Field Unit 5
TA-50

Los Alamos National Laboratory

ENVIRONMENTAL RESTORATION

Environmental Restoration
University of California
Environmental Restoration, MS M992
Los Alamos, New Mexico 87545
505-667-0808/FAX 505-665-4747

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

Date: March 1, 1996
Refer to: EM/ER:96-074

Mr. David Neleigh
NM Federal Facilities Section
Multimedia Planning and Permitting Division
U.S. Environmental Protection Agency
Region 6, 6PD-N
1445 Ross Ave, Suite 1200
Dallas, TX 75202-2733

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SUBJECT: SUBMITTAL OF THE RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION (RFI) REPORT FOR POTENTIAL RELEASE SITE (PRS) IN TECHNICAL AREA (TA) 50

Dear Mr. Neleigh:

Enclosed are two copies of the Los Alamos National Laboratory's RFI Report concerning PRSs 50-004(a), 50-004(c), and 50-011(a) in TA-50. The report documents the field work performed as detailed in the approved RFI Work Plan for Field Unit 5 and the results of the subsurface soil sampling. This RFI Report was due to your office on December 1, 1995. However, an extension was requested until July 30, 1996. The report is now complete and being submitted ahead of the extension date.

Please ask your office to contact Cheryl Rofer or Mike Gilgosch of our staffs at (505) 667-2988 or (505) 667-5794, respectively, if you have any questions.

Sincerely,

Jorg Jansen, Program Manager
Environmental Restoration

Sincerely,

Theodore J. Taylor, Program Manager
Los Alamos Area Office

JJ/TT/bp

Enclosure: RFI Report Concerning PRSs 50-004(a), 50-004(c), and 50-011(a) in TA-50

Cy (w/enc.):
B. Garcia, NMED-HRMB
M. Gilgosch, LAAO, MS A316
D. Griswold, ERD, AL, MS A906
J. Harry, EM/ER, MS M992
B. Hoditschek, NMED-HRMB
R. Kern, NMED-HRMB
C. Rofer, EES-1, MS D462
N. Naraine, EM-453, DOE-HQ
T. Taylor, LAAO, MS A316
N. Weber, Bureau Chief, NMED-AIP
J. White, ESH-19, MS K498
S. Yanicak, NMED-AIP
EM/ER File, MS M992
RPF, MS M707

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

CERTIFICATION

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

Document Title: Submittal Of The Resource Conservation And Recovery Act Facility Investigation Report For Potential Release Sites In Technical Area 50

Name: _____ Date: 3-1-96

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

or

Tom Baca, Program Director
Environmental Management
Los Alamos National Laboratory

Name: _____ Date: 2/29/96

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

or

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

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RFI Report for Potential Release Sites at TA-50

50-004(a)
50-004(c)
50-011(a)

(located in former Operable Unit 1147)

Field Unit 5

Environmental Restoration Project

February 1996

A Department of Energy
Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

LA-UR-96-148

EXECUTIVE SUMMARY

This report describes the results of subsurface soil sampling at potential release sites (PRSs) 50-004(a), 50-004(c), and 50-011(a) at Technical Area (TA) 50. The first two are areas through which passed waste lines that are known to have leaked, and associated manholes. These were part of the system that carried and distributed industrial waste water from many technical areas to the TA-50 liquid waste treatment plant, where it was treated and then disposed of in nearby Mortandad Canyon. The third PRS is the site of a former sanitary septic system that provided on-site treatment and disposal of locally generated sanitary waste water.

During the fall of 1994, Phase I investigations were carried out with the objective of confirming the presence or inferring the absence of metals, radionuclides, and organic chemicals at these three PRSs. Subsurface soil samples, collected from 37 coreholes drilled at the former locations of the PRSs, included tuffaceous rock, backfill soil, and clay material from fractures within the tuff. All samples were analyzed for metals and radionuclides, and selected tuff and tuff fracture samples were analyzed for volatile and semivolatile organic compounds. The analytical data set thus obtained is sufficiently complete and of sufficient quality to support the decisions presented in this report.

All radionuclides and Resource Conservation and Recovery Act (RCRA) hazardous constituents that were detected were within background concentrations or below human health screening action levels (SALs). On that basis, all three PRSs are recommended for no further action (NFA).

Table ES-1 lists proposed actions for each PRS.

TABLE ES-1

PROPOSED ACTIONS FOR PRSs 50-004(a), 50-004(c), and 50-011(a)

PRS	HSWA	Proposed Action	NFA Criteria	Rationale	Section
50-004(a)	X	NFA	4	All radionuclides and RCRA hazardous constituents that were detected are within background or below human health SALs.	5.1
50-004(c)	X	NFA	4		5.2
50-011(a)	X	NFA	4		5.3

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ACRONYMS AND ABBREVIATIONS

ALARA	As Low as Reasonably Achievable
DL	Detection Limit
COPC	Chemical of Potential Concern
EPA	Environmental Protection Agency
EQL	Estimated Quantitation Limit
FIMAD	Facility for Information Management, Analysis, and Display
GIS	Geographic Information System
GPR	Ground-Penetrating Radar
HSWA	Hazardous and Solid Waste Amendments
IWP	Installation Work Plan
J	Estimated
LANL	Los Alamos National Laboratory
LD50	Lethal Dose 50%
MCE	Multiple Chemical Evaluation
nCi	Nano Curies
NFA	No Further Action
OU	Operable Unit
PCB	Polychlorinated Biphenyl
pCi	Pico Curies
ppm	Parts per Million
PRS	Potential Release Site
QA	Quality Assurance
QC	Quality Control
R&D	Research and Development
RCRA	Resource Conservation and Recovery Act
RDA	Recommended Daily Allowance
RFI	RCRA Facility Investigation
SAL	Screening Action Level
SMO	Sample Management Office
SOP	Standard Operating Procedure
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TA	Technical Area
UJ	Estimated Undetected
UTL	Upper Tolerance Limits
VOC	Volatile Organic Compound

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1.0 INTRODUCTION

1.1 General Site History

Technical Area (TA) 50 at Los Alamos National Laboratory includes facilities for the treatment and disposal of liquid radioactive waste and for the storage of solid radioactive materials removed by the treatment. The location of TA-50 is shown in Figure 1-1. The treatment facilities comprise a liquid waste treatment plant and associated waste transfer and storage systems; equipment decontamination areas; and an experimental solid-waste-volume-reduction facility (including a mechanical volume reduction complex and a controlled-air incinerator). The disposal facilities comprise a decommissioned mixed waste landfill (Area C) and a treated-liquid-effluent outfall located north of TA-50 in Mortandad Canyon.

The treatment facilities began operations in 1963, and most are still active. The Area C landfill was used from 1948 until 1969 and was decommissioned in 1974. (TA-50 was formerly designated Operable Unit [OU] 1147.)

Because radioactive liquid waste comes into TA-50 from diverse operations (such as shops, chemistry laboratories, accelerator and laser target preparation facilities, and plutonium fabrication, recovery, and research operations), some spills or leaks could release solvents and other organics, metals, low-pH liquids, and/or radionuclides. Most of the pits and shafts of the Area C landfill, in which a wide variety of chemicals, metals, and radionuclides were disposed of, were unlined (a few of the shafts were lined with concrete).

Given the nature of the R&D activities that generated the solid and liquid wastes sent to TA-50, a variety of inorganic and organic materials are potential contaminants at the site. Most are radionuclides, primarily from stack releases from the liquid waste treatment plant. For a localized area around the head of Ten Site Canyon, the primary sources are spills from the liquid waste treatment plant and possible migration via erosion of surface contamination from Area C. Since the probability of contaminant movement to groundwater at TA-50 is low, surface water runoff and air dispersion are the likely pathways for transport of contaminants.

The Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) Work Plan (LANL 1992, 0787) identified 26 potential release sites (PRSs) within former OU 1147 (Table A of the HSWA Module lists 11). This report describes the results of sampling for both radionuclides and RCRA hazardous constituents at PRSs 50-004(a) and 50-004(c) (decommissioned waste lines) and at PRS 50-011(a) (decommissioned septic system), which are included in Table A of the HSWA module.

1.2 RFI Phase I Work Plan Overview

The OU 1147 RFI Work Plan (LANL 1992, 0787) prescribes how site characterization will be achieved in a cost-effective manner. This approach incorporates a health-risk-based decision-making process, consistent with the Installation Work Plan (IWP) for Environmental Restoration (LANL 1995, 1164) and proposed Subpart S to 40 CFR 264, for recommending PRSs or PRS aggregates for no further action (NFA), expedited cleanup, voluntary corrective action, or further study. It also incorporates a phased site-characterization methodology that follows EPA and IWP guidelines. The technical approach is described in Chapter 4 of the OU 1147 RFI Work Plan.

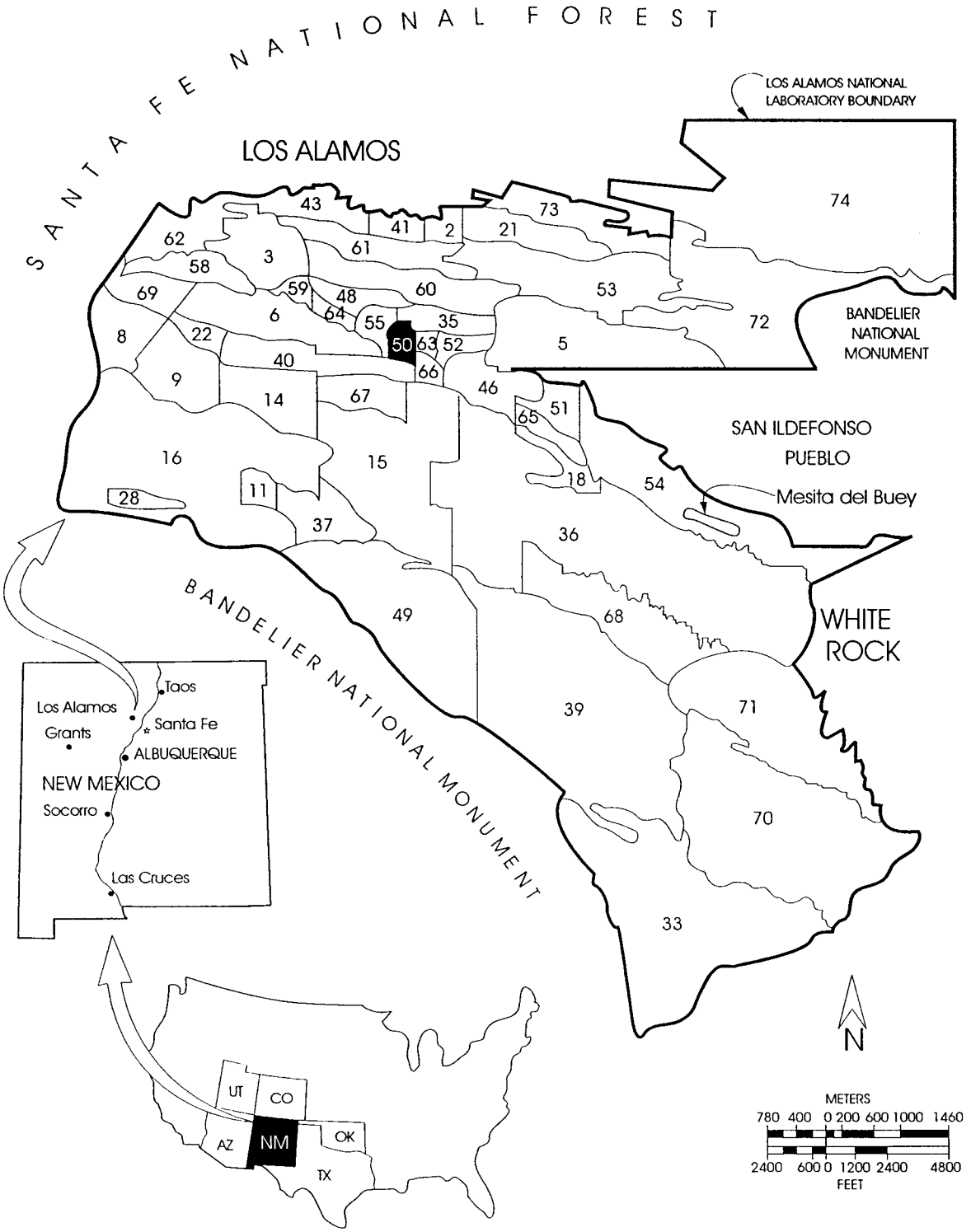

Figure 1-1. Location of TA-50 within Los Alamos National Laboratory.

The primary purpose of the RFI at TA-50 was to determine the current distributions of chemicals of potential concern (COPCs) in soil, sediment, and rock and to compare these findings with risk-based screening action levels (SALs). The objectives of the sampling and analysis plan, then, were to

(1) determine the concentrations of chemicals in soils at the PRSs;

(2) identify COPCs through comparison of the analytical data with background levels and/or SALs (see Section 3.2 of this document); and

(3) determine whether NFA can be recommended, whether Phase II investigations are required, or whether an accelerated cleanup, voluntary corrective action, or corrective measures study should be undertaken (see Section 3.3 of this document).

1.2.1 PRSs 50-004(a) and (c)–Decommissioned Waste Lines

PRSs 50-004(a) and (c) are areas through which underground waste lines–which carried industrial wastes to TA-50–once passed, and the manholes associated with these lines. Some of these waste lines (which were removed after the current influent line became operational) are known to have leaked. Along with PRS 50-004(b) (a decommissioned underground storage tank farm that will be investigated at a later date), these two PRSs make up Aggregate 3 in the RFI Work Plan (LANL 1992, 0787). Figure 1-2 shows their locations.

1.2.1.1 PRS 50-004(a)

This PRS is the trench through which passed a 520-ft section of the original 6-in.-diameter vitrified clay pipe that carried industrial waste to TA-50 and the associated manholes. In 1975, this portion of the line, which ran from TA-50 to Pecos Drive, was removed to clear the area for construction of Building TA 50-37. (A new pipeline, acid waste line 45, which bypassed the TA-50-37 construction zone, replaced the decommissioned line until 1984, when it was removed as well–see 1.2.1.2, below). A large portion of the trench that had carried the original pipe is now under Buildings TA-50-37, TA-50-54, and TA-50-69. Because the clay pipe was known to have leaked in several locations, at the time of its removal contaminated soil was also removed, and both were interred at TA-54, Area G. The trench was cleaned up to levels dictated by the sensitivity of the hand-held radiation detection instruments of the day and to ALARA (As Low As Reasonably Achievable) levels as defined by gross alpha and gross beta measurements on soil. Neither the pipe nor the soil was analyzed for the presence of nonradioactive constituents. The trench was backfilled after the cleanup. The estimated depths to the original trench bottoms are shown in Table 1-1.

The RFI Work Plan (LANL 1992, 0787) called for sampling of the backfilled trenches left after decommissioning, via vertical coreholes drilled to the contact between trench fill and trench bottom, at approximately 100-ft intervals (see Figure 5-3 and Table 5-5 of the Work Plan). All but one of the vertical coreholes was drilled, as discussed in Chapter 5.

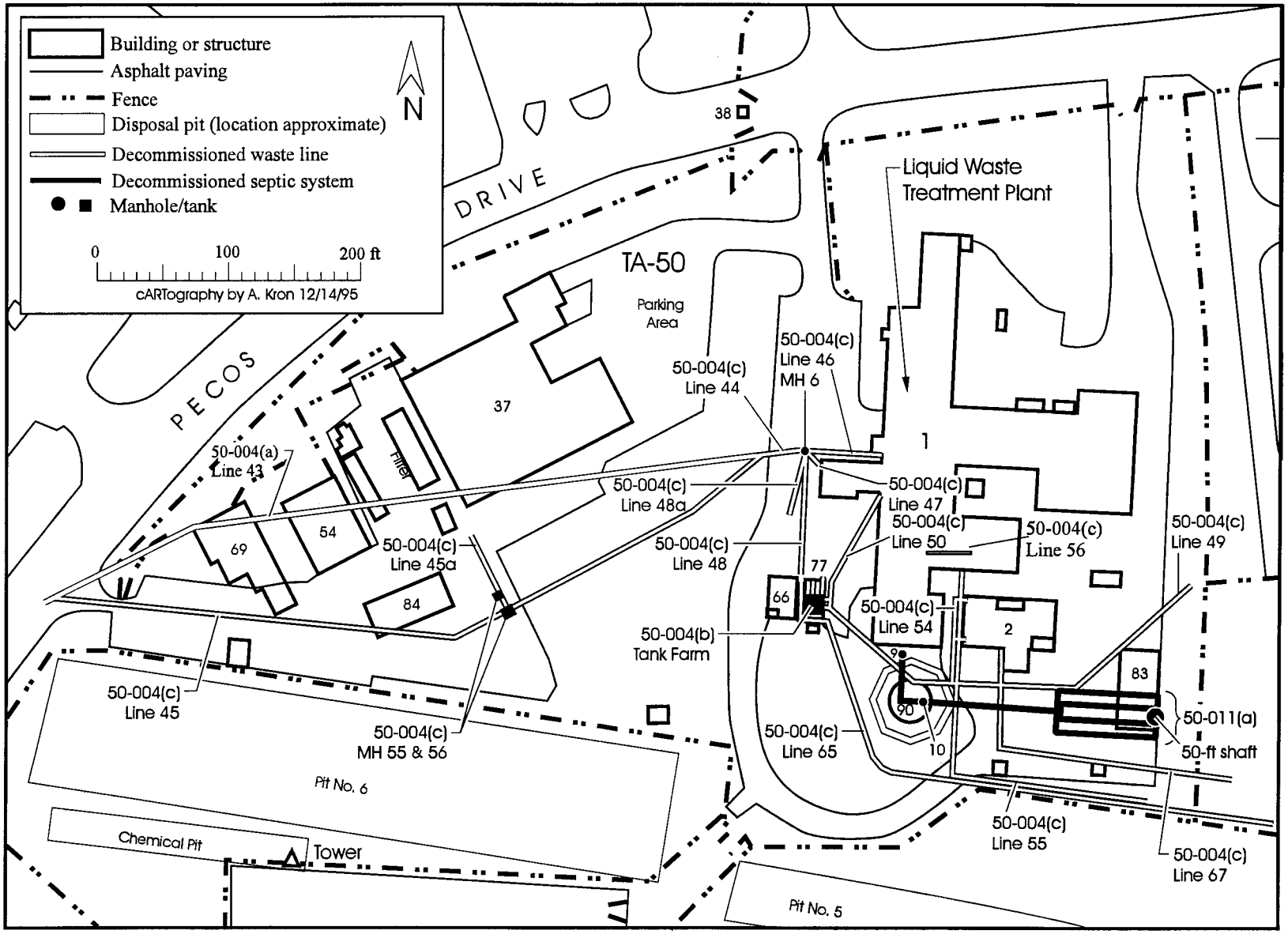

Figure 1-2. Locations of PRSs 50-004(a), 50-004(c), and 50-011(a).

TABLE 1-1
APPROXIMATE BELOW-GRADE ORIGINAL DEPTHS OF SUBSURFACE FACILITIES
(at bottom of unit)

PRS 50-004(a)	
Acid waste line	5 to 6 ft
PRS 50-004(c)	
Thirteen underground waste lines and three manholes (all removed except line 56):	
1. Waste line 44	5 ft
2. Waste line 45	5 ft
3. Waste line 45(a)	7 ft
4. Waste line 46	16 ft
5. Waste line 47	8 ft
6. Waste line 48	6 ft
7. Waste Line 48(a)	6 ft
8. Waste Line 49	5 ft
9. Waste Line 54	4 ft
10. Waste Line 55	5 ft
11. Waste Line 56	5 ft
12. Waste Line 65	5 ft
13. Waste Line 67	17 ft at exit from TA-50-2; 1 ft at canyon outfall
14. Manhole TA-50-55	8 ft
15. Manhole TA-50-56	8 ft
16. Manhole TA-50-6	19 ft
PRS 50-011(a)	
Decommissioned septic system leach field and main from septic tank	4 ft

1.2.1.2 PRS 50-004(c)

This PRS is the site of thirteen former waste lines and three associated manholes, removed between 1981 and 1989. The radioactive industrial waste lines listed in the RFI Work Plan (LANL 1992, 0787) as having been removed are Nos. 44, 45, 45a, 46, 47, 48, 48a, 49, 54, 55, 56, 65, and 67. The manholes listed as removed are TA-50-6, TA-50-55, and TA-50-56. All of these lines and manholes were verified as removed except Line 56, which is still in service; it connects a floor drain in Room 36 of Building TA-50-1 (the liquid waste treatment plant) to a 10-in. cast-iron line that carries radioactive industrial waste to the current tank farm. The point of connection between the two lines is under the floor slab of the Vehicle Decontamination Facility, located in Building TA-50-1. The depths below ground of these drainlines and manholes are given in Table 1-1.

Any radionuclide contamination of soil discovered during decommissioning was cleaned up to ALARA levels by removing the pipe and affected soil. To assess the need for additional cleanup, soil samples from the pipeline trench were subjected to radiation measurements (taken with hand-held radiation-detection instruments) and gross alpha and beta counting. Samples were not analyzed for chemical constituents. The trenches were then backfilled.

As in the case of PRS 50-004(a), the RFI Work Plan (LANL 1992, 0787) called for sampling via vertical coreholes drilled to the contact between trench fill and trench bottom, at approximately 100-ft intervals (see Figure 5-3 and Table 5-5 of the Work Plan). In addition, the Work Plan called for an angled radial corehole, designated Corehole RDH-3, and two vertical coreholes, designated VM-1 and VM-2, to sample specifically in the vicinity of manhole TA-50-6. Corehole RDH-3 may be drilled in the next phase of subsurface sampling at TA-50, to investigate PRSs not addressed in this report. Coreholes VM-1 and VM-2 were not drilled because of the presence of underground utilities and active waste lines, which prevented access to the subsurface near manhole TA-50-6.

1.2.2 PRS 50-011(a)–Septic Systems

This PRS is the site of a (now removed) septic system that was installed about 1964 at the south end of Building 1 (Figure 1-2). It consisted of an effluent line from Building 1 to manhole TA-50-9 and then to septic tank TA-50-10. From the septic tank, the effluent line ran east to a distribution box (TA-50-11) and then into the four parallel, perforated pipes of the leach field. As TA-50 grew, the field was no longer adequate for all of the sanitary effluent being generated, resulting in standing water on the ground surface. To remedy this situation, in 1978 a 4-ft-diameter hole was drilled 50 ft 9 in. deep at the east end of the leach field, a 4-in. perforated pipe was installed down the center of the hole, and the annulus was backfilled with 3/4-in. aggregate to within 4 ft of the surface. The outlets from the four parallel pipes were then tied into the 4-in. perforated pipe. Later, in 1983, the entire septic system was removed, except for the perforated pipe inside the 50-ft-deep hole (LANL 1992, 0787). Currently, the former location of the leach field and a section of the effluent line between the septic tank and the field are the only portions of the old system that are not under buildings and can be reached for core sampling.

Whether any contamination of the soil at TA-50 can be directly attributed to this PRS is not known. There is no evidence that this septic system was ever used for disposal of wastes other than sanitary wastes. However, because it was located in an area of TA-50 in which there were surface spills of liquid waste from the tank farm, it is difficult to positively identify the source of the contaminants assumed to be present in that area (it is likely that the tank farm is the only important source). The below-ground depth of the leach field and the main from the septic tank are shown in Table 1-1.

The RFI Work Plan called for the drilling of four shallow, vertical coreholes approximately 10 ft deep, designated VLL-1 to VLL-4, to sample the interface between the bottom and fill of the four leach-field pipe trenches; and one 45° corehole, designated SP-1, to be drilled in an east-west direction through the center line of the 50-ft shaft, to a lateral point 15 ft west of the center line (see Figure 5-3 and Table 5-9 of the Work Plan). As discussed in Chapter 5 of this report, the 45° corehole was not drilled.

1.3 Field Activities

In carrying out the field activities at TA-50, all applicable LANL-ER-SOPs (LANL, 0875) were followed unless otherwise noted in Chapter 5.

1.3.1 Field Screening and Surveying

1.3.1.1 Land Surveys

Field work at these PRSs began in October 1994, with land surveying of the locations selected for subsurface corehole sampling (these were selected on the basis of engineering drawings, the FIMAD [Facility for Information Management, Analysis, and Display] GIS [Geographical Information Systems] database, information from meetings with TA-50 site personnel, and site visits). Ground-penetrating radar (GPR) was used for a geophysical survey of the area of decommissioned waste lines, but the results were inconclusive in identifying the location of the backfilled trenches (Geophex 1994, 07-0075). Coordinates for the sampling locations were calculated with a surveying computer software program (Leica, Inc. 1990, 1285), and the coordinates were staked out with a total-station, electronic theodolite over the suspected locations of PRSs 50-004(a), 50-004(c), and 50-011(a). All land surveying was completed in accordance with LANL-ER-SOP-3.01.R1. Sampling locations were entered into the FIMAD database.

1.3.1.2 Radiological and Chemical Screening

In order to comply with worker safety requirements and Department of Transportation and Laboratory sample transport requirements, radiological and chemical screenings were conducted simultaneously with sample collection. Each sampling location was screened for radioactivity with an ESP-1 beta/gamma meter equipped with an HP260 pancake probe (following SOPs ESH-1-07-85.R0 and ESH-1-07-04.R0) and for organic vapors with a photoionization detector (Environmental Restoration Project 1995, 1258). Soil samples from each location were dried and screened for gross alpha and gross beta radiation using a Berthold proportional gas counting system (LANL-ER-SOP-14.01.R0).

1.3.2 Subsurface Sampling

Subsurface soil sampling was carried out during October and November, 1994. Most of the samples were collected using a CME 45 hollow-stem-auger drill rig and 5-ft core barrel samplers, following LANL-ER-SOP-6.26.R0. Where drill rig access was limited by overhead utilities or subsurface conveyances, a hand auger was used to collect samples, following LANL-ER-SOP-6.10.R0.

2.0 ENVIRONMENTAL SETTING

The environmental setting of the Laboratory is described in Section 2.4 of the IWP (LANL 1995, 1164). For a detailed discussion of the environmental setting of TA-50, including a conceptual geohydrologic model, see the RFI Work Plan for OU 1147 (LANL 1992, 0787).

TA-50, situated on Mesita del Buey in the central northern half of the Laboratory, is bounded by Two-Mile Canyon, Cañada del Buey, Ten Site Canyon, and Mortandad Canyon. Mesa elevations range from 7200 to 7280 ft (2194 to 2218 m), and all surface runoff from TA-50 drains into Ten Site Canyon. All three PRSs are situated on the mesa top; PRS 50-011(a), the decommissioned septic tank system, is near the head of Ten Site Canyon.

2.1 Climate

Los Alamos County has a semiarid, temperate mountain climate. Summers are generally sunny with warm days and cool nights. With the high altitude, light winds, clear skies, and dry atmosphere, summer temperatures in the TA-50 area range from 50°F at night to 90°F during the day, and winter temperatures typically range from 15°F to 25°F at night (occasionally dropping to 0°F or below) and from 30°F to 50°F during the day (LANL 1995, 1164). Average annual precipitation at TA-50 is estimated to be 18.7 inches. Of this, about 40 percent is produced by brief, intense thunderstorms during July and August, which can generate stream flow in canyons and significant runoff of surface water. Winter snowfall averages 51 in. (130 cm) annually (ESG 1989, 0308), and spring snowmelt can also generate stream flow in area canyons. This suggests that water-driven erosion of surface soils and surface water runoff are important mechanisms for transporting surficial chemicals at TA-50.

2.2 Geology

2.2.1 Geologic Setting

A detailed discussion of the geology of the Los Alamos area can be found in Section 2.5.1 of the IWP (LANL 1995, 1164). TA-50, situated approximately midway between the Jemez Mountains and the Rio Grande, is underlain by Miocene through Pleistocene volcanic and sedimentary rocks. The stratigraphy of the upper rock units can be observed directly in outcrops from canyon walls and slopes south and north of the site (Vaniman and Wohletz 1990, 0541). The stratigraphy of lower units is inferred from drillholes such as Test Well 8 (Mortandad Canyon), from regional exposures to the north and east, and from regional geologic maps. Figure 2-1 shows schematically the stratigraphy of the site, based on these data.

2.2.2 Soils

A detailed discussion of the soils in the Los Alamos area can be found in Section 2.5.1.3 of the IWP (LANL 1995, 1164).

Natural or undisturbed soil cover is limited within TA-50 because of the construction of buildings, parking lots, disposal pits, and other facilities. The original soils in the vicinity of TA-50 were poorly developed, as is typical of soils derived from Bandelier Tuff and formed under semiarid climate conditions (Nyhan et al. 1978, 0161). On the mesa top

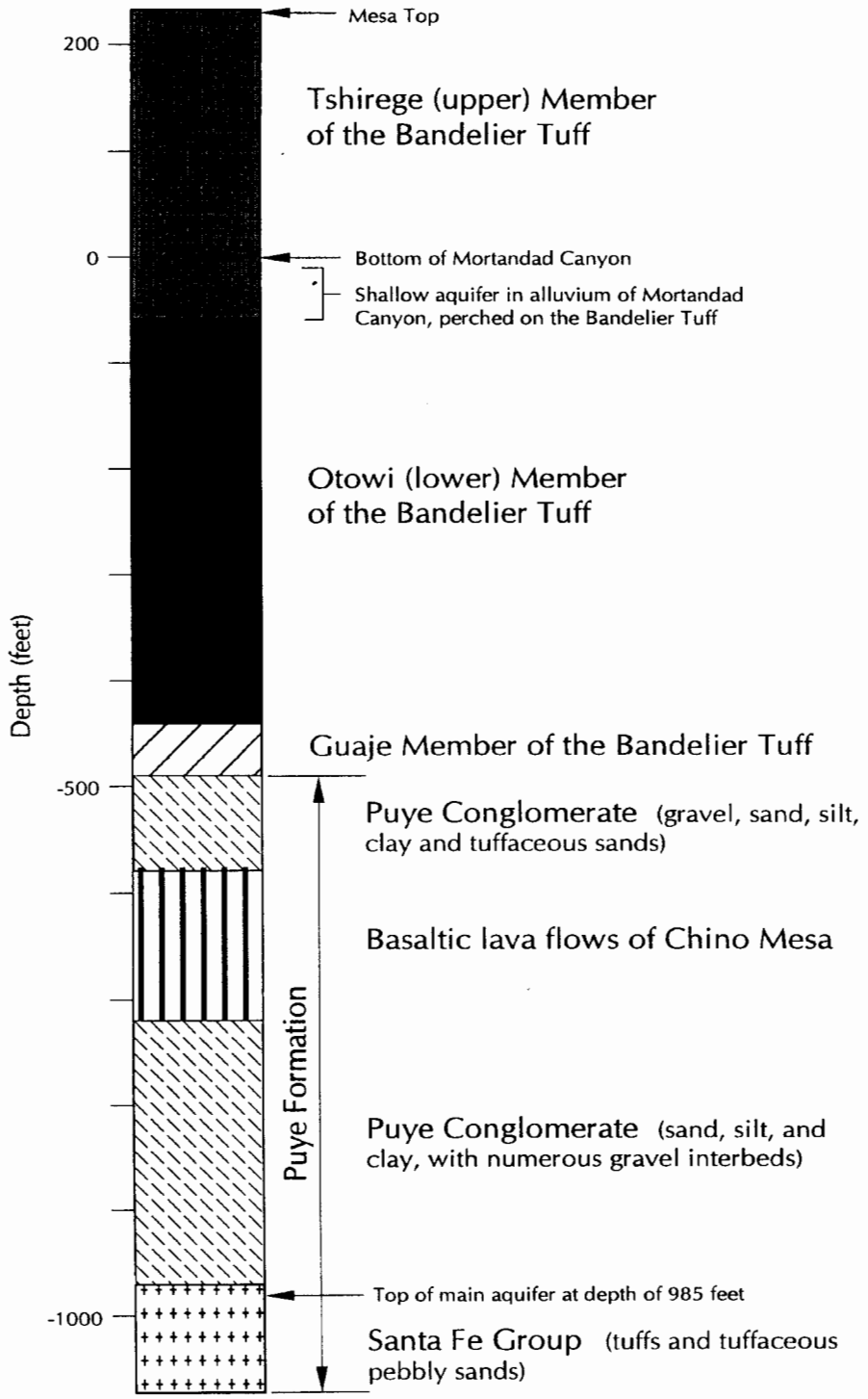

Figure 2-1. Generalized stratigraphy of TA-50.

surrounding TA-50, soils are mainly shallow, well-drained sandy loams of the Hackroy series. As described by Nyhan et al., "The surface layer of the Hackroy soils is a brown sandy loam, or loam, about 10 cm thick. The subsoil is a reddish brown clay, gravelly clay, or clay loam, about 20 cm thick. The depth to tuff bedrock and the effective rooting depth are 20 to 50 cm." Hackroy soils are classified as Alfisols, in part reflecting the clayey subsurface horizons. Intermixed with the Hackroy soils on the mesa tops are small areas of deeper loams of the Nyjack series and patches of bedrock. The Nyjack soils are texturally similar to Hackroy soils but are thicker (50 to 102 cm) and frequently exhibit pumice fragments in the lower levels (Nyhan et al. 1978, 0161).

The mesas are intersected by canyons; one of these, Ten Site Canyon, has experienced a period of accretion since the early activities at TA-50, as eroded soils have been deposited on the canyon bottom and stream banks. These soils have the potential for redistribution downstream.

Section 2.6.3.1.2 of the IWP describes a distinct clay layer often found beneath the Hackroy and Nyjack soils. This layer has been cited, perhaps erroneously, as a possible barrier against infiltration of soil water into the underlying bedrock (Abeele et al. 1981, 0009; Weir and Purtymun 1962, 0228). In areas where soils have been removed or disturbed (such as most of OU 1147), this barrier may no longer exist (Abrahams et al. 1961, 0015).

2.3 Hydrology

The hydrology of the Pajarito Plateau is summarized in Section 2.5.2 of the IWP (LANL 1995, 1164).

2.3.1 Surface Water

In the TA-50 region, surface water consists primarily of intermittent streams. Springs on the flanks of the Jemez Mountains supply base flow (water that enters stream channels from groundwater sources) into the upper reaches of some canyons, but the amount is insufficient to maintain surface flow across the site; it is depleted en route by evaporation, transpiration, and infiltration. Runoff from summer thunderstorms reaches a maximum discharge in less than 2 hours and generally dissipates in less than 24 hours. Spring snowmelt takes place at low discharge rates, over periods of several weeks to several months. Although the long duration of flow results in the movement of significant masses of suspended and bed sediments, the total mass transported by snowmelt runoff is small compared with that carried by summer thunderstorm runoff (Purtymun et al. 1990, 0215).

Studies summarized in the IWP indicate that, for native soil profiles, infiltration of water into the tuff bedrock is not a significant mechanism for the movement of chemicals. Even when water inputs to the soil are continuous over prolonged periods, very little actually infiltrates the tuff because of transpiration and, in vegetated areas, the strong evaporative potential, which quickly removes water from the soil and upper tuff profiles. Figure 2-2 shows the topography of the TA-50 environs.

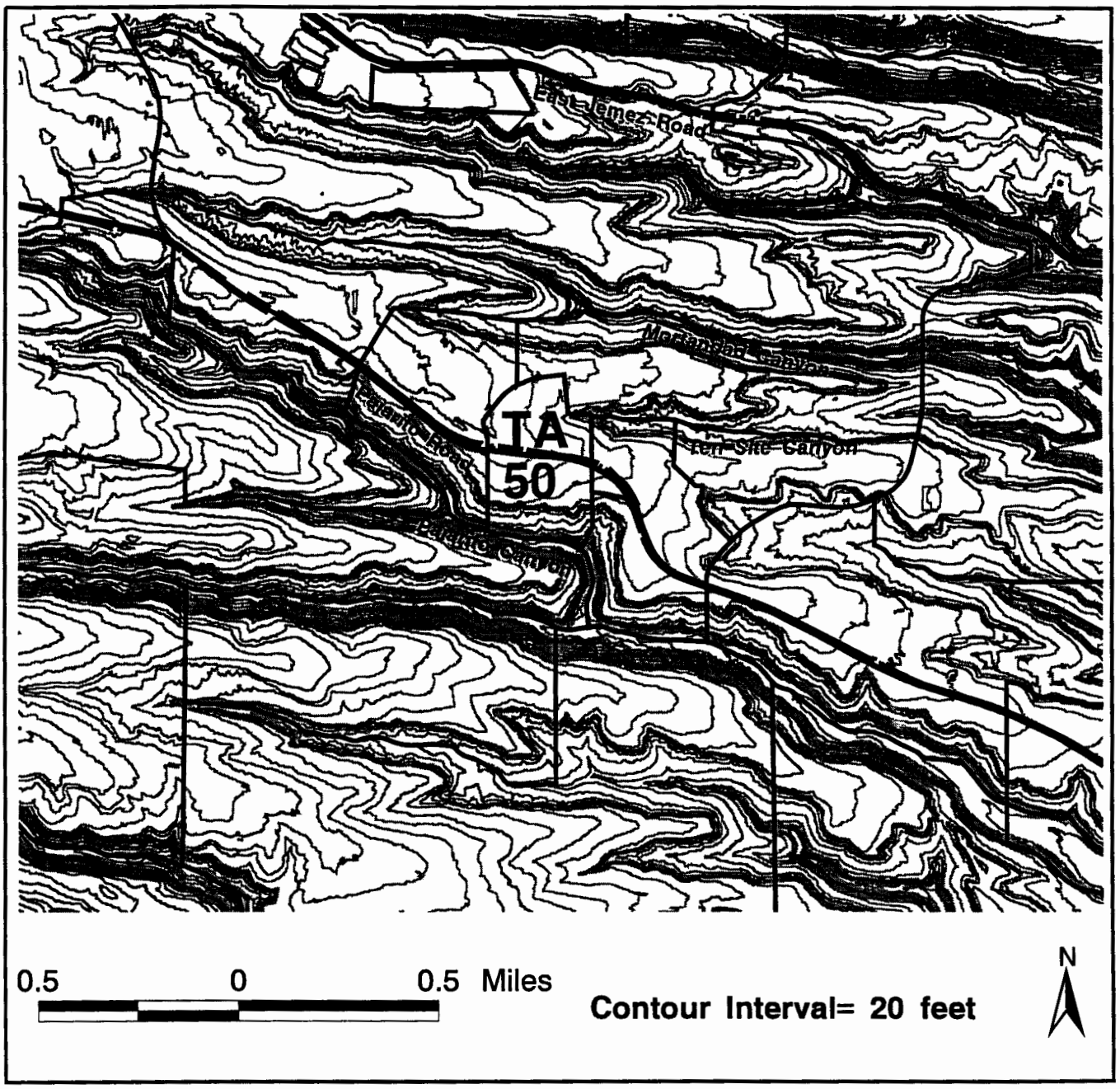

Figure 2-2. Topography of TA-50.

2.3.2 Groundwater

Groundwater in the Los Alamos area takes three forms:

- water in shallow alluvium in canyons,
- perched water, and
- water in the main aquifer.

The alluvium is quite permeable, in contrast to the underlying Bandelier Tuff, which impedes infiltration and causes lateral movement of water in the alluvium. Perched water is found in limited areas beneath the lower reaches of Pueblo and Los Alamos canyons but is not known to exist beneath TA-50. However, as this report was being written, a possible groundwater seep was noted in nearby Ten Site Canyon; the area will be investigated to determine the source of this water. The main aquifer, which is mostly in Santa Fe Group clastic rocks, is the only aquifer in the Los Alamos area capable of serving as a municipal water supply. The aquifer surface rises westward from the Rio Grande within the Tesuque Formation into the lower part of the Puye Formation beneath the central and western parts of the plateau. At TA-50, the depth of the aquifer is approximately 1100 ft (335 m) below the mesa surface.

2.4 Biological Surveys

A biological survey, which included information on Ten Site Canyon, was conducted (Dunham 1993, 07-0070). No threatened or endangered species were identified.

2.5 Cultural Surveys

A cultural survey, which included information on Ten Site Canyon, was conducted (Manz et al. 1994, 07-0071). No historical or archeological sites were found in the areas discussed in this report.

3.0 APPROACH TO DATA ASSESSMENT AND ANALYSES

Assessment and analysis of the data from PRSs 50-004(a), 50-004(c), and 50-011(c) follow the field investigation, chemical analyses, and data reporting, and involve a series of quantitative steps. These begin with data verification and routine data validation, and, if necessary, continue with more focused data validation. Data verification ensures that the data are complete, properly organized, and in compliance with contractual requirements. Routine data validation involves comparing each data item with specific targets and adding a qualifier flag to the data if a potential deficiency is noted. Focused data validation consists of analyzing QA/QC data for their potential impact on the succeeding data assessment steps, which are: comparing site data with background concentration data; verifying the identities of detected organic chemicals; comparing site data with screening action levels (SALs) for human health impacts; and performing human health or ecological risk assessments when necessary. The following subsections provide overviews of the methods used to complete these quantitative steps.

3.1 Sample Analyses

All samples requiring chemical and radiological analysis and chain-of-custody documentation were submitted to the sample management office (SMO) for processing and packaging. The SMO shipped the samples to contract laboratories, where all (fill soil, tuff, and clay fracture-fill) were analyzed for inorganics (metals) and radionuclides (cesium-137 and americium-241 by gamma spectroscopy; tritium by liquid scintillation; and isotopic uranium and isotopic plutonium by alpha spectroscopy). In addition, samples of clay fill from fractures in the tuff—in those cases in which an adequate amount could be recovered from the core—and selected samples of the tuff were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and polychlorinated biphenyl compounds (PCBs).

3.1.1 Analytical Methods

Unless otherwise noted, all samples were prepared and analyzed using EPA SW-846 methods (or equivalent) and/or radiological methods, as described in *Quality Control Data Use* (Environmental Restoration Project Decision Support Council, document in preparation). Samples for metals analyses were digested with nitric acid in accordance with EPA SW-846 Method 3010.

Samples were not submitted to the Mobile Rad Van for gross radiation screening. Instead, gross alpha and gross beta radioactivities of aliquots of all soil samples were determined by gas proportional counting on a Berthold Counter at the LANL ESH-19 TA-59 Counting Facility, in accordance with LANL-ER-SOP-14.01.R0. The samples were dried and analyzed on individual planchets, each containing 1 g of soil. In this way, a measure of the levels of radioactivity of the samples was obtained before they were shipped to analytical laboratories.

Before measurement of the samples for radioactivity, a baseline was obtained by daily measurement of ten calibration standards of clean sand samples spiked with known concentrations of americium-241 (alpha) and ten calibration standards of cesium-137 or strontium-90 (beta). Control charts of the daily standard measurements are maintained. Any out-of-control measurements were also corrected before the prepared soil samples were measured. As an additional quality control measure, certified plutonium-239 and strontium-90 commercial standards were included with the RFI soil samples. The quality control records are kept at the Counting Facility.

3.1.2 Data Verification and Validation

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

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

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

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

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

Validation of the analytical data for PRSs 50-004(a), 50-004(c), and 50-011(a) was performed, in accordance with LANL administrative procedures AP28, AP29, and AP30 (Gautier 1993, 1289), by personnel from LANL Group CST-3. The analytical results and laboratory supporting data are reviewed at one of three levels, as determined by the CST-3 Quality Assurance Officer. The past performance of the laboratory is taken into account in this decision. The most extensive review, Level Three, is a review of all data in the laboratory's data package; Level Two is a review of all final reported data forms, but the raw data is reviewed to a lesser extent if at all; and Level One is a review of most of the final data and of raw data to a lesser extent than Level Two (or not at all). All analytical results for the collected soil samples are reviewed, regardless of the data review level.

Approximately 4800 analyses were conducted for this investigation. Of these, 305 analytical results were qualified as estimated (J) or undetected estimated (UJ). No results were rejected. (See Chapter 4 for details on the data that were qualified.)

3.2 Background Comparisons

Once the data validation process is complete and the site data are finalized, the next step is to compare site data with available background data. The comparison provides the basis for deciding whether a chemical having a natural or anthropogenic background distribution should be retained as a COPC or should be eliminated from further consideration. (The results of focused data validation should exclude from this comparison any contaminant that is identified as an artifact of analytical laboratory or field

contamination, analytical interference, or improper analyte identification or quantitation.) Background data are available from two sources: (1) chemical analyses of soil samples collected throughout Los Alamos County, for certain inorganic (metal) and naturally occurring radioactive chemicals (Longmire et al. 1995, 1142 and 1266); and (2) background concentrations of radioactive chemicals associated with global fallout from atmospheric nuclear testing (e.g., plutonium, cesium, strontium, and tritium), reported in LANL Environmental Surveillance reports (Purtymun et al. 1987, 0211; ESG 1988, 0408; ESG 1989, 0308; Environmental Protection Group 1990, 0497; Environmental Protection Group 1992, 0740).

First, each measured concentration of a chemical from the site in question is compared with an upper tolerance limit (UTL) estimated from background data. (Details of statistical methods used to generate UTLs from the background data sets and suggested statistical methods for comparing site and background concentration distributions are presented in the guidance document, *Statistical Comparisons to Background*, Part I, ER Project Assessments Council 1995, 1218.)

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

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

3.3 Evaluation of Organic Constituents

Because background data are not available for organic chemicals, the preliminary evaluation of organic chemicals considers detected chemicals and chemicals that were analyzed for but not detected in any sample. This evaluation determines whether, on the basis of detection status, organic chemicals should be retained as COPCs or eliminated from further consideration. Detection status is ascertained by the analytical laboratory on a sample-by-sample, analyte-by-analyte basis. For analytes that are not detected, estimated quantitation limits (EQLs) have been established as reporting limits. (It should be noted that the EQLs reported for individual samples depend on a number of factors and may vary from sample to sample and analysis to analysis; therefore, the sample-specific EQL must be used in this evaluation.)

As a general rule, if a chemical is reported as detected, that chemical is carried forward through the screening assessment process; if a chemical is not reported as detected in any sample analyses, that chemical is removed from further consideration. Exceptions may be made if site-specific process knowledge indicates the need. For example, a detected chemical may be removed from further consideration if it can be shown that its presence is not due to Laboratory operations, and a chemical not detected in any sample may be carried through the assessment process if, on the basis of historical operations, it can be expected to be present at the site.

3.4 Human Health Assessment

3.4.1 Screening Assessment

The screening assessment is used to determine whether, as a result of historical Laboratory operations, chemicals have been released to the environment at levels that may be hazardous to human health or the environment. In the steps described below, which were followed for all TA-50 samples, COPCs retained after comparison with background UTLs are compared with their SALs.

3.4.1.1 Comparison with SALs

SALs are medium-specific concentrations that are calculated using chemical-specific toxicity information and conservative, default exposure assumptions. (A complete discussion of the methods used to generate SALs is provided in *Risk-Based Corrective Action Process,* LANL/SNL 1996, 1277.) If the reported concentration is greater than the SAL, the chemical is retained as a COPC pending further analysis. If the reported concentration is below the SAL, the chemical is generally removed from further consideration (if more than one COPC is present at the site, this decision is deferred pending the results of the multiple chemical evaluation–see below). The decision to identify a chemical as a COPC when a SAL is not available is made on a case-by-case basis, taking into account the availability of process knowledge and toxicological information.

If the comparison shows that any chemicals are to be retained as COPCs, further action may be proposed. If no COPCs are retained, NFA may be proposed on the basis of no risk to human health.

3.4.1.2 Multiple Chemical Evaluation

It is possible that a chemical should be retained as a COPC because of its potential for adverse health effects when combined with other chemicals present at the site. This possibility is evaluated through the Multiple Chemical Evaluation (MCE): the reported concentration for each chemical is divided by its respective SAL, and the resulting normalized values are incorporated into a simple additive model. If the sum of the normalized values is less than 1, the chemicals are removed from further consideration. If the sum of the normalized values is greater than or equal to 1, any chemical having an individual normalized value greater than or equal to 0.1 is retained as a COPC pending further evaluation (LANL/SNL 1996, 1277).

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

3.4.2 Risk Assessment

No human health risk assessments were performed for PRSs 50-004(a), 50-004(c), or 50-011(a) because no chemicals were retained as COPCs after the screening assessments (see Chapter 5, Sections 5.1.7, 5.2.7, and 5.3.7).

3.5 Ecological Assessment

Because the landscape around PRSs 50-004(a), 50-004(c), and 50-011(a) is highly developed, there is essentially no potential for receptors to come into contact with COPCs. Therefore, there are no ecotoxicological risk concerns at these PRSs.

4.0 RESULTS OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

Each group of samples submitted to the LANL SMO for shipment to an analytical laboratory was assigned a unique request number (sometimes referred to as a "sample delivery group" by analytical laboratories). The number assigned was based on the suite of analyses requested (organic, inorganic, and/or radiological). Upon receipt of the completed analyses from the laboratory, a number was assigned to each analytical report for the group represented by the request number. (Each report included the results of quality control samples and quality control tests.) The following discussion of the quality control results is organized by PRS number and then by request number.

4.1 Inorganic Analyses

One potential QC problem with all three PRSs was that the holding time for mercury in soils (28 days) was exceeded for many of the samples. To determine whether the amount of mercury recovered was affected, the percent recovery values for mercury in the blind QC samples were reviewed. For two samples, from request number groups 19678 and 19679, reported mercury recovery was greater than 100%; one of these samples was analyzed 19 days beyond the holding time, but the second sample was analyzed within the holding time. In the case of two other QC samples, from request number groups 19910 and 20190, mercury recovery was less than 100%; the sample from group 19910 showed 50% recovery and exceeded the holding time by 3 days, while that from group 20190 showed 99% recovery and exceeded the holding time by 25 days. Finally, two blind QC samples from request number group 19744 both exceeded the holding time by 12 days; one had a recovery of 57% and the other 100%. There appears to be little correlation, then, between holding times and percent recovery. We conclude that the exceeding of the holding time for mercury for this data set had a negligible effect on data quality and does not preclude the use of these data in screening assessments.

4.1.1 PRS 50-004(a)

Data from PRS 50-004(a) are fully usable in support of screening decisions. Five coreholes were drilled at this PRS, and two intervals were collected at each corehole location: one of the fill soil placed in the trench during the decommissioning and one of the tuff material from immediately below the trench floor. In addition, one sample was collected from a clay-filled fracture within the tuff. The 11 samples were analyzed in separate batches. As discussed below, there were some problems with low recoveries for the blind QC samples. Nevertheless, the values found in the soil samples—even if adjusted upward to allow for the low recoveries in some of the QC samples—were low enough that they do not affect the outcome of the screening assessments discussed in Chapter 5.

4.1.1.1 Request Number 19506

The recovery values for cadmium in the blind QC sample exceeded 125% of the true values. Therefore, those soil sample results that were above or equal to the detection limit (DL) were qualified as estimated (J), and those that were below the DL were not qualified. The recovery value in the blind QC sample for chromium (64.1%) was above 10% but below 75% of the true values; therefore, those soil sample results that were above or equal to the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ).

4.1.1.2 Request Number 19678

The samples to be analyzed for mercury were not analyzed within the recommended holding time of 28 days (samples collected on 10/19/95 were not analyzed until 12/05/95). The results, which showed mercury to be below the DL, were qualified as undetected estimated (UJ).

4.1.1.3 Request Number 19720

The blind QC sample sent with the soil samples showed recovery values of >10% but <75% for chromium (70%) and arsenic (73%). Those results that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ).

4.1.2 PRS 50-004(c)

Data from PRS 50-004(c) are fully usable for support of screening decisions. Twenty-nine coreholes were drilled to investigate this PRS. Two intervals were collected at 28 of the corehole locations: one of the fill soil placed in the trench during decommissioning and one of the tuff material from immediately below the trench floor. At one corehole, only a fill sample was collected. In addition, four field replicate samples and six samples of clay fill from fractures within the tuff were collected, for a total of 67 samples. These samples were analyzed in six separate batches. As discussed below, there were some problems with low recoveries on the blind QC samples. Nevertheless, the values found in the soil samples—even if adjusted upward to allow for the low recoveries in some of the QC samples—were low enough that they do not affect the outcome of the screening assessments discussed in Chapter 5.

4.1.2.1 Request Number 19677

The blind QC sample exhibited >10% but <75% recovery for aluminum, chromium, and vanadium. Those results for the three analytes that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ).

4.1.2.2 Request Number 19678

The samples to be analyzed for mercury were not analyzed within the recommended holding time for mercury (samples collected on 10/19/95 were not analyzed until 12/05/95). The results showed mercury to be below the DL and were qualified as undetected estimated (UJ). The blind QC sample exhibited >10% but <75% recovery for aluminum, chromium, and vanadium; those results for the three analytes that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ).

4.1.2.3 Request Number 19679

The matrix spike for antimony and silver did not meet acceptance criteria, and the results for these two analytes were qualified as UJ. The matrix spike for arsenic and

lead did not meet acceptance criteria; the results for lead were qualified as estimated (J) and the results for arsenic were qualified as undetected estimated (UJ). The blind QC sample exhibited >10% and <75% recovery for chromium; those results that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ). The blind QC sample also exhibited >125% and <200% recovery for cadmium. Only one soil sample (AAC0235) had a value above the DL for cadmium, and this result was qualified as estimated (J). The blind QC soil sample 94.27104 exhibited >125% and <200% recovery for mercury. None of the soil sample results were positive, so no qualification is required.

4.1.2.4 Request Number 19774

The 28-day recommended holding time for mercury was exceeded by 12 days in the case of the soil samples. Of the blind QC samples accompanying these, Nos. 94.27909 and 94.27910 exhibited >10% and <75% recovery for aluminum, chromium, iron, and vanadium. The results for the four analytes that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ). Blind QC sample No. 94.27911 had 100% recovery for mercury but No. 94.27912 exhibited >10% and <75% recovery for mercury. The soil sample results that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ) on the basis of the latter QC sample.

4.1.2.5 Request Number 19910

The samples to be analyzed for mercury were not analyzed within the recommended holding time for mercury. The blind QC sample exhibited >10% but <75% recovery for chromium, mercury, and lead. The reported results for the three analytes that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ).

4.1.2.6 Request Number 20190

Because the samples to be analyzed for mercury were analyzed beyond the 28-day holding time, those results that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ).

4.1.3 PRS 50-011(a)

Data from PRS 50-011(a) are fully usable for support of screening decisions. Three coreholes were drilled into the tuff beneath the decommissioned leach field, and one sample of the tuff material was collected from each. In addition, because of the close proximity to the leach field of Corehole 50-3011, drilled previously to investigate PRS 50-004(c), data from this corehole was also used for this PRS: one sample was collected of the fill material and one of the tuff material. Finally, two samples were collected from clay-filled fractures within the tuff. These seven samples were analyzed in the same batch as samples from PRS 50-004(c) (request number 20190, report number 34885). The samples to be analyzed for mercury were analyzed beyond the 28-day holding time. Therefore, those results that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ).

4.2 Organic Analyses

4.2.1 PRS 50-004(a)

Data from PRS 50-004(a) are fully usable for support of screening decisions. As discussed in Section 4.2.1.3, the false-positive problem encountered in one blind QC sample with acetone and/or 2-butanone, common laboratory contaminants, does not significantly affect the quality of the data.

4.2.1.1 Request Number 19488

Holding times were complied with and no QC problems were reported.

4.2.1.2 Request Number 19641

Holding times were complied with and no QC problems were reported.

4.2.1.3 Request Number 19714

Holding times were complied with. Acetone and 2-butanone were detected in the blind QC sample, but because these compounds were not components of the QC sample, their presence was considered to be due to laboratory contamination; the EQLs for acetone and 2-butanone sample AAB6106 were raised accordingly. These EQLs are far below the SALs for acetone and 2-butanone and therefore have no effect on the screening assessment discussed in Chapter 5.

4.2.2 PRS 50-004(c)

Data from PRS 50-004(c) are fully usable for support of screening decisions.

4.2.2.1 Request Number 19638

Holding times were complied with and no QC problems were reported.

4.2.2.2 Request Number 19641

Holding times were complied with and no QC problems were reported.

4.2.2.3 Request Number 19778

Holding times were complied with and no QC problems were reported.

4.2.2.4 Request Number 19889

Holding times were complied with and no QC problems were reported.

4.2.3 PRS 50-011(a)

Data from PRS 50-011(a) are fully usable for support of screening decisions. All holding times were met (except as noted below), and there were no anomalous QC results for PCBs. One QC problem was noted with request number 20015. In sample AAC0296, 2-butanone was found at concentrations exceeding the EQL. It was found that the continuing calibration standard analyzed with this sample had a percent difference of 32% for 2-butanone, which does not meet acceptance criteria. When the laboratory re-analyzed sample AAC0296 using an acceptable continuing calibration standard measurement, 2-butanone was below the EQL. However, because the second analysis was done after the 14-day holding time, the value from the initial analysis was reported for sample AAC0296, but qualified as estimated (J), and was carried through the screening assessment. It did not affect the outcome of the final assessment (see Chapter 5).

4.3 Radiochemistry Analyses

4.3.1 PRS 50-004(a)

Data from PRS 50-004(a) are fully usable for support of screening decisions. Note that in the case of cesium-137, values reported by CST-3 for blind QC samples were consistently lower than those reported by two laboratories; but because the CST-3 results were confirmed to have been biased low, the cesium-137 values were not qualified.

4.3.1.1 Request Number 19670

Because there were only two soil samples in this delivery group, no blind QC samples were submitted by the LANL SMO to the analytical laboratory. There were no QC problems with this data set.

4.3.1.2 Request Number 19671

In the case of cesium-137, percent recovery for the blind QC sample was out of control, but the values were not qualified (see 4.3.1). In addition, the blind QC sample value for americium-241 was out of control, and values for this analyte were qualified as estimated (J). Laboratory duplicate values for tritium were not within three standard deviations of the mean, and therefore the results for this analyte were qualified as estimated (J).

4.3.1.3 Request Number 19722

In the case of uranium-235, percent recovery for the blind QC sample was low. Because the amount spiked in the QC sample was below the EQL, the reported results were not qualified. In the case of tritium, the percent moisture content for the blind QC sample (reported as out of control) was biased low, which caused the calculated values to be higher than the true values. The calculated values were lower than the SAL, however, so this error had no effect.

4.3.2 PRS 50-004(c)

Data from PRS 50-004(c) are fully usable for support of screening decisions.

4.3.2.1 Request Number 19657

In the case of cesium-137, percent recovery for the blind QC sample was out of control (117%), but the values were not qualified (see 4.3.1). In the case of tritium, the percent moisture content for the blind QC sample (reported as out of control) was biased low, causing the calculated values to be higher than the true values. These calculated values were, however, lower than the SAL, so this error had no effect.

4.3.2.2 Request Number 19658

In the case of cesium-137, percent recovery for the blind QC sample was out of control, but the values were not qualified (see 4.3.1). In the case of tritium, the percent moisture content for the blind QC sample (reported as out of control) was biased low, causing the calculated values to be higher than the true values. These calculated values were lower than the SAL, however, so this error had no effect.

4.3.2.3 Request Number 19671

In the case of cesium-137, percent recovery for the blind QC sample was out of control, but the values were not qualified (see 4.3.1). In addition, the blind QC sample value for americium-241 was out of control, and values for this analyte were qualified as estimated (J). Laboratory duplicate values for tritium were not within three standard deviations of the mean, and therefore the results for this analyte were qualified as estimated (J).

4.3.2.4 Request Number 19776

In the case of cesium-137, percent recovery for the blind QC sample was out of control, but the values were not qualified (see 4.3.1). In the case of tritium, one of two blind QC samples was out of control because of low percent recovery (80%). Because a consistent low bias (20%) from more than one laboratory indicated problems with the QC sample, the reported results were qualified as estimated (J).

4.3.2.5 Request Number 19915

In the case of cesium-137, percent recovery for the blind QC sample was out of control, but the values were not qualified (see 4.3.1). In the case of tritium, the percent moisture content for the blind QC sample (reported as out of control) was biased low, causing the calculated values to be higher than the true values. These calculated values, however, were lower than the SAL, so this error had no effect on the quality of the data.

4.3.2.6 Request Number 20195

In the case of cesium-137, percent recovery for the blind QC sample was out of control, but the values were not qualified (see 4.3.1). In the case of tritium, the percent moisture content for the blind QC sample (reported as out of control because of low [80%] percent recovery) was biased low, causing the calculated values to be higher than the true values. These calculated values, however, were lower than the SAL, so this error had no effect. Because a consistent low bias (20%) from more than one laboratory indicated problems with the QC sample, the reported results were qualified as estimated (J).

4.3.3 PRS 50-011(a)

The data from PRS 50-011(a) data are fully usable for support of screening decisions.

Request Number 20195: In the case of cesium-137, percent recovery for the blind QC sample was out of control, but the values were not qualified (see 4.3.1). In the case of tritium, the percent moisture content for the blind QC sample (reported as out of control because of low [80%] percent recovery) was biased low, causing the calculated values to be higher than the true values. These calculated values were lower than the SAL, however, so this error had no effect. Because a consistent low bias (20%) from more than one laboratory indicated problems with the QC sample, the reported results were qualified as estimated (J).

5.0 SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 PRS 50-004(a)

The decommissioned lines near Building TA-50-37 were used to transport liquid radioactive waste from Pajarito Road sites to TA-50. According to the SWMU report (LANL 1990, 0145), these lines "were known to have leaked occasionally." Francis (1991, 07-0037) confirms this on the basis of a records search. On the basis of the human health screening assessment, NFA is recommended for this PRS.

5.1.1 History

This PRS is the trench through which passed a 520-ft section of the original 6-in.-diameter vitrified clay pipe that carried industrial waste to TA-50, and the associated manholes (Figure 1-2). In 1975, this portion of the line, which ran from TA-50 to Pecos Drive, was removed to clear the area for construction of Building TA 50-37. (A new pipe, acid waste line 45, which bypassed the TA-50-37 construction zone, replaced the decommissioned line until 1984, when it was removed as well–see Chapter 1, Section 1.2.1.2). A large portion of the trench that had carried the original pipe is now under Buildings TA-50-37, TA-50-54, and TA-50-69. Because the clay pipe was known to have leaked, at the time of its removal contaminated soil was also removed, and both were interred at TA-54, Area G. The trench was cleaned up to levels dictated by the sensitivity of the hand-held radiation detection instruments of the day and then backfilled. Neither the pipe nor the soil was tested for the presence of nonradioactive constituents. The estimated depths to the original trench bottoms are shown in Table 1-1.

This PRS is discussed in detail in Sections 2.2.1.4.4 and 5.1.2.3 of the RFI Work Plan for OU 1147 (LANL 1992, 0787).

5.1.2 Description

No further site-specific geology, soils, or wildlife habitat information is required.

5.1.3 Previous Investigations

Two previous investigations were conducted at this site: during the decommissioning of the radioactive liquid waste line (Elder et al. 1986, 0456), excavated soils were characterized for radioactive constituents; and in 1993, an RFI investigation was conducted (for radioactive and hazardous waste constituents) on surface soils from unpaved areas at TA-50 (Environmental Restoration Project 1995, 1284).

5.1.4 Field Investigation

Ground-penetrating radar (GPR) was employed to locate the backfilled trench through which the decommissioned waste line had passed, but no definite conclusions could be drawn from the data; the trench could not be accurately located by GPR alone. Existing engineering drawings, information from site personnel, historical documents, and surficial features (such as cuts in the asphalt) were then used to trace the line of the trench. In addition, a footing trench that had been excavated perpendicular to the decommissioned-waste-line trench at an ongoing construction project (Building TA-50-54) provided reference points for the drilling of corehole 50-3027: the outline of the decommissioned-waste-line trench was discernible in the wall of this footing trench.

The waste-line trench was sampled via five vertical coreholes, approximately 100 ft apart, drilled to the contact between trench fill and trench bottom. For one of these coreholes (50-3027), the drilling and sampling were completed in October 1994 (see Table 5-1 for a list of the coreholes and Figure 5-1 for their locations). All locations were identified and surveyed using LANL-ER-SOP-3.01.R1 (in preparation at the time of this investigation).

Except at sampling location 50-3028 (see below), the previously estimated depth of the trench—5 to 6 ft below grade—was shown by the field investigation to be accurate (see Table 1-1 in Chapter 1).

A hollow-stem-auger drill rig and core barrel samplers were used to collect the majority of the samples, in accordance with LANL-ER-SOP-6.26.R0. At two locations, because of overhead utility lines (50-3024) and an ongoing building project (50-3027) that hindered access, a hand auger was used, in accordance with LANL-ER-SOP-6.10.R0. At one location (50-3029), the shallow sampling planned was not done because of the potential hazard presented by subsurface utilities (in this case, relocation of the sampling point was not feasible).

If tuff was encountered at a shallow depth, it was concluded that the drilling point was outside the trench; in these cases, the rig was moved around the original location until the trench was definitely located. At sampling location 50-3028, between buildings TA-50-54 and TA-50-69, three attempts were made to locate the trench; the drilling point was moved two feet to the south, then two feet to the north, and finally four feet to the south of the originally surveyed location. After consultation with TA-50 on-site personnel on the probable location of the trench, the core from the third drilling point was sampled. Much of the soil and some of the tuff at this location apparently had been removed as part of the construction project for buildings TA-50-54 and TA-50-69, accounting for the shallow depth to tuff in the corehole. All final sampling locations were entered into the FIMAD database.

The location of the interface between the trench fill material and the underlying bedrock tuff was determined by examining each collected core interval (in some cases, the change in resistance to the auger made it clear that tuff had been encountered). Samples of the fill material immediately above the interface and of the tuff material

TABLE 5-1

PRS 50-004(a): SUMMARY OF SAMPLES TAKEN

				Sample Request Number				
Location ID	Sample ID	Depth (ft)	Sample Matrix	VOCs	SVOCs	PCBs	INORG	RAD
50-3024	AAC0227	4.5 - 5.5	fill	**	**	**	19678	19671
50-3024	AAC0228	6.0 - 7.0	tuff	19641	19641	19641	19678	19671
50-3025	AAC0254	5.0 - 6.1	fill	**	**	**	19720	19722
50-3025	AAC0255	6.1 - 7.0	tuff	**	**	**	19720	19722
50-3026	AAC0256	6 .0 - 7.0	fill	**	**	**	19720	19722
50-3026	AAC0257	7.0 - 8.0	tuff	**	**	**	19720	19722
50-3027	AAC0210	5.33 - 5.83	fill	**	**	**	19506	19670
50-3027	AAC0211	8.75 - 9.33	tuff	19488	19488	19488	19506	19670
50-3028	AAC0258	0.75 - 1.5	fill	**	**	**	19720	19722
50-3028	AAC0259	1.5 - 3.0	tuff	**	**	**	19720	19722
50-3028F	AAB6106	3.5 - 4.25	fracture*	19714	19714	19714	19720	19722

* Clay-filled fracture
** Analysis not requested

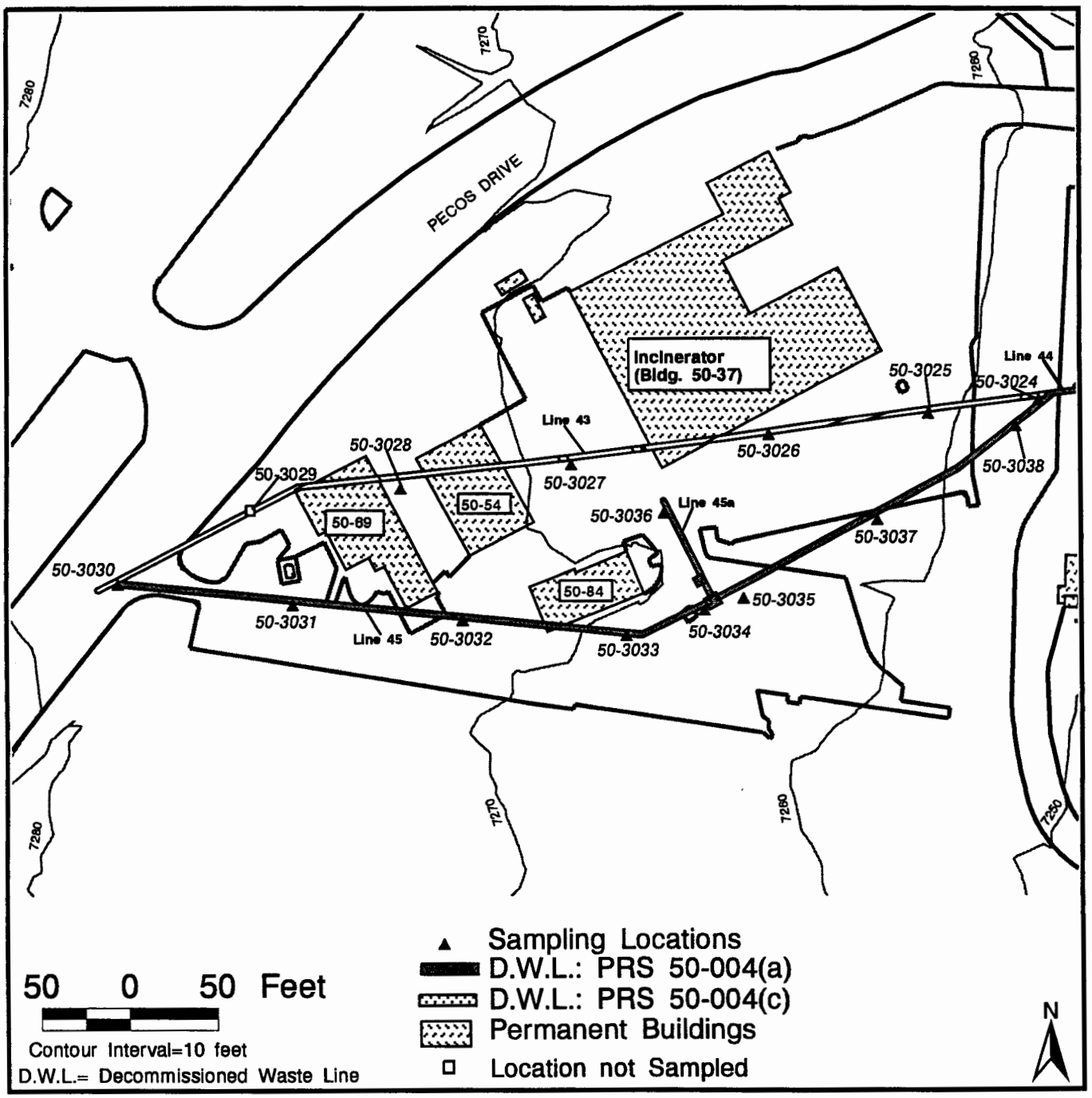

Figure 5-1. Sampling locations: PRS 50-004(a) and west side of PRS 50-004(c).

below the interface were then collected. In the core material from corehole 50-3028, a clay-filled fracture was noted in the tuff, and a sample of the clay was also collected. Each core sample was field-screened for alpha and beta/gamma radiation and for organic vapors, using hand-held instruments: a Ludlum 139 alpha meter, an ESP-1 beta/gamma meter, and an hnu photoionization detector. The alpha and the beta/gamma radiation screening results were all near or below the LANL sitewide background values; the organic vapors were <1 ppm. In addition, each sample was screened for gross alpha and gross beta radiation at the TA-59 Counting Facility, by means of a gas proportional counter (LANL-ER-SOP-14.01.R0). All the results were within background values. The collected samples were promptly submitted, in accordance with chain-of-custody procedures, to the SMO for shipment to analytical laboratories.

5.1.5 Background Comparisons

The results of the inorganic analysis for the sediment samples taken at PRS 50-004(a) were compared with LANL background UTL concentrations. Beryllium was found to be present at concentrations above UTL background for LANL soil in one sample, and two radionuclides, plutonium-238 and plutonium-239, were measured at concentrations above UTLs in seven samples from PRS 50-004(a). These three analytes, therefore, were included in the next phase of the assessment.

The specific results of the sample analyses for inorganic chemicals and radionuclides at PRS 50-004(a), by sample and interval, are shown in Tables 5-2 and 5-3. Figure 5-2 shows the locations from which samples were collected that contained analytes in concentrations exceeding background UTLs.

5.1.6 Evaluation of Organic Constituents

No organic analytes were reported as having concentrations above detection limits for soil samples from PRS 50-004(a).

5.1.7 Human Health Assessment

5.1.7.1 Screening Assessment

The COPCs identified at this PRS (those having soil concentrations greater than background UTLs) were next compared with their SALs. The maximum detected concentration for each of these COPCs is shown in Table 5-4.

Greater than or equal to SAL. None of the chemicals found in the soils at this PRS fall into the "Greater than or equal to SAL" category.

No SAL. Beryllium was detected in one location at a concentration slightly exceeding the background UTL. A laboratory duplicate analysis of the same sample for beryllium showed a level slightly below background UTL, at 1.9 mg/kg. The sample in question was collected from a clay fracture, where leachate from overlying soils might percolate into and sorb to the clay. The fines in the tuff fractures may contain higher concentrations of certain natural elements, such as beryllium; analyses of channel sands from TA-39 show beryllium at 1 mg/kg in the coarse fractions and 3.5 mg/kg in the fine (silt/clay) fractions (Longmire et al. 1995, 1266). It is likely that if the source of the beryllium were the radioactive liquid waste line, radionuclides from the waste also would have been adsorbed onto the clay material; but no radionuclides above UTL were found in

TABLE 5-2

PRS 50-004(a): INORGANIC ANALYTES FOUND AT CONCENTRATIONS GREATER THAN BACKGROUND UTLs

Sample ID	Depth (ft)	Beryllium (mg/kg)
LANL UTL		1.95
SAL		NA*
AAB6106	3.5 - 4.3	**2.1**
AAC0211	8.8 - 9.3	0.45
AAC0227	4.5 - 5.5	<0.39
AAC0228	6.0 - 7.0	<0.53
AAC0254	5.0 - 6.1	<1.0
AAC0255	6.1 - 7.0	<0.72
AAC0256	6.0 - 7.0	<0.81
AAC0257	7.0 - 8.0	<0.87
AAC0258	0.8 - 1.5	<1.1
AAC0259	1.5 - 3.0	<0.58

Note: Values in shaded cells are those that exceed background UTLs.
*The SAL for beryllium is below the background UTL.

TABLE 5-3

PRS 50-004(a): RADIONUCLIDES FOUND AT CONCENTRATIONS GREATER THAN BACKGROUND UTLs

Sample ID	Depth (ft)	Plutonium-238 (pCi/g)	Plutonium-239 (pCi/g)
LANL UTL		0.014	0.052
SAL		27	24
AAB6106	3.5 - 4.3	**0.018**	0.007
AAC0211	8.8 - 9.3	**0.027**	**0.09**
AAC0227	4.5 - 5.5	**0.014**	**0.135**
AAC0228	6.0 - 7.0	**0.065**	**0.14**
AAC0257	7.0 - 8.0	**0.034**	0.016
AAC0258	0.8 - 1.5	0.002	**0.059**
AAC0259	1.5 - 3.0	**0.018**	0

Note: Values in shaded cells are those that exceed background UTLs.

this sample. Therefore, beryllium at this location is proposed as having originated from background sources and on that basis is eliminated as a COPC.

Below SAL. Two chemicals, plutonium-238 and plutonium-239, were detected at concentrations above the UTL but below their respective SALs.

Multiple Chemical Evaluation. To evaluate multiple chemical effects for this data set, COPCs detected below their respective SALs were considered according to whether they were radionuclides, carcinogens, or noncarcinogens. All the COPCs in this group were radionuclides. The maximum analyte concentrations of these COPCs were normalized to the SAL, and the normalized values were then summed, as described in Chapter 3, Section 3.4.1. The results of this multiple chemical evaluation are presented in Table 5-5.

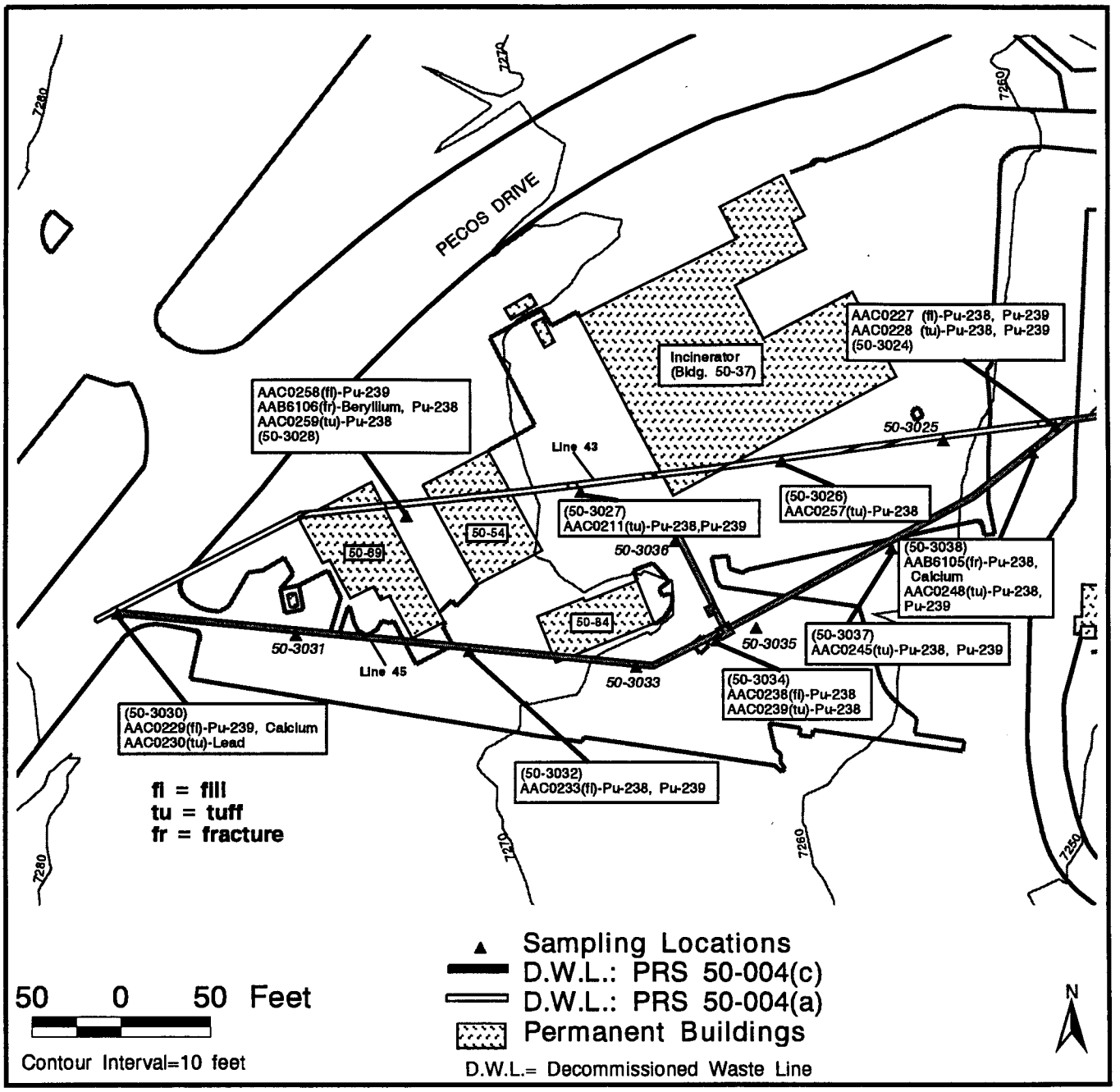

Figure 5-2. PRS 50-004(a) and west side of PRS 50-004(c): Locations from which samples were collected that contained analytes in concentrations exceeding background UTLs.

TABLE 5-4

PRS 50-004(a): MAXIMUM DETECTED CONCENTRATIONS OF COPCs

COPC	Location ID	Sample ID	Sample Value	Depth (ft)	Location Description	SAL
Beryllium	50-3028F	AAB6106	2.1 mg/kg	3.5-4.25	fracture	NA*
Plutonium-238	50-3024	AAC0228	0.065 pCi/g	6.0-7.0	tuff	27 pCi/g
Plutonium-239	50-3024	AAC0228	0.14 pCi/g	6.0-7.0	tuff	24 pCi/g

*The SAL for beryllium is below the background UTL

TABLE 5-5

PRS 50-004(a): MULTIPLE CHEMICAL EVALUATION

Chemical	Sample Value (pCi/g)	SAL (pCi/g)	Normalized Value
Plutonium-238	0.065	27	0.002
Plutonium-239	0.14	24	0.006
Sum of Normalized Values			0.008

The sum of the normalized values for the two radionuclides is much less than 1 (0.008), indicating that adverse human health effects from exposure are unlikely. Therefore, both are eliminated as COPCs.

5.1.7.2 Risk Assessment

On the basis of the results of the screening assessment, no risk assessment was performed for this PRS.

5.1.8 Ecological Assessment

The landscape around this PRS is highly developed, most of it covered by buildings and parking lots. Because there is essentially no potential for receptors to come in contact with COPCs, there are no ecotoxicological risk concerns at this PRS.

5.1.9 Extent of Contamination

The objective of the Phase 1 sampling plan was to screen the site for the presence of chemicals from previous operational releases. The plan was not designed to define the extent of contamination, but rather to sample the areas of the site in which the highest concentrations of any potential contaminants, if present, would be expected to occur.

5.1.10 Conclusions and Recommendations

Because no human health COPCs were identified by the screening assessment for this PRS, the recommendation is NFA. This recommendation is based on NFA criterion No. 4 (Los Alamos National Laboratory, Environmental Restoration Department, Project Consistency Team Policy number 015):

> *The PRS has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants of concern are either not present or are present in concentrations that would pose an acceptable risk under the projected future land use. The determination of acceptable risk and future land use has considered stakeholder involvement.*

A Class III permit modification will be requested to remove this site from the HSWA Module of the Laboratory's Resource Conservation and Recovery Act operating permit.

5.1.11 Sampling and Analysis Plan for PRS 50-004(a)

On the basis of the conclusions and recommendations presented for this PRS, no further investigation requiring a sampling and analysis plan is necessary.

5.2 PRS 50-004(c)

This PRS includes miscellaneous decommissioned waste lines (Nos. 44, 45, 45a, 46, 47, 48, 48a, 49, 54, 55, 56, 65, and 67—see Figure 1-2 and Table 1-1), which were used to transport various wastes, and manholes TA-50-6, TA-50-55, and TA-50-56 (Francis, 1991, 07-0037). According to the SWMU report (LANL 1990, 0145), decommissioning involved removing the lines (all were removed except No. 56), screening for radionuclides, and cleaning to the ALARA standards in force at the time.

5.2.1 History

This PRS is the site of thirteen former radioactive industrial waste lines and three manholes associated with them; all, except for one waste line, were removed between 1981 and 1989. Although all of these lines and manholes were listed as having been removed, Line 56 is still in service; it connects a floor drain in Room 36 of Building TA-50-1 to an active, 10-in., cast-iron radioactive industrial waste line (the point of connection between the two lines is under the floor slab of the Vehicle Decontamination Facility). This PRS is discussed in detail in Sections 2.2.1.4.4 and 5.1.2.3 of the RFI Work Plan for OU 1147 (LANL 1992, 0787).

Any radionuclide contamination of soil and/or pipe discovered during decommissioning of the lines was cleaned up to ALARA levels by removing the pipe and affected soil (these were disposed of in Area G at TA-54). Hand-held radiation-detection instruments and soil sampling for gross alpha and gross beta screening at 10-ft intervals along the trench were used to evaluate the need for soil cleanup. Sampling for nonradioactive constituents was not done at that time.

A release of contaminants that may have been above present acceptable limits was documented at Manhole TA-50-6. At the time of decommissioning in 1984, the manhole structure and about 20 yd^3 of soil were excavated to approximately 19 ft below grade, but, because equipment capable of deeper excavation was not available, the soil at the bottom of the excavation was left with up to 3.8 nCi/g of alpha contamination (Elder et al. 1986, 0456). (See Section 5.2.10.)

5.2.2 Description

No further site-specific geology, soils, or wildlife habitat information is required.

5.2.3 Previous Investigations

Two previous investigations were conducted at this site: during the decommissioning of the radioactive liquid waste line (Elder et al. 1986, 0456), excavated soils were characterized for radioactive constituents; and in 1993, an RFI investigation was conducted (for radioactive and hazardous waste constituents) on surface soils from unpaved areas at TA-50 (Environmental Restoration Project 1995, 1284).

5.2.4 Field Investigation

Ground-penetrating radar (GPR) was employed to try to locate the backfilled trenches associated with the decommissioned waste lines, but no definite conclusions could be drawn from the GPR data; the trenches could not be accurately located by this method alone. They were subsequently located using existing engineering drawings, information from site personnel, historical documents, and surface clues. They were sampled via 29 vertical holes, approximately 100 ft apart (locations were adjusted so as not to interfere with existing pipeline junctions, building entrances or exits, etc.). All locations were identified and surveyed using LANL-ER-SOP-3.01.R1 (in preparation at the time of this investigation). The coreholes were drilled to just below the contact between the trench fill and the trench floor. See Table 5-6 for a list of these coreholes and Figures 5-1 and 5-3 for their locations).

The previously estimated depths for the various trenches (see Table 1-1 in Chapter 1) were shown by the field investigation to be accurate.

A hollow-stem-auger drill rig and core barrel samplers were used to collect the majority of the samples, in accordance with LANL-ER-SOP-6.26.R0. At seven locations, because of either the close proximity of utility lines (50-3021 - 50-3023) or limited access on the southeast side (50-3001 - 50-3003 and 50-3006), a hand auger was used, in accordance with LANL-ER-SOP-6.10.R0.

The 8-degree-angle corehole (RDH-3) to be drilled at Manhole TA-50-6 (Section 5.1.2.3.1 of the RFI Work Plan) was not attempted because the area was found to be so congested with underground utilities and the present waste line that neither drilling nor hand augering was feasible.

If tuff was encountered at a shallow depth, it was concluded that the drilling point was outside the trench; in these cases, a new drilling point was determined, using available information, until the trench was located. Several of the originally selected corehole locations had to be moved in this way (the final sampling locations were entered into the FIMAD database). Those locations, and the distance and direction in which each was moved, are as follows:

- 50-3001: Two feet eight inches (south).
- 50-3002: One foot nine inches (south).
- 50-3031: One foot (south).

TABLE 5-6

PRS 50-004(c): SUMMARY OF SAMPLES TAKEN

				Sample Request Number				
Location ID	Sample ID	Depth (ft)	Sample Matrix	VOCs	SVOCs	PCBs	INORG	RAD
50-3001	AAC0212	5.766 - 6.0	tuff	19638	19638	19638	19677	19658
50-3001	AAC0213	2.0 - 5.0	fill	**	**	**	19677	19658
50-3002	AAC0214	1.0 - 5.0	fill	**	**	**	19677	19658
50-3002	AAC0215	5.25 - 5.75	tuff	**	**	**	19677	19658
50-3003	AAC0216	1.0 -3.0	fill	**	**	**	19677	19658
50-3003	AAC0217	3.0 - 4.0	tuff	**	**	**	19677	19658
50-3004	AAC0270	5.0 - 6.25	fill	**	**	**	19677	19776
50-3004	AAC0271	6.25 - 7.25	tuff	**	**	**	19677	19776
50-3005	AAC0260	5.25 - 6.25	fill	**	**	**	19674	19658
50-3005	AAC0261	6.25 - 7.25	tuff	**	**	**	19674	19658
50-3006	AAC0218	0 - 1.5	fill	**	**	**	19677	19658
50-3006	AAC0219	1.5 - 2.5	tuff	**	**	**	19677	19658
50-3007	AAC0272	16.0 - 17.0	fill	**	**	**	19910	19915
50-3007	AAC0273	17.0 - 18.0	tuff	**	**	**	19910	19915
50-3008	AAC0274	11.4 - 12.4	fill	**	**	**	19910	19915
50-3008	AAC0275	12.4 - 16.0	tuff	**	**	**	19910	19915
50-3009	AAC0278	5.0 - 6.0	fill	**	**	**	19910	19915
50-3009	AAC0279	6.0 - 9.5	tuff	**	**	**	19910	19915
50-3009F	AAC0294	12.25 - 13.5	fracture*	19889	19889	19889	19910	19915
50-3010	AAC0280	6.75 - 7.75	fill	**	**	**	20190	20195
50-3010	AAC0281	10.0 - 11.0	tuff	**	**	**	20190	20195
50-3011	AAC0276	7 .0 - 8.0	fill	**	**	**	20190	20195
50-3011	AAC0277	8 .0 - 9.0	tuff	**	**	**	20190	20195
50-3012	AAC0262	7.0 - 8.0	fill	**	**	**	19910	19915
50-3012	AAC0263	8.0 - 11.0	tuff	19889	19889	19889	19910	19915
50-3014	AAC0264	6.5 - 7.5	fill	**	**	**	19910	19915
50-3014	AAC0265	7.5 - 8..5	tuff	19889	19889	19889	19910	19915
50-3016	AAC0266	10.0 - 11.0	fill	**	**	**	19774	19776
50-3016	AAC0267	11.0 - 12.25	tuff	**	**	**	19774	19776
50-3016F	AAC0292	12.5 - 13.6	fracture*	19778	19778	19778	19774	19776
50-3017	AAC0268	7.0 - 10.5	fill	**	**	**	19774	19776
50-3017	AAC0269	10.5 - 11.5	tuff	**	**	**	19774	19776
50-3017F	AAC0291	12.5 & 14.5	fracture*	***	***	***	19774	19776
50-3018	AAC0249	6.0 - 7.0	fill	**	**	**	19774	19776
50-3018	AAC0250	7.0 - 9.0	tuff	**	**	**	19774	19776
50-3018F	AAC0290	10.5 - 12.5	fracture*	19778	19778	19778	19774	19776
50-3018R	AAC0251	6.0 - 7.0	fill	**	**	**	19774	19776
50-3020	AAC0252	5.0 - 6.0	fill	**	**	**	19774	19776
50-3020	AAC0253	6.0 - 7.0	tuff	**	**	**	19774	19776
50-3020F	AAC0293	7.0 - 9.5	fracture*	19778	19778	19778	19774	19776
50-3021	AAC0220	7.0 - 9.0	fill	**	**	**	19679	19657
50-3021	AAC0221	9.42 -10.0	tuff	**	**	**	19679	19657
50-3021R	AAC0222	9.42 - 10.0	tuff	**	**	**	19679	19657
50-3022	AAC0223	7.0 - 12.0	fill	**	**	**	19677	19658
50-3022	AAC0224	14.5 - 16.0	tuff	**	**	**	19677	19658
50-3023	AAC0231	5.5 - 6.5	fill	**	**	**	19678	19671
50-3030	AAC0229	4.0 - 4.5	fill	**	**	**	19679	19657
50-3030	AAC0230	6.0 - 7.0	tuff	**	**	**	19679	19657
50-3031	AAC0225	3.0 - 4.0	fill	**	**	**	19679	19657

TABLE 5-6 (Continued)

				Sample Request Number				
Location ID	Sample ID	Depth (ft)	Sample Matrix	VOCs	SVOCs	PCBs	INORG	RAD
50-3031	AAC0232	5.6 - 6.6	tuff	**	**	**	19679	19657
50-3032	AAC0233	3.75 - 5.0	fill	**	**	**	19679	19657
50-3032	AAC0234	5.5 - 6.5	tuff	**	**	**	19679	19657
50-3032R	AAC0235	3.75 - 5.0	fill	**	**	**	19679	19657
50-3033	AAC0236	7.0 - 8.0	fill	**	**	**	19679	19657
50-3033	AAC0237	8.0 - 9.0	tuff	**	**	**	19679	19657
50-3034	AAC0238	7.9 - 8.9	fill	**	**	**	19678	19671
50-3034	AAC0239	9.0 - 10.0	tuff	19641	19641	19641	19678	19671
50-3035	AAC0240	7.6 - 8.6	fill	**	**	**	19678	19671
50-3035	AAC0241	8.5 - 10.0	tuff	**	**	**	19678	19671
50-3036	AAC0242	8.5 - 9.5	fill	**	**	**	19678	19657
50-3036	AAC0243	9.5 - 10.0	tuff	**	**	**	19678	19657
50-3037	AAC0244	6.0 - 7.0	fill	**	**	**	19678	19671
50-3037	AAC0245	7.0 - 8.5	tuff	**	**	**	19678	19671
50-3037R	AAC0246	7.0 - 8.5	tuff	**	**	**	19678	19671
50-3038	AAC0247	8.5 - 9.5	fill	**	**	**	19678	19671
50-3038	AAC0248	9.5 - 10.5	tuff	**	**	**	19678	19671
50-3038F	AAB6105	10.25 - 13.0	fracture*	***	***	***	19678	19671

* Clay-filled fracture within the tuff
** Analysis not requested
*** Analysis not requested because amount of fracture material available was inadequate for organic analysis.

At sampling location 50-3023, where overhead utility lines precluded the use of a drill rig, hand augering was attempted. But the tuff was too consolidated to be penetrated with the hand auger, so a sample of the fill material only was collected.

The location of the interface between the trench fill material and the underlying bedrock tuff was determined by examining each collected core interval (in some cases, the change in resistance to the auger made it clear that tuff had been encountered). Samples of the fill material immediately above the interface and of the tuff material below the interface were then collected. In the core material from coreholes 50-3009, 50-3016, 50-3017, 50-3018, 50-3020, and 50-3028, clay-filled fractures were noted in the tuff, and samples of the clay were also collected. Each core sample was field-screened for alpha and beta/gamma radiation and for organic vapors, using hand-held instruments: a Ludlum 139 alpha meter, an ESP-1 beta/gamma meter, and an hnu photoionization detector. The alpha and the beta/gamma radiation screening results were all near or below the LANL sitewide background values; the organic vapors were <1 ppm. In addition, each sample was screened for gross alpha and gross beta radiation at the TA-59 Counting Facility, by means of a gas proportional counter (LANL-ER-SOP-14.01.R0. All the results were within background values. The collected samples were promptly submitted, in accordance with chain-of-custody procedures, to the SMO for shipment to analytical laboratories.

5.2.5 Background Comparisons

The results of the inorganic analysis for the soil samples taken at PRS 50-004(c) were compared with LANL background UTL concentrations. Copper, chromium, lead, mercury, calcium, potassium, nickel, and zinc were found in ten samples at concentrations

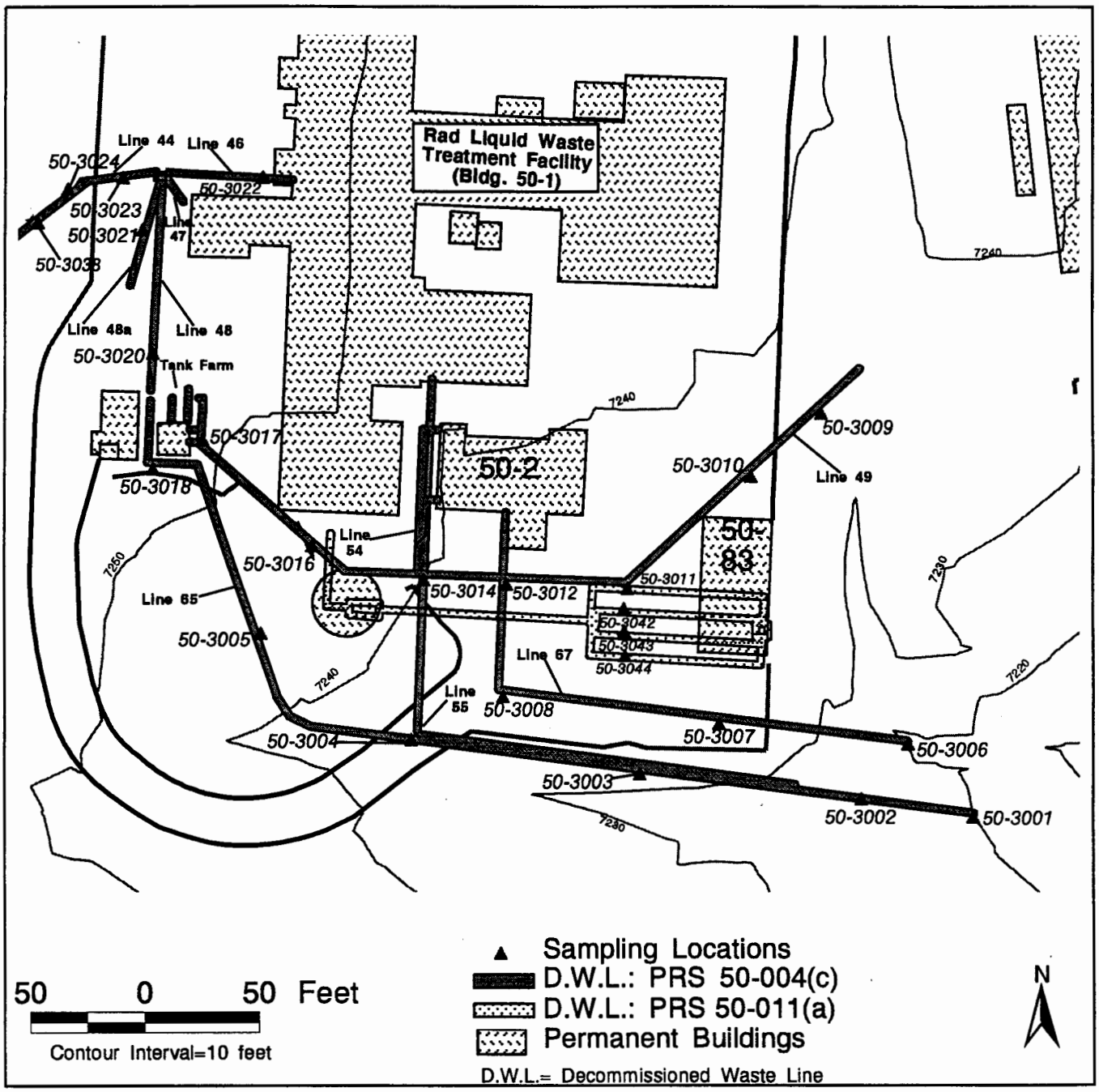

Figure 5-3. Sampling locations: PRS 50-004(c), east side, and PRS 50-011(a).

above the UTL background for LANL soil; beryllium was found at a concentration above the UTL in one soil sample (AAC0294). These nine chemicals, then, were carried forward to the screening assessment. Antimony was undetected in all soils analyzed; however, because of a QC problem (see Section 4.1.2.3), this chemical was also included in the screening assessment. These results are shown in Table 5-7.

Three radionuclides, plutonium-238, plutonium-239, and uranium-235, were detected at levels above their background UTLs, as shown in Table 5-8. These radionuclides were included in the screening assessment.

The locations from which samples were collected that contained analytes in concentrations exceeding background UTLs are shown in Figure 5-4.

5.2.6 Evaluation of Organic Constituents

Three organic analytes were found to have concentrations above the EQL, as shown in Table 5-9. For acetone, 2-hexanone, and methylene chloride, seven of the twenty-four detected values shown in Table 5-9 were above the EQL and therefore are carried forward to the screening assessment (see Section 5.2.7.1).

5.2.7 Human Health Assessment

5.2.7.1 Screening Assessment

The COPCs identified at this PRS (those having soil concentrations greater than background UTLs or for which no background data are available) were next compared with their SALs. The maximum detected concentration for each of these COPCs is shown in Table 5-10.

Greater than or equal to SAL. There were no chemicals that fell into the "Greater than or equal to SAL" category.

No SAL. Five chemicals fell into the "No SAL" category: calcium, magnesium, potassium, 2-hexanone, and beryllium. The first three are essential nutrients, having recommended daily allowances (RDAs) of 1200 mg, 350 mg, and 1600-2000 mg respectively (National Research Council 1989, 1251). To reach these levels, an individual weighing 70 kg would have to ingest 0.05, 0.05, and 0.28 kg, respectively, of soil daily. Since average soil ingestion is assumed to be 0.0001 kg/day, it is unlikely that even the RDA (a nontoxic endpoint) could be reached through soil ingestion at this PRS. Therefore, the concentrations of calcium, magnesium, and potassium found at PRS 50-004(c) are not likely to cause adverse human health effects.

The fourth chemical, 2-hexanone, is a solvent that is moderately toxic via the oral route; the oral median lethal dose (LD50) in rats is 2.59 g/kg body weight. To ingest a comparable dose, an individual weighing 70 kg would have to consume 1 oz to 1 lb of pure 2-hexanone (Gosselin et al. 1984, 1280), which translates to 443,000 kg of soil. The concentrations of 2-hexanone at this PRS, then, are not likely to cause adverse human health effects.

Beryllium, the fifth chemical, was detected in only one location at a concentration (4.7 mg/kg) exceeding the soil background UTL. This sample was collected from a clay fracture (at a depth of approximately 13 feet), where leachate from overlying soils would be expected to sorb to the clay as it percolates through the fracture.

TABLE 5-7

PRS 50-004(c): INORGANIC ANALYTES FOUND AT CONCENTRATIONS GREATER THAN BACKGROUND UTLS

Sample ID	Depth (ft)	Copper (mg/kg)	Mercury (mg/kg)	Lead (mg/kg)	Antimony (mg/kg)	Beryllium (mg/kg)	Calcium (mg/kg)	Chromium (mg/kg)	Potassium (mg/kg)	Magnesium (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)
	N/A	15.7	0.1	23.3	2.5	1.95	6,120	19.3	3,410	4,160	15.2	50.8
SAL	N/A	2,800	23	400	32	NA*	NA	210	NA	NA	1,500	23,000
AAB6105	10.3 - 13.0	6.1	<0.08(UJ)	3.9	**<5.1**	1.4	**6650**	9.9(J)	1880	<2670	<7.9	36.6
AAC0212	5.7 - 6.0	<2.7	**0.12**	2.4	**<4.5**	<0.91	348	**19.7(J)**	618	199	10.3	24.6
AAC0213	2.0 - 5.0	<3	**0.12**	4.3	**<4.5**	<0.75	<807	2.9(J)	<602	<488	<1.5	26
AAC0214	1.0 - 5.0	6.5	**0.16**	5.5	**<4.8**	<0.86	<839	5(J)	<707	<611	<2.6	28.3
AAC0215	5.3 - 5.8	<2	**0.14**	3.2	**<4.8**	<0.75	<422	3.3(J)	<551	<318	<1.3	23.3
AAC0216	1.0 - 3.0	5.7	**0.25**	9.6	**<4.6**	<0.78	1530	5.5(J)	<1020	<1050	<4	45.3
AAC0217	3.0 - 4.0	<4.1	**0.14**	4.4	**<4.6**	<0.96	<734	4(J)	<615	<592	<3.1	30
AAC0218	0.0 - 1.5	<4	**0.14**	8.7	**<5**	<0.74	1380	10.3(J)	<1010	2340	<8.3	39
AAC0219	1.5 - 2.5	<2.2	**0.14**	3.3	**<5**	<0.52	<850	3.3(J)	<637	<645	<1.9	28.6
AAC0220	7.0 - 9.0	<3.8	<0.02	9.3(J)	**<4.7(UJ)**	<0.68	3600	4.5(J)	<1100	1280	<4.4	20.4
AAC0221	9.4 - 10.0	<3.4	<0.02	5.1(J)	**<4.6(UJ)**	<0.61	5110	3.3(J)	<965	1130	<3.8	21.2
AAC0222	9.4 - 10.0	<2.2	<0.02	4.6(J)	**<4.5(UJ)**	<0.53	2520	2.5(J)	<576	<697	<2.4	15.5
AAC0223	7.0 - 12.0	<3.9	**0.14**	4.3	**<4.8**	<0.77	2210	3.7(J)	<653	<849	<3.2	24.5
AAC0224	14.5 - 16.0	<3.1	**0.19**	3.7	**<4.7**	<0.85	<1000	2.6(J)	<540	<694	<1.5	27.4
AAC0225	3.0 - 4.0	<5.7	<0.02	14.3(J)	**<5.1(UJ)**	<1.1	4870	8.3(J)	1950	2520	<7.7	38.8
AAC0229	4.0 - 4.5	6.1	<0.02	12.0(J)	**<5.1(UJ)**	1.2	**25000**	8(J)	1910	2290	8.9	30.6
AAC0230	6.0 - 7.0	<1.3	<0.02	**70.1(J)**	**<5(UJ)**	<0.51	<946	<1.6(J)	<854	<822	<1.9	26.8
AAC0231	5.5 - 6.5	<1.6	<0.02(UJ)	2.9	**<4.6**	<0.75	1180	<2.1(UJ)	<360	<334	<2.8	28.6
AAC0232	5.6 - 6.6	<1.5	<0.02	3.7(J)	**<5.8(UJ)**	<0.39	<1130	3.6(J)	<685	<835	<2.8	26.2
AAC0233	3.8 - 5.0	7.4	<0.02	14.0(J)	**<5.1(UJ)**	1.2	2840	8.7(J)	2020	2750	<8.8	31.8
AAC0234	5.5 - 6.5	<2.2	<0.02	3.8(J)	**<5.4(UJ)**	<0.62	1810	3.7(J)	872	1420	<5	30.6
AAC0235	3.8 - 5.0	6.9	<0.02	12.5(J)	**<8.6(UJ)**	1.3	3300	8.5(J)	2020	2720	<8.2	32.2
AAC0236	7.0 - 8.0	5.7	<0.02	18.5(J)	**<4.7(UJ)**	1.2	2740	6.2(J)	1580	2330	<8.1	37.5
AAC0237	8.0 - 9.0	<2.6	<0.02	**23.7(J)**	**<4.5(UJ)**	<0.64	1090	3.6(J)	<754	<951	<2.9	27
AAC0238	7.9 - 8.9	<4.9	<0.02(UJ)	9.5	**<4.9**	<1.1	2510	6.1(J)	1260	1890	<6.2	34.7
AAC0239	9.0 - 10.0	<1.3	<0.02(UJ)	4.2	**<4.5**	<0.57	463	1.3(UJ)	<471	401	2.5	25.2
AAC0240	7.6 - 8.6	<5.6	<0.02(UJ)	15.3	**<4.9**	<1.0	2810	7.8(J)	1570	<449	<8.1	38.8
AAC0241	8.5 - 10.0	<2.6	<0.02(UJ)	14.1	**<4.8**	<0.66	<1050	3.2(J)	<714	2310	<3.9	33.1
AAC0242	8.5 - 9.5	<4	<0.02	7.5(J)	**<5(UJ)**	<1.0	1980	5.4(J)	1280	<874	<5.1	27.3
AAC0243	9.5 - 10.0	<2.3	<0.02	4.1(J)	**<4.9(UJ)**	<0.94	1090	2.9(J)	579	1810	<3.5	24.5
AAC0244	6.0 - 7.0	<4.6	<0.02(UJ)	8.0	**<4.7**	<1.0	2220	6.2(J)	1250	909	<6	31.8
AAC0245	7.0 - 8.5	<1.8	<0.02(UJ)	4.6	**<4.7**	<0.74	965	2.6(J)	588	1930	<3.6	25.4
AAC0246	7.0 - 8.5	<1.6	<0.02(UJ)	4.2	**<4.7**	<0.62	<813	3(J)	<519	792	<3.9	24
AAC0247	8.5 - 9.5	<2.6	<0.02(UJ)	4.7	**<4.6**	<0.64	2130	4.4(J)	<823	<691	<2.9	19

TABLE 5-7 (Continued)

Sample ID	Depth (ft)	Copper (mg/kg)	Mercury (mg/kg)	Lead (mg/kg)	Antimony (mg/kg)	Beryllium (mg/kg)	Calcium (mg/kg)	Chromium (mg/kg)	Potassium (mg/kg)	Magnesium (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)
AAC0248	9.5 - 10.5	<3.2	<0.03(UJ)	4.5	**<4.8**	<0.73	2770	5(J)	<851	1280	<2.9	27.8
AAC0249	6.0 - 7.0	<4.7	<0.02(UJ)	7.6	**<4.8**	<0.95	1520	4.8(J)	<838	1300	<3.4	21.3
AAC0250	7.0 - 9.5	<2.4	<0.02(UJ)	4.4	**<4.8**	<0.78	1310	2.7(J)	<485	<1010	<1.7	14.9
AAC0251	6.0 - 7.0	<4.6	<0.02(UJ)	6.3	**<4.9**	<0.98	1930	4.3(J)	<944	<582	<3	21.8
AAC0252	5.0 - 6.0	<4.3	<0.02(UJ)	5.6	**<4.9**	<0.91	1460	3.9(J)	<848	<1110	<3.1	22.8
AAC0253	6.0 -7.0	2.7	<0.02(UJ)	3.6	**<4.9**	<0.67	830	3.3(J)	636	<1080	1.5	19.6
AAC0260	5.3 - 6.3	<4.8	<0.02(UJ)	8.5	**<4.9**	<1.1	2260	4.8(J)	1200	751	<4.6	27.2
AAC0261	6.3 - 7.3	<3.3	<0.02(UJ)	3.6	**<4.7**	<1.1	<631	3.2(J)	<477	<522	<2.2	20.3
AAC0262	7.0 - 8.0	<1.9	<0.02(UJ)	5.1(J)	**<4.6**	<0.72	<590	2.9(J)	<423	<403	<2.5	20.4
AAC0263	8.0 - 11.0	<1.7	<0.02(UJ)	3.5(J)	**<4.6**	<0.57	<437	<1.5(UJ)	<391	<363	<1.3	19.6
AAC0264	6.5 - 7.5	<3.0	<0.02(UJ)	7.2(J)	**<4.6**	<0.83	<756	<2.1(UJ)	<640	<570	<2.1	21
AAC0265	7.5 - 8.5	2.7	<0.02(UJ)	5.2(J)	**<4.6**	0.76	512	2.3(J)	558	524	2.3	22.2
AAC0266	10.0 - 11.0	<3.2	<0.02(UJ)	4.5	**<4.7**	<1.0	2120	<2(UJ)	<599	<599	<1.5	23.5
AAC0267	11.0 - 12.3	<2.3	<0.02(UJ)	4.0(J)	**<4.7**	<0.98	<469	2.5(J)	<459	<366	<1.3	23.6
AAC0268	7.0 - 10.5	<3.6	<0.02(UJ)	4.8	**<4.7**	<0.85	1280	3.8(J)	<752	<819	<1.7	25.2
AAC0269	10.5 - 11.5	<2.4	<0.02(UJ)	1.7	**<4.7**	<1.0	<517	2.7(J)	<447	<408	<1.3	18.3
AAC0270	5.0 - 6.3	7.2	<0.03(UJ)	4.2	**<4.6**	<0.63	**12900**	6.8	1800	3150	<4.9	24.4
AAC0271	6.3 - 7.3	<1.6	<0.03(UJ)	2.2	**<4.8**	<0.72	<377	<1.5	<250	<249	<1.4	29.2
AAC0272	16.0 - 17.0	<1.7	<0.02(UJ)	6.0(J)	**<4.5**	<0.56	<466	<1.5(UJ)	<388	<323	<1.5	21.5
AAC0273	17.0 - 18.0	<1.2	<0.02(UJ)	4.2(J)	**<4.5**	<0.59	<231	<1.2(UJ)	<550	<129	<1.3	17.8
AAC0274	11.4 - 12.4	<2.8	<0.02(UJ)	5.2(J)	**<5**	<0.87	<687	<2(UJ)	<566	<510	<1.7	24.9
AAC0275	12.4 - 16.0	<1.7	<0.02(UJ)	4.6(J)	**<4.7**	<0.53	<399	2.4(J)	<471	<238	<1.8	20.5
AAC0276	7.0 - 8.0	<3.3	<0.06(UJ)	4.6	**<4.6**	<0.76	<568	<1.7	<441	<438	<1.5	29.3
AAC0277	8.0 - 9.0	<1.2	<0.02(UJ)	2.3	**<4.4**	<0.4	<196	<1.2	<166	<117	<1.2	27.6
AAC0278	5.0 - 6.0	<3.3	<0.02(UJ)	8.2(J)	**<4.7**	<0.78	1150	3.1(J)	<813	<841	<2.7	25.3
AAC0279	6.0 - 9.5	<1.9	<0.02(UJ)	5.3(J)	**<4.6**	<0.61	<581	<1.2(UJ)	<565	<394	<1.8	21.8
AAC0280	6.8 - 7.8	<4.6	<0.04(UJ)	7.4	**<4.7**	<0.85	1430	4.7	<846	<908	<3.3	28.5
AAC0281	10.0 - 11.0	<1.7	<0.03(UJ)	1.6	**<4.5**	<0.84	<268	<1.2	<192	<202	<1.3	24.7
AAC0290	10.5 - 12.5	<4.1	<0.02(UJ)	6.5	**<4.9**	<1.0	5930	4.1(J)	<737	1210	<3.5	21.3
AAC0291	12.5 - 14.5	<2.6	<0.02(UJ)	3.2	**<4.8**	1.5	3190	3.8(J)	<539	<790	<2.3	16.5
AAC0292	12.5 - 13.6	<1.9	<0.02(UJ)	5.6	**<4.7**	<0.92	<423	<1.2(UJ)	<469	<306	<1.3	21
AAC0293	7.0 - 9.5	<2.6	<0.02(UJ)	2.7	**<4.8**	<1.1	5050	3.1(J)	<524	<837	<1.4	19.7
AAC0294	12.3 - 13.5	**16.9**	<0.03(UJ)	16.0(J)	**<6.7**	**4.7**	**17200**	15.9(J)	**4,270**	**7,700**	**16.2**	**64.5**

Note: Values in shaded cells are those that exceed background UTLs.
*The SAL for beryllium is below the background UTL .

TABLE 5-8

PRS 50-004(c): RADIONUCLIDES FOUND AT CONCENTRATIONS GREATER THAN BACKGROUND UTLs

Sample ID	Depth (ft)	Plutonium-238 (pCi/g)	Plutonium-239 (pCi/g)	Uranium-235 (pCi/g)
LANL UTL		0.014	0.052	0.088
SAL		27	24	10
AAB6105	10.3 - 13.0	0.025(J)	0.002	0.029
AAC0212	5.7 - 6.0	0.007	0.178	0.043
AAC0213	2.0 - 5.0	0.032	4.46	0.036
AAC0214	1.0 - 5.0	0.054	0.64	0.38
AAC0215	5.3 - 5.8	0.016	0.241	0.029
AAC0216	1.0 - 3.0	0.047	1.15	0.029
AAC0217	3.0 - 4.0	-0.007	0.448	0.034
AAC0218	0.0 - 1.5	0.286	0.637	0.056
AAC0219	1.5 - 2.5	0.372	0.381	0.032
AAC0220	7.0 - 9.0	0.007	0.126	0.036
AAC0221	9.4 - 10.0	0.063	0.527	0.041
AAC0222	9.4 - 10.0	0.034	0.691	0.032
AAC0223	7.0 - 12.0	0.011	0.164	0.023
AAC0224	14.5 - 16.0	0.016	0.705	0.036
AAC0229	4.0 - 4.5	0.014	0.077	0.063
AAC0233	3.8 - 5.0	0.034	0.151	0.041
AAC0235	3.8 - 5.0	-0.009	0.061	0.063
AAC0238	7.9 - 8.9	0.770(J)	0.047	0.029
AAC0239	9.0 - 10.0	0.036(J)	0.036	0.016
AAC0245	7.0 - 8.5	0.018(J)	0.054	0.025
AAC0248	9.5 - 10.5	0.02(J)	0.063	0.02
AAC0249	6.0 - 7.0	0.029	0.146	0.045
AAC0251	6.0 - 7.0	0.016	0.104	0.05
AAC0253	6.0 - 7.0	0.009	0.119	0.043
AAC0260	5.3 - 6.3	0.018	-0.005	0.047
AAC0264	6.5 - 7.5	0.023	0.525	0.034
AAC0266	10.0 - 11.0	0.018	0.101	0.032
AAC0267	11.0 - 12.3	-0.016	0.016	0.025
AAC0268	7.0 - 10.5	0.079	0.403	0.059
AAC0272	16.0 - 17.0	-0.002	0.068	0.034
AAC0274	11.4 - 12.4	0.002	0.131	0.036
AAC0276	7.0 - 8.0	0.02	0.06	0.06
AAC0278	5.0 - 6.0	0.009	0.122	0.047
AAC0280	6.8 - 7.8	0	0.11	0.03

Note: Values in shaded cells are those that exceed background UTLs.

Although background geochemical data for clay fractures at Los Alamos are limited, the background beryllium concentration for a sample collected from a clay fracture at TA-46 was 3.4 mg/kg (Longmire, 1995, 1142). Further, it is likely that if the source of the beryllium were the radioactive liquid waste line, radionuclides from the waste also would have been adsorbed onto the clay material; but no radionuclides above UTL were found in this sample. Therefore, beryllium at this location is proposed as having originated from background sources and on that basis is eliminated as a COPC.

On the basis of these results, all chemicals in the "No SAL" category are eliminated as COPCs.

Below SAL. Eleven chemicals were detected at concentrations above background but well below their respective SALs: copper, chromium, lead, mercury, nickel, zinc, plutonium-238, plutonium-239, uranium-235, acetone, and methylene chloride. Antimony

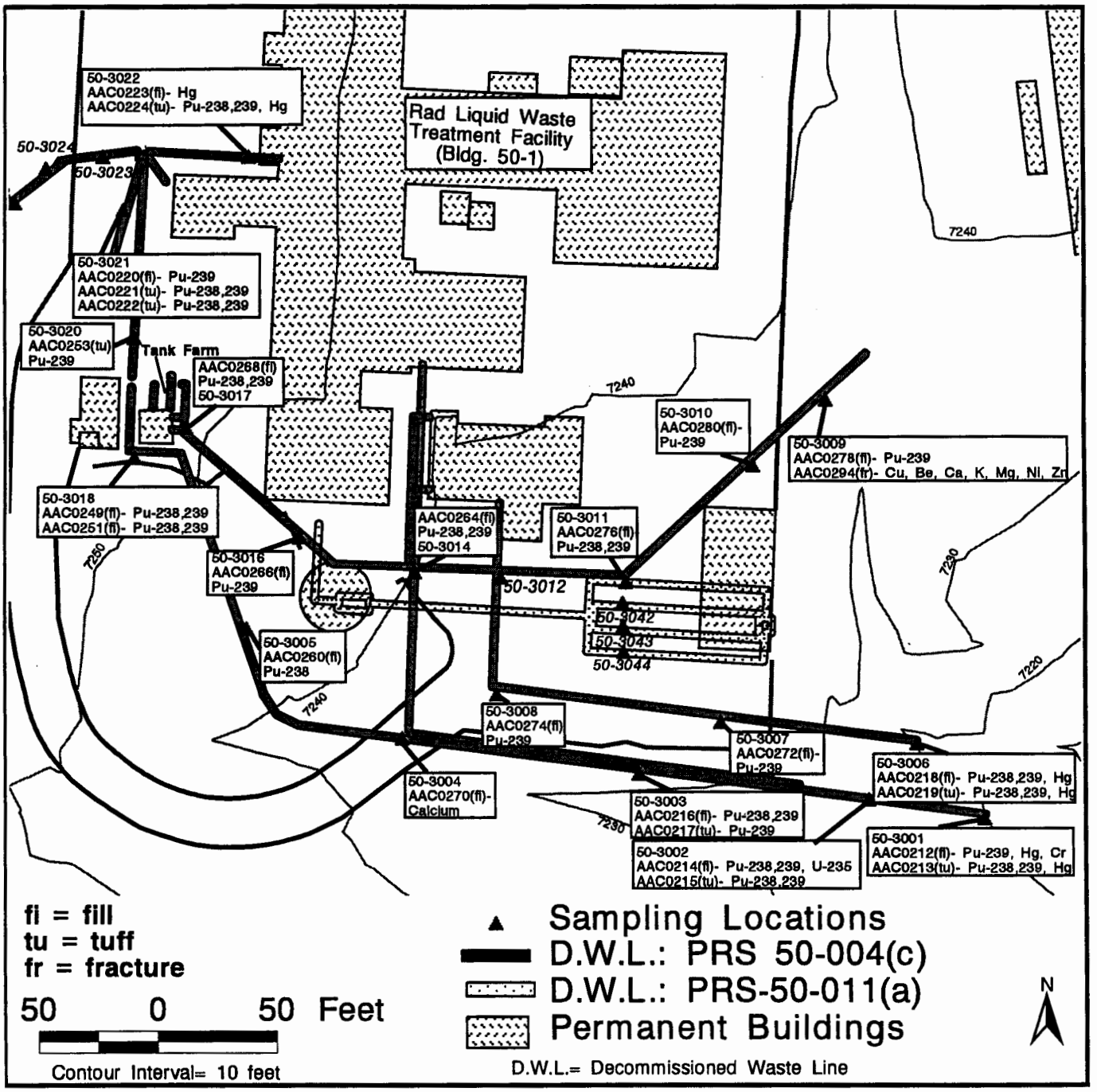

Figure 5-4. PRS 50-004(c), east side, and PRS 50-011(a): Locations from which samples were collected that contained analytes in concentrations exceeding background UTLs.

TABLE 5-9

PRS 50-004(c): ORGANIC ANALYTES FOUND IN SOILS AT CONCENTRATIONS GREATER THAN THE EQL

Sample ID	Depth (ft)	Acetone (mg/kg)	Hexanone [2-] (mg/kg)	Methylene chloride (mg/kg)
SAL		2000	Not available	11.0
EQL		0.01	0.01	0.01
AAC0212	5.7 - 6.0	<0.02	<0.02	<0.005
AAC0239	9.0 - 10	0.038	0.041	<0.005
AAC0263	8.0 - 11.0	0.028	<0.02	<0.005
AAC0265	7.5 - 8.5	0.032	<0.02	<0.005
AAC0290	10.5 - 12.5	<0.02	<0.02	0.02
AAC0292	12.5 - 13.6	<0.031	<0.02	0.017
AAC0293	7.0 - 9.5	<0.038	<0.02	0.015
AAC0294	12.3 - 13.5	<0.02	<0.02	<0.005

Note: Values in shaded cells are those that exceed the EQL.

TABLE 5-10

PRS 50-004(c): MAXIMUM DETECTED CONCENTRATIONS OF COPCs

Chemical	Location ID	Sample ID	Sample Value (mg/kg)	Depth (ft)	Location Description	SAL (mg/kg)
Antimony	50-3032	AAC0235	<8.6	3.8-5.0	fill	32
Beryllium	50-3009F	AAC0294	4.7	12.25-13.5	fracture	NA*
Calcium	50-3030	AAC0229	25000	4.0-4.5	fill	NA
Copper	50-3009F	AAC0294	16.9	12.25-13.5	fracture	2,800
Chromium	50-3001	AAC0212	19.7	5.7-6.0	tuff	210
Lead	50-3030	AAC0230	70.1	6.0-7.0	tuff	400
Magnesium	50-3009F	AAC0294	7,700	12.25-13.5	fracture	NA
Mercury	50-3003	AAC0216	0.25	1.0-3.0	fill	23
Nickel	50-3009F	AAC0294	16.2	12.25-13.5	fracture	1,500
Potassium	50-3009F	AAC0294	4,270	12.25-13.5	fracture	NA
Zinc	50-3009F	AAC0294	64.5	12.25-13.5	fracture	23,000
Plutonium-238	50-3034	AAC0238	0.770 pCi/g	7.9-8.9	fill	27 pCi/g
Plutonium-239	50-3001	AAC0213	4.462 pCi/g	2.0-5.0	fill	24 pCi/g
Uranium-235	50-3002	AAC0214	0.38 pCi/g	1.0-5.0	fill	10 pCi/g
Acetone	50-3034	AAC0239	0.038	9.0-10.0	tuff	2000
2-Hexanone	50-3034	AAC0239	0.041	9.0-10.0	tuff	NA
Methylene chloride	50-3018F	AAC0290	0.02	10.5-12.5	fracture	11

NA = None Available
*The SAL for beryllium is below the background UTL.

results were below detection, but a matrix spike QC problem cast some uncertainty on those results. Therefore, the highest non-detect value for antimony is included in the multiple chemical evaluation.

Multiple Chemical Evaluation. To evaluate multiple chemical effects for this data set, COPCs detected below their respective SALs were divided into three categories: radionuclides, carcinogens, and noncarcinogens. The maximum analyte concentrations of these COPCs were normalized to the SAL, and the normalized values were then summed, as described in Chapter 3, Section 3.4.1. The results of this multiple chemical evaluation are presented in Table 5-11.

TABLE 5-11

PRS 50-004(c): MULTIPLE CHEMICAL EVALUATION

Chemical	Sample Value (mg/kg)	SAL (mg/kg)	Normalized Value
RADIONUCLIDES			
Plutonium-238	0.770 pCi/g	27 pCi/g	0.03
Plutonium-239	4.462 pCi/g	24 pCi/g	0.19
Uranium-235	0.38 pCi/g	10 pCi/g	0.04
Sum of Normalized Values			0.26
CARCINOGENS			
Chromium	19.7	210	0.09
Methylene chloride	0.02	11	0.002
Sum of Normalized Values			0.09
NONCARCINOGENS			
Antimony	<8.6	32	<0.27
Copper	16.9	2,800	0.006
Lead	70.1	400	0.18
Mercury	0.25	23	0.01
Nickel	16.2	1,500	0.01
Zinc	64.5	23,000	0.003
Acetone	0.038	2,000	0.00002
Sum of Normalized Values			<0.48

The results of the multiple chemical evaluation for all categories are less than 1 (0.26 for radionuclides, 0.09 for carcinogens, and <0.48 for noncarcinogens), indicating that adverse human health effects from exposure are very unlikely. Therefore, all of these chemicals are eliminated as COPCs.

5.2.7.2 Risk Assessment

On the basis of the results of the screening assessment, no risk assessment was performed.

5.2.8 Ecological Assessment

Given the generally highly developed condition of the landscape around this PRS, there is essentially no potential for receptors to come in contact with COPCs. There are therefore no ecotoxicological risk concerns at this PRS.

5.2.9 Extent of Contamination

The objective of the Phase 1 sampling plan was to screen the site for the presence of any chemicals from previous operational releases. The plan was not designed to define the extent of contamination, but rather to sample the areas of the site in which the highest concentrations of any potential contaminants, if present, would be expected to occur.

5.2.10 Conclusions and Recommendations

Because no human health COPCs were identified from the screening of this PRS, the recommendation is NFA. This recommendation is based on NFA criterion No. 4 (Los Alamos National Laboratory, Environmental Restoration Department, Project Consistency Team Policy number 015):

> *The PRS has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants of concern are either not present or are present in concentrations that would pose an acceptable risk under the projected future land use. The determination of acceptable risk and future land use has considered stakeholder involvement.*

A Class III permit modification will be requested to remove this site from the Hazardous and Solid Waste Amendments Module of the Laboratory's Resource Conservation and Recovery Act operating permit.

Radiological constituents, which are not regulated under RCRA, may be evaluated further by DOE for additional management activities.

5.2.11 Sampling and Analysis Plan for PRS 50-004(c)

On the basis of the conclusions and recommendations presented for this PRS, no further investigation requiring a sampling and analysis plan is necessary.

5.3 PRS 50-011(a)

This PRS consists of a decommissioned septic system, located south and east of TA-50-1 near the perimeter fence. It includes a tank (TA-50-10), a manhole (TA-50-9), a sanitary distribution box (TA-50-11), and a leach field with a 50-ft-deep infiltration shaft on the east side. The leach field and the main from the septic tank are buried about 4 ft below grade (Figure 1-2).

5.3.1 History

This PRS is the site of a (now removed) septic system that was installed about 1964 at the south end of Building 1. It consisted of an effluent line from Building 1 to manhole TA-50-9 and then to septic tank TA-50-10. From the septic tank, the effluent line ran east to a distribution box (TA-50-11) and then into the four parallel, perforated pipes of the leach field. As TA-50 operations expanded, the field was no longer adequate for all of the effluent, resulting in standing waste water on the ground surface. To remedy this situation, in 1978 a 4-ft-diameter hole was drilled 50 ft 9 in. deep at the east end of the leach field, a 4-in. perforated pipe was installed down the center of the hole, and the annulus was backfilled with 3/4-in. aggregate to within 4 ft of the surface. The outlets of the four parallel pipes were then tied into the 4-in. perforated pipe. Later, in 1983, the entire septic system was removed (except for the perforated pipe inside the 50-ft-deep hole). Currently, the leach field and a section of the effluent line between the septic tank and the field are the only portions of the old system that can be reached for core sampling.

This PRS is discussed in detail in Sections 2.2.1.4.10.1 and 5.1.2.7 of the RFI Work Plan for OU 1147 (LANL 1992, 0787).

5.3.2 Description

No further site-specific geology, soils, or wildlife habitat information is required.

5.3.3 Previous Investigations

Two previous investigations were conducted in the areas surrounding this PRS: during the decommissioning of the radioactive liquid waste line (Elder et al. 1986, 0456), excavated soils were characterized for radioactive constituents; and in 1993, an RFI investigation was conducted (for radioactive and hazardous waste constituents) on surface soils from unpaved areas at TA-50 (Environmental Restoration Project 1995, 1284).

5.3.4 Field Investigation

This PRS was sampled via four shallow vertical holes, approximately 10 ft deep. The locations for the coreholes were identified and surveyed using LANL-ER-SOP-3.01.R1 (in preparation at the time of this investigation). One of the four coreholes was FIMAD Site ID 50-3011, which had previously been drilled for sampling at PRS 50-004(c); because of its close proximity to the site of one of the projected coreholes for PRS 50-011(a), this corehole was used to provide data for both PRSs, avoiding duplication of effort. In addition, a projected 45° corehole to intersect the 50-ft shaft at the end of the leach field was not drilled; because sanitary waste water that flowed from the septic tank into the leach field flowed into the shaft as well, the conditions found in the subsurface of the leach field could be assumed to be representative of those in the shaft. In addition, this septic system was intended for sanitary wastes only, and there are no documented occurrences of hazardous material ever having entered the system. For these reasons, the additional corehole was deemed to be unnecessary.

A hollow-stem-auger drill rig and core barrel samplers were used to collect the samples, in accordance with LANL-ER-SOP-6.26.R0. Table 5-12 lists the coreholes, and Figure 5-3 shows their locations).

TABLE 5-12

PRS 50-011(a): SUMMARY OF SAMPLES TAKEN

				Sample Request Number				
Location ID	Sample ID	Depth (ft)	Sample Matrix	VOCs	SVOCs	PCBs	INORG	RAD
50-3042	AAC0285	6.5 - 7.5	tuff	**	**	**	20190	20195
50-3042F	AAC0296	8.0 - 9.0	fracture*	20015	20015	20015	20190	20195
50-3043	AAC0287	6.0 - 7.0	tuff	**	**	**	20190	20195
50-3043F	AAC0295	7.75 - 8.5	fracture*	20015	20015	20015	20190	20195
50-3044	AAC0289	7.25 - 8.75	tuff	20015	20015	20015	20190	20195
50-3011	AAC0276	7.0 - 8.0	fill	**	**	**	20190	20195
50-3011	AAC0277	8.0 - 9.0	tuff	**	**	**	20190	20195

* Clay-filled fracture
** Analysis not requested

The interface between the leach field fill material and the underlying bedrock tuff was determined by examining each collected core interval. Samples of the tuff material below the interface were collected (the fill material, which consists of clean soil brought in after removal of the perforated pipes, was not sampled). In the core material from coreholes 50-3042 and 50-3043, clay-filled fractures were noted in the tuff, and samples of the clay were also collected. Each core sample was field-screened for alpha and beta/gamma radiation and for organic vapors, using hand-held instruments: a Ludlum 139 alpha meter, an ESP-1 beta/gamma meter, and an hnu photoionization detector. The alpha and the beta/gamma radiation screening results were all near or below the LANL sitewide background values; the organic vapors were <1 ppm. In addition, each sample was screened for gross alpha and gross beta radiation at the TA-59 Counting Facility, by means of a gas proportional counter (LANL-ER-SOP-14.01.R0). All the results were within background limits. The collected samples were promptly submitted, in accordance with chain-of-custody procedures, to the SMO for shipment to analytical laboratories.

5.3.5 Background Comparisons

The results of the inorganic analyses for the soil samples taken at PRS 50-011(a) were compared with LANL background UTL concentrations. None of the inorganic analytes were found to be present at concentrations above the UTL values for LANL soil. No radionuclides were found at concentrations above the LANL UTL values.

5.3.6 Evaluation of Organic Constituents

Two organic analytes, acetone and 2-butanone, were found at concentrations above the EQL, as shown in Table 5-13. Four of the six detected values shown in Table 5-13 were above the EQL; therefore, these chemicals are carried forward to the screening assessment (see Section 5.3.7.1).

5.3.7 Human Health Assessment

5.3.7.1 Screening Assessment

The COPCs identified at this PRS (those having soil concentrations greater than background UTLs or for which no background data are available) were next compared with their SALs. The maximum detected concentration for each of these COPCs is shown in Table 5-14.

Greater than or equal to SAL. No chemicals were found at concentrations equal to or above their SALs.

TABLE 5-13

PRS 50-011(a): ORGANIC ANALYTES FOUND IN SOILS AT CONCENTRATIONS GREATER THAN THE EQL

Sample ID	Depth (ft)	Acetone (mg/kg)	Butanone [2-] (mg/kg)
SAL		2000	8700
EQL		0.01	0.01
AAC0289	7.3 - 8.8	0.059	<0.02
AAC0295	7.8 - 8.5	0.069	<0.02
AAC0296	8.0 - 9.0	0.088	0.027

Note: Values in shaded cells are those that exceed the EQL.

TABLE 5-14

PRS 50-011(a): MAXIMUM DETECTED CONCENTRATIONS OF COPCs

COPC	Location ID	Sample ID	Sample Value	Depth (ft)	Location Description	SAL
Acetone	50-3042	AAC0296	0.088 mg/kg	8.0-9.0	fracture	2000 mg/kg
2-Butanone	50-3042	AAC0296	0.027 mg/kg	8.0-9.0	fracture	8700 mg/kg

No SAL. No chemicals analyzed for fell into the "No SAL" category.

Below SAL. Two organic chemicals, acetone and 2-butanone, were detected in soils, but at concentrations considerably below their respective SALs.

Multiple Chemical Evaluation. To evaluate multiple chemical effects for this data set, COPCs detected below their respective SALs were considered according to whether they were radionuclides, carcinogens, or noncarcinogens. All the COPCs in this group were noncarcinogens. The maximum analyte concentrations of these COPCs were normalized to the SAL, and the normalized values were then summed, as described in Chapter 3, Section 3.4.1. The results of this multiple chemical evaluation are presented in Table 5-15.

The sum of the normalized values for noncarcinogens is much less than 1 (0.00004), indicating that potential adverse human health effects resulting from exposure are highly unlikely. Therefore, both chemicals are eliminated as COPCs.

5.3.7.2 Risk Assessment

On the basis of the results of the screening assessment, no risk assessment was required or performed for this PRS.

5.3.8 Ecological Assessment

Given the generally highly developed condition of the landscape around this PRS, there is essentially no potential for receptors to come in contact with COPCs. Therefore, there are no ecotoxicological risk concerns at this PRS.

5.3.9 Extent of Contamination

The objective of the Phase 1 sampling plan was to screen the site for the presence of any chemicals from previous operational releases. The plan was not designed to

TABLE 5-15

PRS 50-011(a): MULTIPLE CHEMICAL EVALUATION

Chemical	Sample Value (mg/kg)	SAL (mg/kg)	Normalized Value
Acetone	0.088	2,000	0.00004
2-Butanone	0.027	8,700	0.000003
Sum of Normalized Values			0.00004

define the extent of contamination, but rather to sample the areas of the site in which the highest concentrations of any potential contaminants, if present, would be expected to occur.

5.3.10 Conclusions and Recommendations

Because no human health COPCs were identified from the screening of this PRS, the recommendation is NFA. This recommendation is based on NFA criterion No. 4 (Los Alamos National Laboratory, Environmental Restoration Department, Project Consistency Team Policy number 015):

> *The PRS has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants of concern are either not present or are present in concentrations that would pose an acceptable risk under the projected future land use. The determination of acceptable risk and future land use has considered stakeholder involvement.*

A Class III permit modification will be requested to remove this site from the Hazardous and Solid Waste Amendments Module of the Laboratory's Resource Conservation and Recovery Act operating permit.

5.3.11 Sampling and Analysis Plan for PRS 50-011(a)

On the basis of the conclusions and recommendations presented for this PRS, no further investigation requiring a sampling and analysis plan is necessary.

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APPENDIX A ANALYTICAL DATA

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

APPENDIX B DATA QUALITY EVALUATION SUMMARY

The three tables below summarize quality data for the three PRSs covered by this report. Chapter 4 discusses quality assurance and quality control.

TABLE B-1

PRS 50-004(a)

Suite	Request Number	Comments
Inorganic	19506	The percent recovery for Cr in the blind QC sample was >10 and <75%; Cd percent recovery was 131%. Those results that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ).
Inorganic	19678	Hg was not analyzed within the 28-day holding time for soils. The percent Hg recovery was high (136%) in the blind QC sample. The reported Hg results were qualified as undetected estimated (UJ).
Inorganic	19720	The percent recoveries for Cr and As in the blind QC sample were >10 and <75%. Those results that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ).
Rad	19670	Because there were only two soil samples in this delivery group, no blind QC samples were submitted by the LANL SMO to the analytical laboratory. There were no other QC problems with this data set.
Rad	19671	Cs-137 percent recovery for the blind QC sample was out of control. A consistently high bias noted for the blind QC samples from more than one laboratory indicated that the CST-3 result for the blind QC sample is biased low. Therefore, the Cs-137 analyses were not qualified.
Rad	19671	The blind QC value for Am-241 was out of control. The AM-241 sample values were qualified as estimated (J).
Rad	19671	Laboratory duplicate values for tritium are not within three standard deviations. The reported results were qualified as estimated (J).
Rad	19722	The % moisture content for the blind QC sample was biased low and was reported as out of control. This low bias caused the calculated tritium values to be higher than true values. Since the calculated tritium results were below the SAL, this error had no effect.
Rad	19722	The blind QC sample had a low U-235 percent recovery. The amount spiked was below the EQL, so reported sample results were not qualified.

TABLE B-2

PRS 50-004(c)

Suite	Request Number	Comments
Inorganic	19677	The percent recoveries for Al, Cr, and V in the blind QC sample were >10 and <75%. Those results that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ).
Inorganic	19678	Hg was not analyzed within the 28-day holding time for soils. The percent recovery for Hg was 136%, which was below the DL and was qualified as undetected estimated (UJ). The percent recoveries for Al, Cr, and V in the blind QC sample were >10% and <75%. Those results that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ).
Inorganic	19679	The matrix spike QC sample for Ag, As, Pb, and Sb did not meet acceptance criteria. The results for Ag, As, and Sb were below the DL and were qualified as undetected estimated (UJ). The results for Pb were above the DL and were qualified as estimated (J). The percent recovery for Cr in the blind QC sample was >10% and <75%. Those Cr results that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ).
Inorganic	19774	Hg was not analyzed within the 28-day holding time for soils. The percent recoveries for Al, Fe, Cr, Hg, and V in the blind QC sample were >10% and <75%. The reported Al, Fe, Cr, Hg, and V results that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ).
Inorganic	19910	Hg was not analyzed within the 28-day holding time for soils. The percent recoveries for Cr, Hg, and Pb in the blind QC sample were >10% and <75%. The reported Cr, Hg, and Pb results that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ).
Inorganic	20190	Hg was not analyzed within the 28-day holding time for soils. The reported Hg results that were above the DL were qualified as estimated (J), and those that were below the DL were qualified as undetected estimated (UJ)
Rad	19657	Cs-137 percent recovery for the blind QC sample was out of control (117%). A consistently high bias noted for the blind QC samples from more than one laboratory indicated that the CST-3 result for the blind QC sample is biased low. Therefore, the Cs-137 analyses were not qualified.
Rad	19657	The % moisture content for the blind QC sample was biased low and was reported as out of control. This low bias caused the calculated tritium values to be higher than true values. Since the calculated tritium results were below the SAL, this error had no effect.
Rad	19658	Cs-137 percent recovery for the blind QC sample was out of control. A consistently high bias noted for the blind QC samples from more than one laboratory indicated that the CST-3 result for the blind QC sample is biased low. Therefore, the Cs-137 analyses were not qualified.
Rad	19658	The % moisture content for the blind QC sample was biased low and was reported as out of control. This low bias caused the calculated tritium values to be higher than true values. Since the calculated tritium results were below the SAL, this error had no effect.

TABLE B-2 (Continued)

PRS 50-004(c)

Suite	Request Number	Comments
Rad	19671	Cs-137 percent recovery for the blind QC sample was out of control. A consistently high bias noted for the blind QC samples from more than one laboratory indicated that the CST-3 result for the blind QC sample is biased low. Therefore, the Cs-137 analyses were not qualified.
Rad	19671	The blind QC value for Am-241 was out of control. The Am-241 sample values were qualified as estimated (J).
Rad	19671	Laboratory duplicate values for tritium are not within three standard deviations. The reported results were qualified as estimated (J).
Rad	19776	Cs-137 percent recovery for the blind QC sample was out of control. A consistently high bias noted for the blind QC samples from more than one laboratory indicated that the CST-3 result for the blind QC sample is biased low. Therefore, the Cs-137 analyses were not qualified.
Rad	19776	1 of 2 blind QC samples for tritium were out of control because of low percent recovery (80%). A consistent low bias (20%) from more than one laboratory indicated problems with the QC sample.
Rad	19915	Cs-137 percent recovery for the blind QC sample was out of control. A consistently high bias noted for the blind QC samples from more than one laboratory indicated that the CST-3 result for the blind QC sample is biased low. Therefore, the Cs-137 analyses were not qualified.
Rad	19915	The % moisture content for the blind QC sample was biased low and was reported as out of control. This low bias caused the calculated tritium values to be higher than true values. Since the calculated tritium results were below the SAL, this error had no effect.
Rad	20195	Cs-137 percent recovery for the blind QC sample was out of control. A consistently high bias noted for the blind QC samples from more than one laboratory indicated that the CST-3 result for the blind QC sample is biased low. Therefore, the Cs-137 analyses were not qualified.
Rad	20195	The blind QC sample for tritium was out of control because of low percent recovery (80%). A consistent low bias (20%) from more than one laboratory indicated problems with the QC sample.
Rad	20195	The % moisture content for the blind QC sample was biased low and was reported as out of control. This low bias caused the calculated tritium values to be higher than true values. Since the calculated tritium results were below the SAL, this error had no effect.

TABLE B-3

PRS 50-011(a)

Suite	Request Number	Comments
Rad	20195	Cs-137 percent recovery for the blind QC sample was out of control. A consistently high bias noted for the blind QC samples from more than one laboratory indicated that the CST-3 result for the blind QC sample is biased low. Therefore, the Cs-137 analyses were not qualified.
Rad	20195	The blind QC sample for tritium was out of control because of low percent recovery (80%). A consistent low bias (20%) from more than one laboratory indicated problems with the QC sample.
Rad	20195	The % moisture content for the blind QC sample was biased low and was reported as out of control. This low bias caused the calculated tritium values to be higher than true values. Since the calculated tritium results were below the SAL, this error had no effect.
VOC	19714	Acetone and 2-butanone were detected in the blind QC sample even though these were not components of the QC sample. The detection limits of these two compounds were raised to the level found in the blank and reported as undetected in sample AAB6106.
VOC	20015	The continuing calibration standard had a percent difference of 32% for 2-butanone. The 2-butanone result for sample AAC0296 was qualified as estimated.

APPENDIX C RISK ASSESSMENT CALCULATIONS

No risk assessments were performed for PRS 50-004(a), 50-004(c) or 50-011(a).