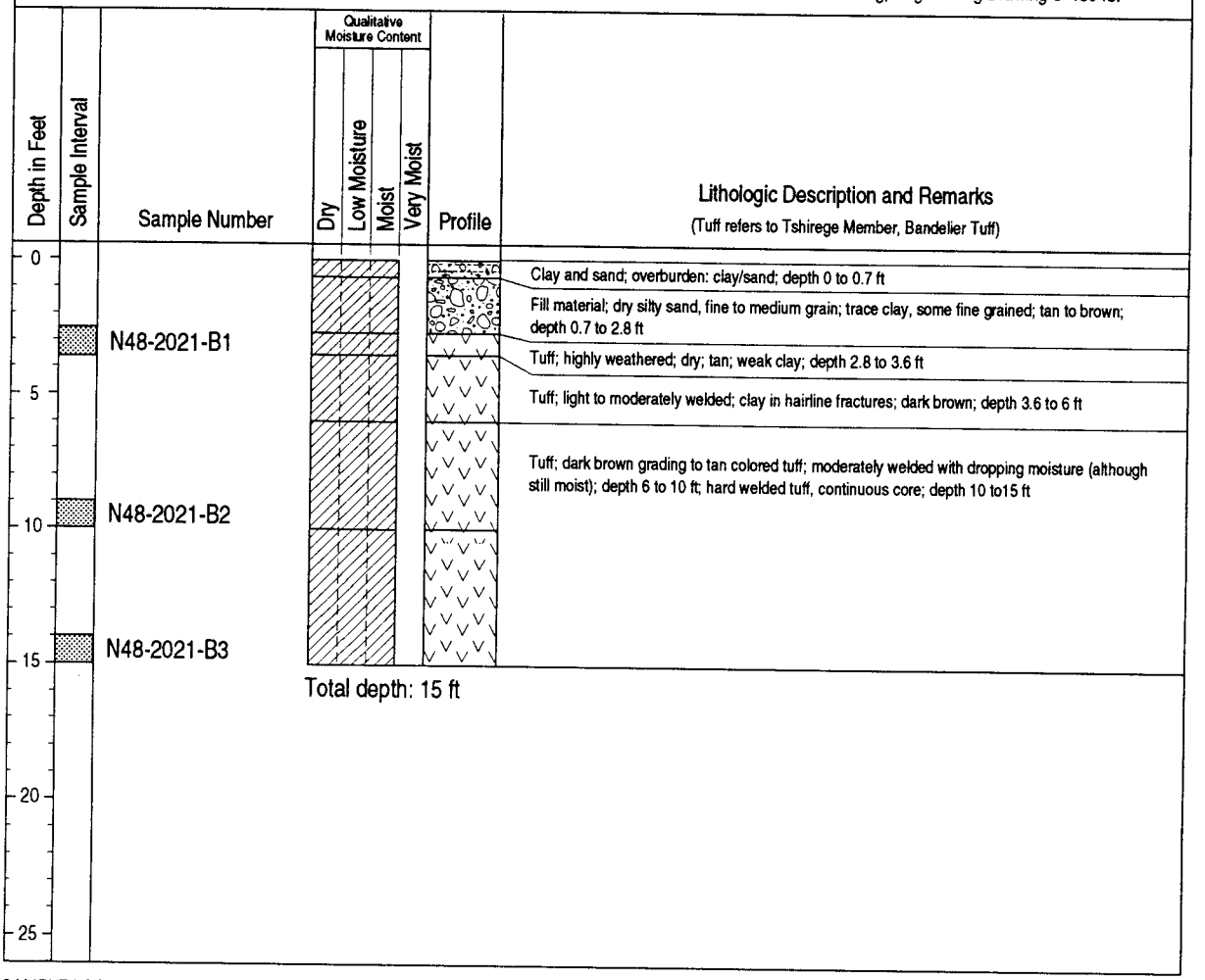
Figure D-5. Geological log of borehole at Location ID No 48-2015.

Los Alamos National Laboratory
Summary of OU 1129 Geological Log

RCRA Site Characterization

Technical Area:	48	SAP:	Aggregate N	Date Logged:	07-21-93
Location ID No.:	48-2021	Collar Elevation:	7320.8 ft	Field Team Leader:	Steve Stellavato
Core Size:	3.5 in.	Total Depth:	15 ft	Geologist:	Jeff Walterscheid
Method:	6-1/2-in. hollow-stem auger	Coordinates:	N1623487.5180 E1770353.5210		
PRS No.:	005				

NOTE: Did not drill into trench. Drilled four probed holes with auger and did not locate trench in the as-built drawing, Engineering Drawing C-43943.



SAMPLE LOCATIONS: 2.5 to 3.7 ft, silt-sand/tuff; 9 to 10 ft, tuff; 14 to 15 ft, tuff.
NOTE: Core barrel = 5 ft, split spoons = two 2.5 ft.
2.8 to 15 ft is Tshirege Member of Bandelier Tuff.
Drilling in the as-built location for the removed acid waste line no. 34. Cannot confirm location of trench using a small hand-held drill probe.

F D-6GL TA-48 RFI RPT / 091295

Figure D-6. Geological log of borehole at Location ID No. 48-2021.