Environmental Restoration
University of California
Environmental Restoration Project, 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
Environmental Restoration Program
Los Alamos, New Mexico 87544
505-667-7203/FAX 505-665-4504

Date: June 14, 1996
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Mr. Benito Garcia
NMED-HRMB
P.O. Box 26110
Santa Fe, NM 87502

SUBJECT: SUBMITTAL OF THE RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION (RFI) REPORT FOR POTENTIAL RELEASE SITES (PRSs) IN TECHNICAL AREA (TA) 21

Dear Mr. Garcia:

Enclosed is a copy of the Los Alamos National Laboratory's RFI Report concerning PRSs 21-004(a-c) and 21-028(d, e) in TA-21. The report documents the field work performed as detailed in the approved RFI Work Plan for Operable Unit 1106 and the results of the sampling.

Please ask your office to contact Garry Allen at (505) 667-3394 or Bonnie Koch at (505) 665-7202, if you have any questions.

Sincerely,

Jansen, Program Manager
ER Project

Sincerely,

for Theodore J. Taylor, Program Manager
DOE/LAAO

el

sures: RFI Report for PRSs at TA-21
Certification

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Cy (w/ encs.):
G. Allen, CST-18, MS E525
D. Griswold, AL-ERD, MS A906
J. Harry, EES-5, MS M992
B. Hoditschek, NMED-HRMB/
R. Kern, NMED-HRMB
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RPF, MS M707

Cy (w/o encs.):
T. Baca, EM, MS J591
T. Glatzmaier, DDEES/ER, MS M992
D. McInroy, EM/ER, MS M992
G. Rael, AL-ERD, MS A906
L. Soholt, EM/ER, MS M992
W. Spurgeon, DOE-HQ, EM-453
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RFI Report for Potential Release Sites

21-004(a–c)
21-028(d,e)

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Field Unit 1

Environmental Restoration Project

June 1996

A Department of Energy
Environmental Cleanup Program

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EXECUTIVE SUMMARY

This report contains the results of the Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Technical Area-21 (TA-21), for potential release sites (PRSs) 21-004(a–c) and 21-028(d,e). Included are site-specific investigation activities, data assessment, and analytical results. Also included are conclusions and recommendations for the PRSs investigated. Although radiological constituents are not regulated under RCRA, this investigation and report include both hazardous (as defined by RCRA) and radiological constituents.

During World War II, the Laboratory was established to research, development, and test the first nuclear weapon. The Laboratory's Chemistry Division was created in 1943 and given the responsibility of purifying plutonium received from other production facilities. In 1945 these operations were transferred to the newly built facilities at TA-21.

Five PRSs within TA-21 were investigated in the fall of 1994. Three PRSs 21-004(a–c) are aboveground liquid waste storage tanks [PRSs 21-004(a–c)]. The other two PRSs are active container storage areas. PRS 21-028(d) a less than 90-day storage area and PRS 21-028(e) is a satellite container storage area.

PRS 21-004(a) consists of a single tank, TA-21-335. The tank was installed in 1974 and is an active, but unused, radioactive liquid waste holding tank. The tank is connected to floor drains in building TA-21-21 where refined plutonium and uranium metal were stored. PRSs 21-004(b,c) are two active tanks, TA-21-346, used as overflow holding tanks for liquid waste from cooling towers and laboratory and radionuclide experimental operations. Both tanks were moved to their present location from TA-53 in 1979. Waste potentially reaching PRSs 21-004(b–c) is liquid industrial waste that generally consists of diluted laboratory wastes and liquids from chilled water systems originating at DP East.

PRSs 21-028(d,e) are the two active storage areas investigated in this RFI. PRS 21-028(d) is a less than 90-day storage site located on a concrete loading dock on the northwest side of Building TA-21-209. Building TA-21-209 is currently used for high-temperature chemistry and research involving tritium. The starting date for the use of this area is assumed to be 1965. Waste materials that had been stored on the loading dock include lithium-deuterium waste, waste containing natural uranium, natural thorium, and uranium and thorium isotopes, and gas cylinders of tritium-contaminated hydrogen and argon gas. Containers not specifically labeled as waste but stored in the same area include cylinders of deuterium, argon, nitrogen, helium, and compressed hydrogen, drums of oil, acetone, convoil 20, ethanol, ethyl alcohol, and various solvents stored in a chemical safety cabinet.

PRS 21-028(e) is a satellite container area, or storage area loading dock on the north side of building TA-21-210. The starting date for the use of the north dock as a satellite container storage area is also assumed to be 1965. Currently the building is being used for geological core analysis and, in the past was listed as office space for plutonium research. Reported materials stored on the north dock include alcohol, acetone, freon, acetone-contaminated wipes, and vacuum pump oil. There is no information suggesting that contaminants have been released from the container storage areas to the environment.

Based on historical information, the following chemicals of potential concern (COPCs) were suspected: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), target analyte list (TAL) metals, and the radiological constituents used within TA-21. The objective of the RFI was to confirm the presence or absence of COPCs at PRSs 21-004(a–c) and PRSs 21-028(d,e). Radiological surveys and field screening were performed. Samples were collected and analyzed. The information was then used to determine, by background comparisons and screening assessment processes, if COPCs were present at concentrations that required further action or no further action (NFA).

Field activities and subsequent analytical results at PRSs 21-004(a–c) and PRSs 21-028(d,e) determined by the human health screening assessment that no COPCs should be retained. Therefore, PRSs 21-004(a–c) and 21-028(d,e) are recommended for NFA based on LANL's NFA Criteria Policy, criterion 4 which states that the PRS has been characterized in accordance with current applicable state or federal regulations, and that COPCs are not present in concentrations that would pose an unacceptable risk under the present and projected future land use). Table ES-1 summarizes actions proposed for PRSs 21-004(a–c) and PRSs 21-028(d,e) and the rationales on which the proposed actions are based.

TABLE ES-1

SUMMARY OF PROPOSED ACTIONS

		PROPOSED ACTION			
PRS[a]	HSWA[b]	NFA CRITERIA[c]	FURTHER ACTION	RATIONALE	SECTION #
21-004(a)		4	None	Contamination below SALs	5.1.4.3
21-004(b)	X	4	None	Contamination below SALs	5.1.6
21-004(c)	X	4	None	Contamination below SALs	5.1.6
21-028(d)		4	None	Contamination below SALs	5.2.7.1
21-028(e)		4	None	Contamination below SALs	5.3.7.1

[a] PRS = Potential release site.
[b] HSWA = Hazardous and Solid Waste Admendment. This column indicates whether or not the site is listed on the HSWA module (Module VII) of the Laboratory's RCRA operating permit.
[c] Project Consistency Team Policy Number 015, "No Further Action Criteria" Policy.

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1.0 INTRODUCTION

This report presents results of the Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Technical Area-21 (TA-21) for potential release sites (PRSs) 21-004(a–c)and 21-028(d,e). Included are site-specific investigation activities, data assessment, and analytical results. Also included are conclusions and recommendations for the PRSs investigated. Although radiological constituents are not regulated under RCRA, this investigation and report include both hazardous (as defined by RCRA) and radiological constituents.

1.1 General Site History

During World War II, the Laboratory was established in Los Alamos, New Mexico, to research, develop, and test the first nuclear weapon (Fig. 1.1-1). The Laboratory's Chemistry Division was created in 1943 and given responsibility for purifying plutonium received from other production facilities. In 1945 these operations were transferred to the newly built facilities at TA-21 (Fig.1.1-2).

TA-21 is located on DP Mesa and adjacent canyon slope, on the northern boundary of Los Alamos National Laboratory (LANL) and immediately east-southeast of the Los Alamos townsite (Fig. 1.1-3). TA-21 covers approximately 311 acres and consists of 112 PRSs, including PRSs 21-004(a–c) and PRSs 21-028(d,e) addressed in this RFI report.

Two active container storage areas were investigated in the fall of 1994, a RCRA les than 90-day storage area, PRS 21-028(d) and a satellite container storage area, PRS 21-028(e). Three aboveground liquid waste storage tanks, PRSs 21-004(a–c), were also investigated at that time.

1.2 RFI Overview

The objective of the RFI was to confirm the presence or absence of chemicals of potential concern (COPCs) at PRSs 21-004(a–c) and PRSs 21-028(d,e) (LANL 1991, 0689). Samples were collected and analyzed. Results of analyses were then used to determine if COPCs were present at concentrations that required further action or no further action (NFA). Based on materials that were thought to have been received by the aboveground storage tanks or stored at the storage areas, the following COPCs were suspected: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), target analyte list (TAL) metals, and radiological constituents used within TA-21. Primary radionuclides considered as potential contaminants at TA-21 included americium-241, plutonium isotopes, thorium isotopes, uranium isotopes, and tritium.

The conceptual exposure models for the storage areas at TA-21 are presented in Subsection 2.3.1 of the RFI Work Plan for TA-21 (LANL 1991, 0689).

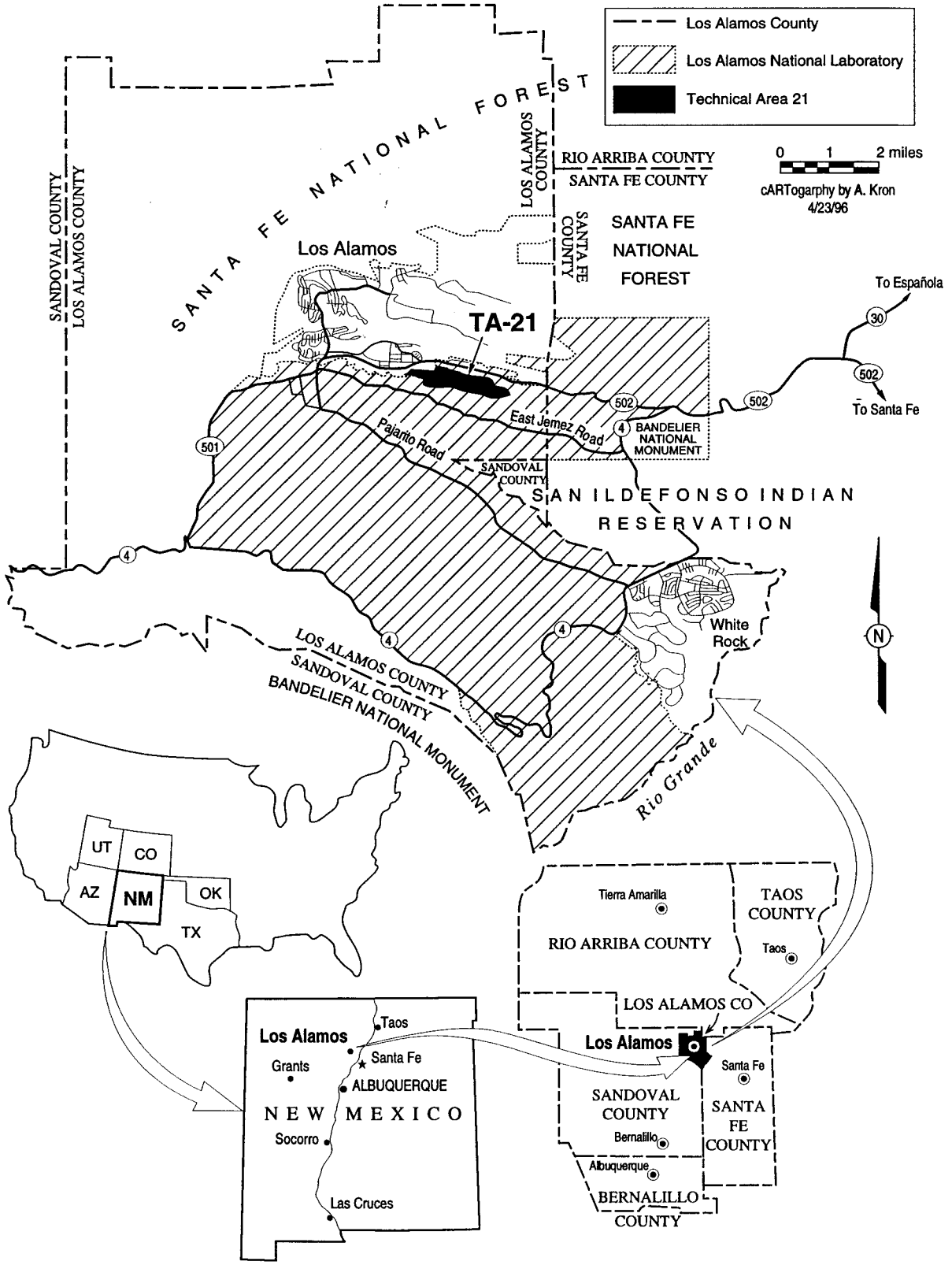

Fig. 1.1-1. Location map of TA-21 within Los Alamos National Laboratory, Los Alamos County, New Mexico

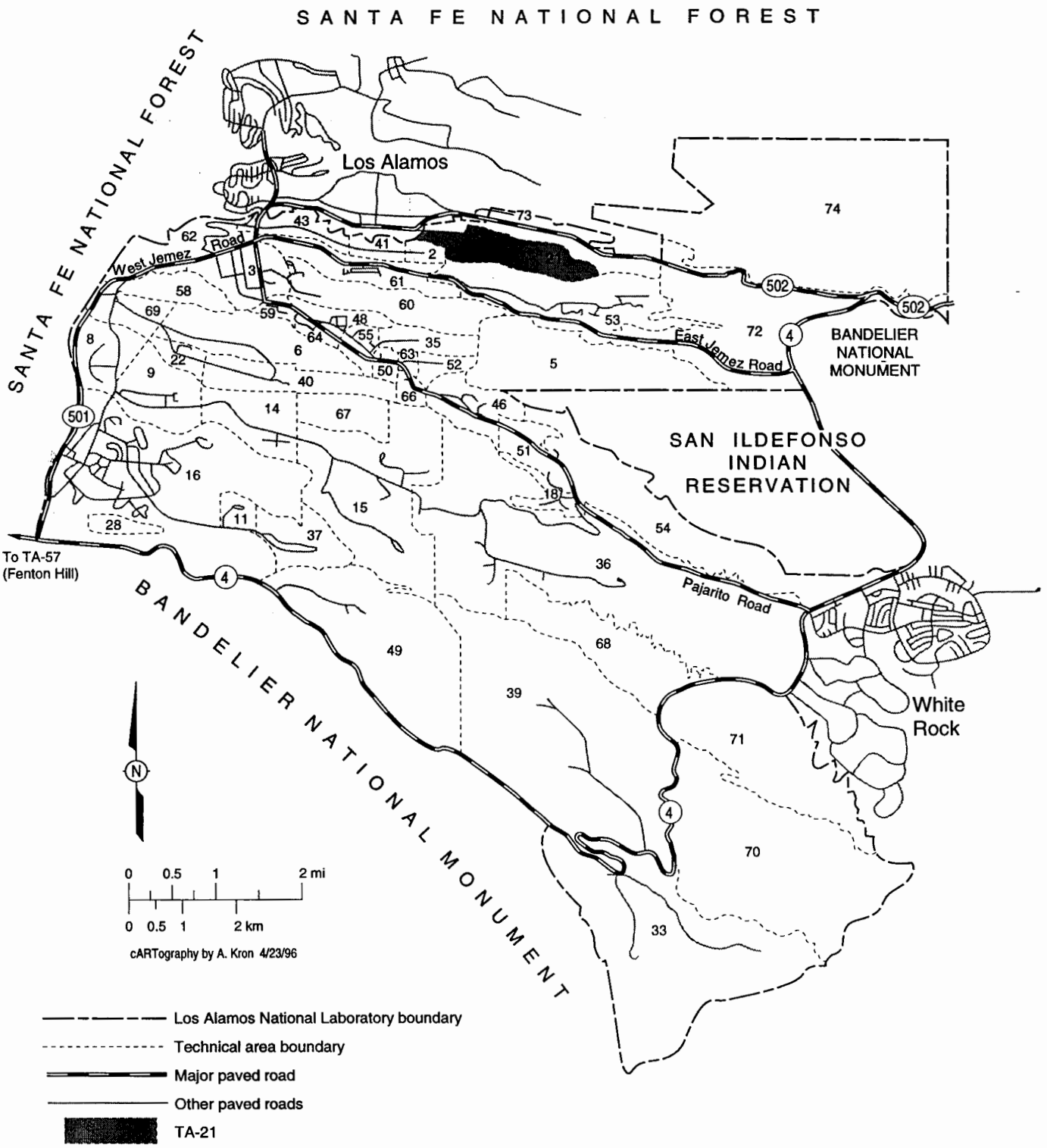

Fig. 1.1-2. Location of TA-21 with respect to Laboratory technical areas and surrounding landholdings.

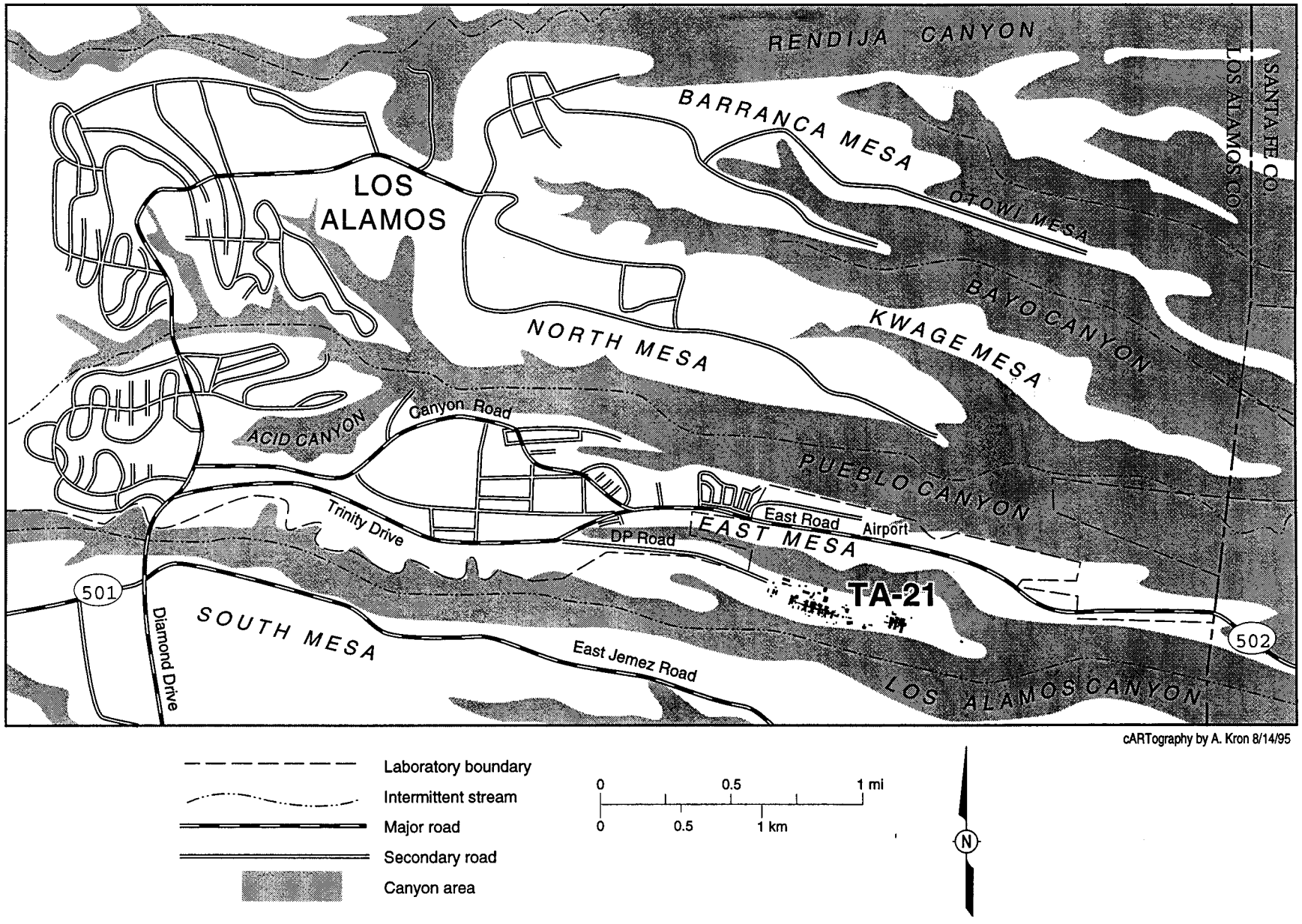

Fig. 1.1-3. General location of TA-21.

1.3 Field Activities

Initial site investigation activities were conducted during September and October 1994. Field activities included radiological survey, sample screening, borehole drilling, and tank and soil sampling. These activities were conducted using the procedures described in LANL-ER-SOP-01.01, R0, General Instructions for Field Investigations. Activities were documented using the procedures outlined in LANL-ER-SOP-03.12, R0, Field and Laboratory Notebook Documentation of Environmental Restoration Earth Science Studies (LANL 1993, 0875).

1.3.1 Radiological Surveys

On September 22 and September 30, 1994, gamma and alpha radiation surveys were conducted at PRSs 21-004(a–c) and 21-028(d,e). To detect gamma radiation, a field instrument for the detection of low energy radiation (FIDLER) G-5 sodium-iodide (NaI) scintillation detector, Ludlum 44-10™ NaI scintillation detector, and a Ludlum 19™ NaI scintillation survey meter were used. To detect alpha radiation, a Ludlum 43-1™ zinc sulfide (ZnS) scintillation detector was used. Surveys were conducted following LANL-ER-SOP-10.04, R1, FIDLER Instrument System and LANL-ER-SOP-06.23, R0, Measurement of Gamma-Ray Fields Using a Sodium Iodide Detector (LANL 1993, 0875). Results of the PRS-specific radiological surveys are presented in Subsections 5.1.4.2, 5.2.4.2, and 5.3.4.2 of this RFI report.

1.3.2 Field Screening

Borehole samples were screened for organic vapors; surface soil samples were not. All samples were screened twice for radioactivity, once in the field to meet worker health and safety requirements and again by the mobile radiological analytical laboratory (MRAL) to meet the requirements of analytical laboratories. Results of soil screening for radiation are presented in Sections 5.1.4.3, 5.2.4.3, and 5.3.4.3 of this RFI report.

1.3.3 Soil Sampling

Samples were collected using LANL-ER-SOP-06.09, R0, Spade and Scoop Method for Collection of Soil Samples. Samples were handled using LANL-ER-SOP-01.02, R0, Sample Containers and Preservation and LANL-ER-SOP-01.03, R1, Handling, Packaging, and Shipping of Samples. Samples were tracked using LANL-ER-SOP-01.04, R2, Sample Control and Field Documentation and sample collection logs (LANL 1993, 0875). Chain-of-custody forms were completed for each sample.

Sampling locations were entered into the Facility for Information Management, Analysis, and Display (FIMAD) system. In addition to soil samples collected for COPC analyses, samples were collected for quality assurance/quality control (QA/QC) purposes, following LANL-ER-SOP-01.05, R0, Field Quality Control Samples (LANL 1993, 0875). Soil sample results are presented in Subsections 5.1.4.4, 5.2.4.4, and 5.3.4.4 of this RFI report.

2.0 ENVIRONMENTAL SETTING

The environmental setting for the Laboratory is described in Section 2.4 of the Installation Work Plan (IWP) for Environmental Restoration (LANL 1995, 1164). A detailed discussion of the environmental setting for TA-21, including climate, geology, hydrology, and a conceptual hydrogeologic model for the area and its surroundings, is in the RFI Work Plan for TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689). A summary is presented in the following sections.

2.1 Climate

Los Alamos County has a semiarid, temperate, mountain climate. Summers are generally sunny with moderate, warm days and cool nights. High altitude, light winds, clear skies, and dry atmosphere allow summer temperatures to range from 50°F to 90°F. During the winter, temperatures typically range from 15°F to 50°F. Normal annual precipitation in Los Alamos, including rainfall and water-equivalent snowfall, is 18 in. Of this total, approximately 40% occurs as brief, intense thunderstorms during July and August. Streamflow in canyons can occur as a result of these storms. Spring snowmelt runoff may also induce streamflow in the canyons. Winter snowfall averages 51 in. annually (ESG 1989, 0308). Wind speeds are less than 5.5 mph about 40% of the time and greater than 11 mph about 20% of the time. Strong winds occur mainly in the spring. The predominant wind direction is from the south-southwest.

2.2 Geology

2.2.1 Geologic Setting

A detailed discussion of the geology of the Los Alamos area can be found in Section 2.5.1.3 of the IWP (LANL 1995, 1164). Reports of geological studies at TA-21 from Broxton and Eller (1995, 1162) are summarized below, emphasizing conditions relevant to PRSs 21-004(a–c) and 21-028(d,e).

TA-21 is located on DP Mesa at an elevation of approximately 7 130 ft. The area is bounded on the north by DP Canyon and on the south by Los Alamos Canyon. PRSs 21-004(a–c) and 21-028(d,e) are mesa-top sites. Bedrock underlying the site is cooling unit 3 of the Upper (Tshirege) Member of Bandelier Tuff (Fig. 2.2.1-1), comprised of volcanic ash fallout and ash flow deposits of silicic volcanic rock erupted 1.5–1.2 million years ago. Cooling unit 3 is a cliff-forming, nonwelded to partially welded unit. Bandelier Tuff is approximately 710-ft thick at TA-21.

Bandelier Tuff is overlain by 0-20 ft of alluvium, which consists of poorly sorted, clay-rich sand and gravel. Alluvium is generally thickest near the center of the mesa and thin to absent at mesa edges. Much of the alluvium consists of angular to subrounded lithic clasts of Tshicoma volcanic rocks, feldspar, quartz, and biotite crystals, and other ferromagnesian minerals derived from the Tshicoma Formation. In addition, the alluvium contains clasts of pumice and tuff probably derived from units of Bandelier Tuff, Cerro Toledo Tuffs, and possibly from the El Cajete Tuff.

Bandelier Tuff is underlain by sedimentary rocks of the Puyé Formation, which consists of fine-to-coarse-grained fanglomerates interbedded locally with axial river gravels and lacustrine siltstone and clay. Material comprising the fanglomerates is derived mainly from the Tschicoma Formation to the west.

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). Material specific to TA-21 is summarized below.

At undisturbed areas at TA-21, the soil is composed of moderately to well developed soils on Bandelier Tuff and on alluvium. Soils belong to either the Hackroy or Nyjack soil series (Nyhan et al. 1978, 0161). The Hackroy series consists of very shallow to shallow, well-drained soils that have an A-Bt-R profile. Soil textures range from sandy loam to clay. The Nyjack series consists of moderately deep, well-drained soils that have an A-Bt-C-R profile. Texture ranges from gravelly sandy loam to clay loam. In the TA-21 area, the R horizon is highly fractured Bandelier Tuff that shows signs of incipient weathering and usually has clay-rich soil matrix along bedrock fractures.

Most of TA-21 has been disturbed by construction and operation of facilities located within TA-21 for the last 40 years. As a result, the natural soil profiles are not well preserved. In some cases, soil has been removed or buried by fill during construction of pads for buildings and parking lots.

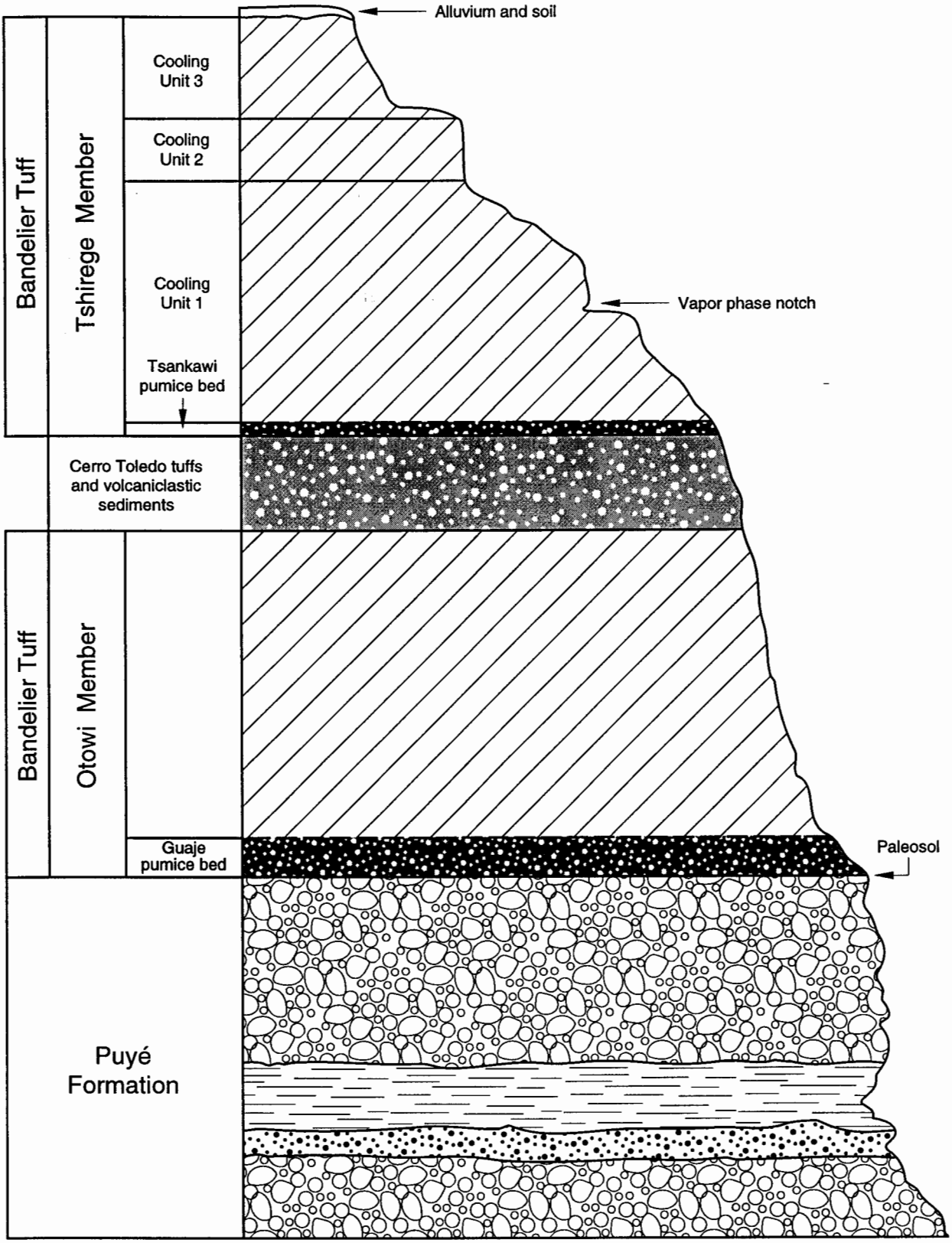

Fig. 2.2.1-1. Stratigraphy of TA-21.

2.3 Hydrology

2.3.1 Surface water

Surface flow at PRSs 21-004 (a–c) and PRSs 21-028 (d,e) occurs as sheetflow during precipitation events, mainly summer thunderstorms. Sheetflow may transport sediments from the mesa surface to adjacent canyons.

2.3.2 Groundwater

The main aquifer beneath TA-21 is at an elevation of approximately 5 900 ft (determined in Test Well 2, Pueblo Canyon, and in Otowi 4, Los Alamos Canyon), chiefly within sediments of the Puyé and Tesuque Formations (Purtymun 1995, 1293; Broxton and Reneau 1995, 1320). Therefore, for mesa-top sites at TA-21, more than 1 200 ft of tuff and volcaniclastic sediments separate the surface from the main aquifer. In addition to the main aquifer, two perched aquifers exist at TA-21. Shallow alluvial aquifers are present in sediments of both Los Alamos Canyon and in DP Canyon, a side canyon that merges with Los Alamos Canyon east of TA-21. These alluvial aquifers were intercepted by drill holes LADP 3, LAUZ-1, and LAUZ-2). A second perched aquifer, encountered in drill hole LADP-3, is present in the Guaje pumice bed at the base of the Bandelier tuff, approximately 325 ft below the floor of Los Alamos Canyon (Broxton and Eller 1995, 1162). Unpublished information from drill cores in Bayo Canyon show that the top of the Puyé Formation is a weakly to moderately developed paleosol (old soil profile) containing a significant amount of clay. The clay content of the paleosol apparently reduces the permeability enough so that water, if available, will perch on top of the Puyé Formation, within the overlying Guaje pumice bed (Fig. 2.2.1-1). That is, the paleosol at the top of the Puyé acts as an aquitard. From borehole LADP-4, the aquifer at the base of the Bandelier Tuff is known to be absent in DP Canyon (approximately 437 yds north of LADP-3), and therefore probably does not underlie TA-21. The perched aquifer continues up Los Alamos Canyon at least 1.6 miles, based on well LAOI(A)-1.1, but the lateral continuity of the aquifer in other directions beyond TA-21 is not known at present.

A perennial spring (DP Spring), located on the north side of lower DP Canyon 1.6 miles east-northeast of LADP-4 (Broxton and Eller 1995, 1162), discharges at a rate 1–4 gal./min (Purtymun 1995, 1293). Possibly the source of water that emerges at DP Spring is from alluvial groundwater in DP Canyon, or, alternatively, from a water body perched within Bandelier Tuff (between units 1g and 1v) beneath DP Mesa (Broxton and Eller 1995, 1162). However, no perched zone with the Bandelier Tuff was encountered in LADP-4 or LAUZ 1 (to a depth of 255 ft) to support the latter possibility. Study of DP Spring is ongoing.

2.4 Biological Surveys

Comprehensive plant and animal inventories are required by the Federal Endangered Species Act of 1973, the New Mexico Wildlife Conservation Act, Executive Order 11990, Protection of Wetlands, Executive Order 11988, Floodplain Management, 10 CFR 1022, Compliance With Floodplain/Wetlands Environmental Review Requirements, and DOE order 5400.1, General Environmental Protection Program (DOE 1979, 0633;DOE 1988, 0075).

TA-21 is a mesa-top site in a developed, industrialized area. The preurban natural overstory for the mesa was a ponderosa pine community. The understory currently present is comprised of grasses and forbs commonly found in disturbed soils: western wheat grass, Canada bluegrass, bottlebrush squirreltail, cheat grass, sand dropseed, summer cypress, prickly lettuce, and horseweed. The mesa proper provides limited habitat for biota, does not contain sensitive habitat, and threatened or endangered species are not present on the mesa top. Although survey data indicate that potential habitat exists for several protected species, including the Jemez Mountain salamander, the spotted bat, the meadow jumping mouse, the peregrine falcon, and the goshawk, the presence of these species could not be confirmed during the biological assessment. The Cooper's hawk is known to use the area (Bennett 1992, 01-0034).

2.5 Cultural Surveys

As required by the National Historic Preservation Act of 1966 (as amended), a cultural resource survey was conducted at Operable Unit (OU) 1106 during the summer of 1991 (McGehee et al. in preparation, 0611). The methods and techniques used for this survey conform to those specified in the Secretary of the Interior's standards and guidelines for archeology and historic preservation.

There are no archeological sites eligible for inclusion in the National Register of Historic Places under Criterion D located in the area of PRSs 21-004(a–c) and PRSs 21-028(d,e).

3.0 APPROACH TO DATA ASSESSMENT AND ANALYSIS

The data assessment approach used for PRSs 21-004(a–c) and PRSs 21-028(d,e) involves a series of quantitative steps that occur after the field investigation, chemical analysis, and data reporting are complete. These steps begin with routine data validation and continue with more focused data validation, if necessary. Routine validation involves validating each data item against specific targets and adding qualifier flags to the data to signify a potential deficiency. Focused validation consists of analyzing QA/QC data for their potential impact on the succeeding data assessment steps, i.e., 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 risk assessments when necessary. The following sections provide overviews of the methods used to complete these quantitative steps. Further details can be found in Technical Approach to RFI Reports (LANL in preparation, 1281).

3.1 Sample Analyses

All samples requiring chemical and radiological analyses and chain-of-custody documentation are submitted to the sample management office (SMO), the mobile chemistry analytical laboratory (MCAL), and/or the MRAL for analysis.

3.1.1 Analytical Methods

All samples were analyzed using Environmental Protection Agency (EPA) SW-846 methods or their equivalents.

3.1.2 Data 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 determine data sufficiency for decision-making.

Data verification is a check of data deliverables against a set of stated requirements to ensure that what has been ordered has been delivered. All analytical data generated in support of the Environmental Restoration (ER) Project are verified.

Data validation is the process of determining whether an individual result (a datum) can be reliably used to support the decision-making process. During the 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 analytical precision or bias constraints.

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

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

3.2 Background Comparisons

3.2.1 Inorganic Chemicals

Once the data validation process is complete and the site data are finalized, the next step in the process is to compare site data with available background data. The results of a focused data validation should exclude from consideration for background comparison any contaminant that is identified as an artifact of laboratory or field contamination, analytical interference, or improper analyte identification or quantitation. The purpose of this decision step is to determine if chemicals that have natural or anthropogenic background distributions should be retained as COPCs or eliminated from further consideration. Background data are available from soil samples collected throughout Los Alamos County for which chemical analyses were performed for certain inorganic chemicals (metals) (Longmire et al. 1995, 1142; 1266).

Comparisons between site data and background data are initially performed by comparing each observed concentration datum with a chemical-specific background screening value. Background screening values are upper tolerance limits (UTLs) or maximums estimated from background data. Statistical methods used to generate UTLs or maximums and suggestions for statistical methods to compare site and background concentration distributions are detailed in the guidance document, Statistical Comparisons to Background, Part I (Ryti et al. 1996, 1298). Further statistical comparisons between site and background data will be performed when UTLs are exceeded.

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

The ER Project has developed background screening values for the most commonly sampled chemicals and the most commonly analyzed media. Because disturbed fill media were sampled in this RFI, LANL-wide soil data, specifically, the LANL all-soil-horizon background screening values are appropriate background data for inorganic chemicals. Background screening values for inorganic chemicals include UTLs and maximum detected values. The data and methods used to calculate these background screening values is in Longmire et al.(1995, 1142; 1266). For chemicals and media not included in the LANL background data (or in FIMAD), UTLs will be developed by the ER Project's Decision Support Council as needed.

3.2.2 Radionuclides

Radionuclides that are considered detected are compared with an appropriate set of background data. Background data for these PRSs are defined by the TA-21 baseline data. The TA-21 baseline data reflects generally elevated activities of certain radionuclides, including americium-241, plutonium-238, plutonium-239, and uranium isotopes. The activity of other radionuclides are not distinguishable from LANL-wide background data. Table 3.2.2-1 summarizes the TA-21 radionuclide background screening values. The statistical basis for these values is presented in the Technical Position Paper on Use of TA-21 Baseline Data for RFI Reports (Ryti 1996, 01-0023).

Analyses of radionuclides by gamma spectroscopy often leads to reporting concentrations for certain radionuclides that are inappropriate to evaluate as potential site contaminants, or COPCs. These include short-lived activation/fission products, naturally occurring background radionuclides, and daughter radionuclides of naturally occurring radionuclides. These three classes of radionuclides are not considered site contaminants for the following reasons.

Short-lived activation/fission products commonly reported (e.g., barium-140, cerium-144, cesium-134, cobalt-57, manganese-54, ruthenium-106, and sodium-22) have half-lives ranging from a few days to 2.6 years. Several of these radionuclides are used as internal standards to measure such things as equipment performance or laboratory background (or contamination). Because activation/fission products with short half-lives are routinely reported for reasons not related to RFI investigations, they are not expected to be normally occurring at TA-21 sites. Because there is no documentation of releases from these sites in the three years preceding the 1994 sampling campaign, any radionuclide detected with a short half-life would not be attributed to these sites. Therefore, short-lived activation/fission products are eliminated as COPCs.

TABLE 3.2.2-1

SUMMARY OF TA-21 RADIONUCLIDE SCREENING VALUES

RADIONUCLIDE	BASELINE SCREENING VALUE (pCi/g[a])
Americium-241	0.818
Cesium-137	1.4[b]
Plutonium-238	0.447
Plutonium-239	15.5
Strontium-90	0.766
Thorium-228	1.98
Thorium-230	1.60
Thorium-232	1.86
Tritium[c]	9.92
Uranium[d]	10.7
Uranium-234	3.80
Uranium-235	0.164
Uranium-238	3.57

[a] Unless otherwise noted.
[b] The LANL-wide background screening value for cesium-137 will be used for TA-21 PRS comparisons.
[c] Units = pCi/ml.
[d] Natural uranium. Units = mg/kg.

Potassium-40 is a naturally occurring radionuclide that is found in every soil sample (as long as it contains potassium); and it is often used to measure laboratory background. There is no process knowledge of the use of potassium-40 at TA-21, and reported concentrations are generally within known background ranges for potassium-40 (Longmire et al. 1995, 1142; 1266; ER Project Assessments Council 1995, 1295). Potassium-40 will not be considered a potential radionuclide contaminant because site-specific process knowledge indicates no use of potassium-40.

Daughters of naturally occurring radionuclides (uranium and thorium) are also reported by gamma-spectroscopy analyses. These daughters (e.g., isotopes of actinium, bismuth, francium, lead, polonium, protactinium, radium, radon, thallium, thorium, and uranium) are normally present in secular equilibrium concentrations (and therefore, have equal activity concentrations) with the first member of the decay chain and are not directly evaluated as potential radionuclide contaminants. QA/QC activities will review daughter radionuclides for consistency with parent activities, and any that cannot be attributed to background concentrations of the parent will be retained as potential contaminants.

Estimated quantitation limits (EQLs) and minimum detectable activity (MDAs) are often not available for radionuclides by gamma spectroscopy. A value of three times the analytical uncertainty measurement (3 sigma or three standard deviations) is used to calculate a sample-specific MDA, which is then employed in the same manner as a detection limit. This methodology is similar to Currie's method of determining radionuclide MDA (Currie 1988, 0792). This 3 sigma screening value takes into account variability due to counting statistics, but does not account for spectral peak identification problems. This 3 sigma screening value is conservative, and may include radionuclides whose presence is spuriously reported due to spectral interferences or misidentifications. Any radionuclides below MDA are eliminated as COPCs.

3.3 Evaluation of Organic Constituents

Background screening values are not available for organic chemicals. The preliminary evaluation of organic chemicals considers detected chemicals and chemicals that were analyzed for but not detected in any sample. The purpose of this decision step is to determine if organic chemicals should be retained as COPCs or eliminated from further consideration based on detection status. Detection status is determined by the analytical laboratory on a sample-by-sample, analyte-by-analyte basis. EQLs have been established for each analyte as reporting limits when the analyte is not detected. It should be noted that the EQLs reported for individual samples are dependent on a number of factors and may vary from sample to sample and from analysis to analysis. Therefore, the sample-specific EQL for a chemical must be used in this comparison.

If a chemical has a reported concentration that exceeds its reporting limits, then that chemical is generally carried forward through the screening assessment process. If a chemical does not have a reported concentration that exceeds its reporting limits, then that chemical is generally removed from further consideration. Exceptions to these general rules may be made if site-specific process knowledge so indicates. A chemical that is detected may be removed from further consideration if it can be determined that its presence is not due to LANL operations. A chemical that is not detected in any sample may be carried through the decision process if the chemical can be expected to be present at the site based on historical operations.

3.4 Human Health Assessment

3.4.1 Screening Assessment

The purpose of this decision step is to determine if chemicals should be retained as COPCs or eliminated from further consideration based on comparisons with SALs. This is the last step in the screening assessment process for human health concerns. If COPCs remain after this step, then further action may be proposed. If no COPCs remain after this step, then NFA may be proposed based on human health concerns. SALs are medium-specific concentrations that are calculated using chemical-specific toxicity information and conservative, default exposure assumptions. For those chemicals with available SALs, each observed concentration datum is compared with the chemical's SAL. If a chemical has a reported concentration greater than its SAL, then that chemical is retained as a COPC pending further analysis. If a chemical does not have a reported concentration greater than its SAL, then that chemical is generally removed from further consideration. If more than one chemical is present at the site, this decision is deferred pending the results of the multiple chemical evaluation (MCE) described below. The decision to identify a chemical as a COPC when a SAL is not available is made on a case-by-case basis, taking into account the availability of process knowledge and toxicological information.

It is possible that COPCs should be retained because of the combined adverse health effects of several chemicals. This possibility is evaluated in an MCE, in which 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 (i.e., the total normalized value) is less than one, then the chemicals are removed from further consideration. If the total normalized value is greater than one, then chemicals having an individual normalized value greater than or equal to 0.1 are retained as COPCs pending further evaluation.

Only those chemicals that exceed background concentration thresholds (certain inorganics and radionuclides), fail other background comparison tests, or exceed reporting limits (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 Technical Approach to RFI Reports (LANL in preparation, 1281).

3.4.2 Risk Assessment

The human health risk assessment presented in Subsections 5.1.7, 5.2.7, and 5.3.7 follows the guidance document Risk-Based Corrective Action Process (LANL/SNL 1996, 1277). The human health risk assessment process consists of the following four steps:

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

If no COPCs are carried forward through the screening assessment process, then a risk assessment is not performed.

3.5 Ecological Assessment

In accordance with conversations between LANL ER Project personnel, New Mexico Environmental Division (NMED), and EPA Region 6 Officials, discussion of ecological risk assessment methodology will be deferred until the ecological exposure unit (ecozone) has been approved by regulators. The ecozone methodology is being developed by LANL in conjunction with the EPA and the NMED.

4.0 RESULTS OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

Soil samples for PRSs 21-004(b,c) and 21-028(d,e), along with chain-of-custody documentation, were submitted to the SMO, and/or to the MRAL.

Selected samples were analyzed for TAL metals. The TAL metals include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc. All metals except mercury were analyzed using inductively coupled plasma emission spectroscopy (ICPES), EPA SW-846 method 6010. Mercury was analyzed using cold vaporization atomic absorption (CVAA), EPA SW-846 method 7471.

VOC analyses were conducted using purge and trap-gas chromatography/mass spectrometry (P&T-GC/MS), EPA SW-846 method 8260. SVOC analyses were conducted using GC/MS, EPA SW-846 method 8270 (Solvent Extraction/Direct Injection).

Radiological analyses were conducted in fixed-base laboratories using alpha spectroscopy for isotopic plutonium, and americium-241, kinetic phosphorescence analysis (KPA) for total uranium, gamma spectroscopy and gamma scan for americium-241 and other gamma isotopes, gas proportional counting (GPC) for strontium-90, liquid scintillation counting for tritium, and gravimetric procedures for percent moisture.

Data validation was performed on all data from the analytical laboratories. Validation was performed using the guidelines from the ER Project's Generic Quality Assurance Project Plan for RCRA Facility Investigations, Appendix T of the IWP (LANL 1991, 0553). Reviews of the validation and the QA/QC activities for each PRS are included in the following sections. A summary table of all the QA/QC results for each sample can be found in Appendix B of this document.

As a result of QA/QC activities, qualifiers are added to the data when necessary as part of routine data validation activities. The following is a list of the qualifiers used in this RFI report and their definitions.

- J = Estimated quantity. The analyte was detected in the sample, but there were one or more QC parameters associated with this sample that were outside allowed limits.
- U = Undetected quantity. The analyte was not detected in the sample above the EQL and/or MDA.

- UJ = Undetected estimated quantity. Analyte was not detected, but there were one or more QC parameters associated with this sample that were outside allowed limits.

- R = Rejected quantity.

4.1 Inorganic Analyses

4.1.1 PRSs 21-004(a–c)

As specified in the work plan, no samples required off-site laboratory analyses for PRS 21-004(a). The only samples collected were for radionuclide analyses, and they were swipe samples. For further information about sample collection at this PRS, see section 5.1 of this RFI report.

Inorganic analyses QA/QC discussions for each PRS are presented in the following sections. One inorganic QA/QC consideration common to all PRSs [except PRS 21-004(a)] in this RFI, is that holding times for mercury had been exceeded. Because all of the samples were soil samples, the following must be considered when qualifying the mercury data.

- The specified holding times were developed using unpreserved water samples. The holding times were then applied to soil samples as recommended values without any technical reasoning for that application. All of the samples in this request were soil samples,

- Soil samples are less likely than water samples to undergo the biotransformation from elemental mercury to organomercury compounds (the volatile compounds responsible for the 28-day holding time for mercury). If reactions occurred in soil at all, the reaction would be much slower than a water reaction.

- Because most of the samples were collected near the surface, any reactions the mercury might undergo would already have occurred. By placing the material in a sampling container away from air, moisture, and temperature changes, the likelihood of a reaction occurring is actually minimized (Finnegan 1996, 17-853).

4.1.1.1 PRS 21-004(a)

No fixed laboratory inorganic analytical samples were collected for PRS 21-004(a); therefore, no QA/QC review is required.

4.1.1.2 PRSs 21-004(b,c)

Soil samples were analyzed for TAL metals in request number 20239. There were several QC problems with this request. The first was that vanadium, sodium, and potassium had high recoveries in the laboratory control sample (LCS) and QC sample (>125%). Therefore, all detects for these elements are qualified 'J' for possible high bias. The other QC problem was that the recommended holding time for mercury was exceeded by 39 to 42 days. Therefore, all of the mercury data are qualified 'UJ'. There were no mercury detects and as discussed above, the missed holding times do not have a substantial effect on the data. All other data are valid without qualification.

4.1.2 PRSs 21-028(d,e)

Soil samples were analyzed for TAL metals in request 20246. There were several QC problems with this request. The first was that sodium had high recoveries in the LCS and soil QC sample (>125%). Therefore, all detects for this element are qualified 'J' for possible high bias. There was also a problem with nickel and chromium in the soil QC sample. Both had recoveries of <5%. Therefore, all data for these elements in soil samples are qualified 'R' for possible false negative values. Another QC problem was that the recommended holding time for mercury was exceeded by approximately 20 days. As a result, all mercury detects were quite low (<0.3 mg/kg) and all of the mercury data are qualified 'J' or 'UJ'. All other data are valid without qualification.

4.2 Organic Analyses

4.2.1 PRSs 21-004(a–c)

4.2.1.1 PRSs 21-004(a)

No fixed laboratory organic analytical samples were collected for PRS 21-004(a); therefore, no QA/QC review is required.

4.2.1.2 PRSs 21-004(b,c)

Soil samples were analyzed for VOCs in request 19363. All of the QC parameters associated with this request were within allowed limits. All data are valid without qualification.

Soil samples were analyzed for SVOCs in request 19363. There were problems with the blind QC sample. 1,2-Dichlorobenzene had a recovery of <10% in the QC sample; therefore, all of the data for this analyte are qualified 'R' for possible false negatives. Six analytes had recoveries between 10% and 50% in the QC sample and are qualified 'UJ'. They are anthracene, 1,4-dichlorobenzene, 2-methylphenol, 4-methylphenol, naphthalene, and 1,2,4-trichlorobenzene. All other data are valid without qualification.

4.2.2 PRSs 21-028(d,e)

Samples were analyzed for VOCs in request 19413. There were several minor QC problems. There was one high surrogate recovery bromofluorobenzene (BFB) for samples AAC0146, AAC0152, and AAC0153 (126, 121, and 131%, respectively). Because no analytes were detected in these samples, no data qualification is necessary. Also, methylene chloride was found in the method blank (9 µg/kg). It was detected in one sample (AAC0152) at 21 µg/kg. Because methylene chloride is a common lab contaminant and the detected level is less than 10 times the amount in the blank, the EQL was raised to the detected level and was reported as <21 µg/kg. All other data are valid without qualification.

Samples were analyzed for SVOCs in request 19413. There were problems with the blind QC samples. Twenty-one analytes had recoveries between 10% and 50% in the soil QC sample and are qualified 'UJ' in all of the soil samples. The analytes are anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, 4-chloro-3-methylphenol, chrysene, dibenzofuran, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, hexachloroethane, 2-methylphenol, 4-methylphenol, naphthalene, 4-nitrophenol, pentachlorophenol, pyrene, 1,2,4-trichlorobenzene, and 2,4,6-trichlorophenol. In one water sample (AAC0155), a rinsate blank is qualified 'R' for <10% surrogate recovery of 2-fluorophenol. All other data are valid without qualification.

4.3 Radiochemistry Analyses

4.3.1 PRSs 21-004(a–c)

4.3.1.1 PRS 21-004(a)

No fixed laboratory radiochemical analytical samples were collected for PRS 21-004(a); therefore, no QA/QC review is required.

4.3.1.2 PRSs 21-004(b,c)

Soil samples were analyzed for isotopic plutonium, uranium, strontium-90, tritium, percent moisture, gamma scan, and americium-241 and other gamma-emitting radionuclides in request number 19906. There were a number of problems with the different analyses. For isotopic plutonium, there was a low recovery of plutonium-238 in the QC sample associated with sample AAB9184 (70%). Therefore, the plutonium-238 value for this sample is qualified 'J'. The data for strontium-90 are all qualified 'J' for low recoveries in the LCS and QC samples (40-70%). The uranium data are all qualified 'J' for a number of reasons. One of the QC samples had a low recovery (72%) and one had a high recovery (>120%). Also, the duplicate analysis did not agree within three standard deviations of the original result. The tritium data are qualified 'J' for a low recovery in the matrix spike sample (79%) and a high recovery in the LCS (122%). All other data are usable without qualification.

4.3.2 PRSs 21-028(d,e)

Samples were analyzed for isotopic plutonium, uranium, strontium-90, percent moisture, americium-241, and other gamma-emitting radionuclides in request number 20097. There were a number of problems with the different analyses. The data for strontium-90 are all qualified 'J' for a low recovery in the QC sample (57%). The uranium data are all qualified 'J' for a low recovery in the QC sample (57%). All detected tritium data are qualified 'J' for a high recovery in the LCS (126%). All other data are valid without qualification.

5.0 SPECIFIC INVESTIGATIONS, RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 PRSs 21-004(a–c)

PRSs 21-004(a–c) are three aboveground storage tanks: tank TA-21-335, PRS 21-004(a) and two tanks designated TA-21-346, PRSs 21-004(b,c).

5.1.1 History

5.1.1.1 PRS 21-004(a)

PRS 21-004(a), tank TA-21-335, is a 6 000-gal. aboveground steel tank, used as an active radioactive liquid waste holding tank (Fig. 5.1.1-1). The tank is 8-ft in diameter and 16-ft long. It was installed in 1974 and is still in use today (LANL 1991, 0689). No stains or evidence of leaks were noted during a TA-21 site reconnaissance walk-through (Weston 1990, 01-0027).

A drawing shows tank TA-21-335 connected to a drain line originating from building TA-21-21 (LANL 1991, 0689). A LANL source, onsite when the tank was installed in 1974, stated that the tank was connected to floor drains in TA-21-21 where plutonium and uranium metal were stored after refinement (Trujillo 1991, 01-0026). There are no documented releases to or from the tank and there is no information suggesting that this tank ever released contaminants to the environment (LANL 1991, 0689; Trujillo 1991, 01-0026). Liquid waste (if existent) in TA-21-335, may have included uranium, plutonium, and VOCs. (VOCs are highly unlikely because there is no known, documented use at TA-21-21). From the time of its installation in 1974, the tank has not been pumped out (Buchholtz 1991, 01-0028). In addition, the tank was found dry and empty during the 1994 sampling campaign; therefore, it had never received waste.

5.1.1.2 PRSs 21-004(b,c)

PRSs 21-004(b,c) are two aboveground stainless steel tanks, TA-21-346, used as overflow holding tanks for liquid waste from cooling towers, laboratory, and radionuclide experimental operations. The PRSs are located within an asphalt-lined berm, approximately 110 ft north of sump pump TA-21-223 (Fig. 5.1.1-1). Each tank is 9-ft high and 8 ft in diameter and has a capacity of 3 000 gal. (LANL 1991, 0689). Both tanks are mounted on steel legs above the surface of the asphalt berm (Weston 1990, 01-0027). The bermed area is 36-ft long, 18-ft wide, and was originally designed to contain 6 000 gal. but has an actual capacity of 9 600 gal. (LASL 1979, 01-0029).

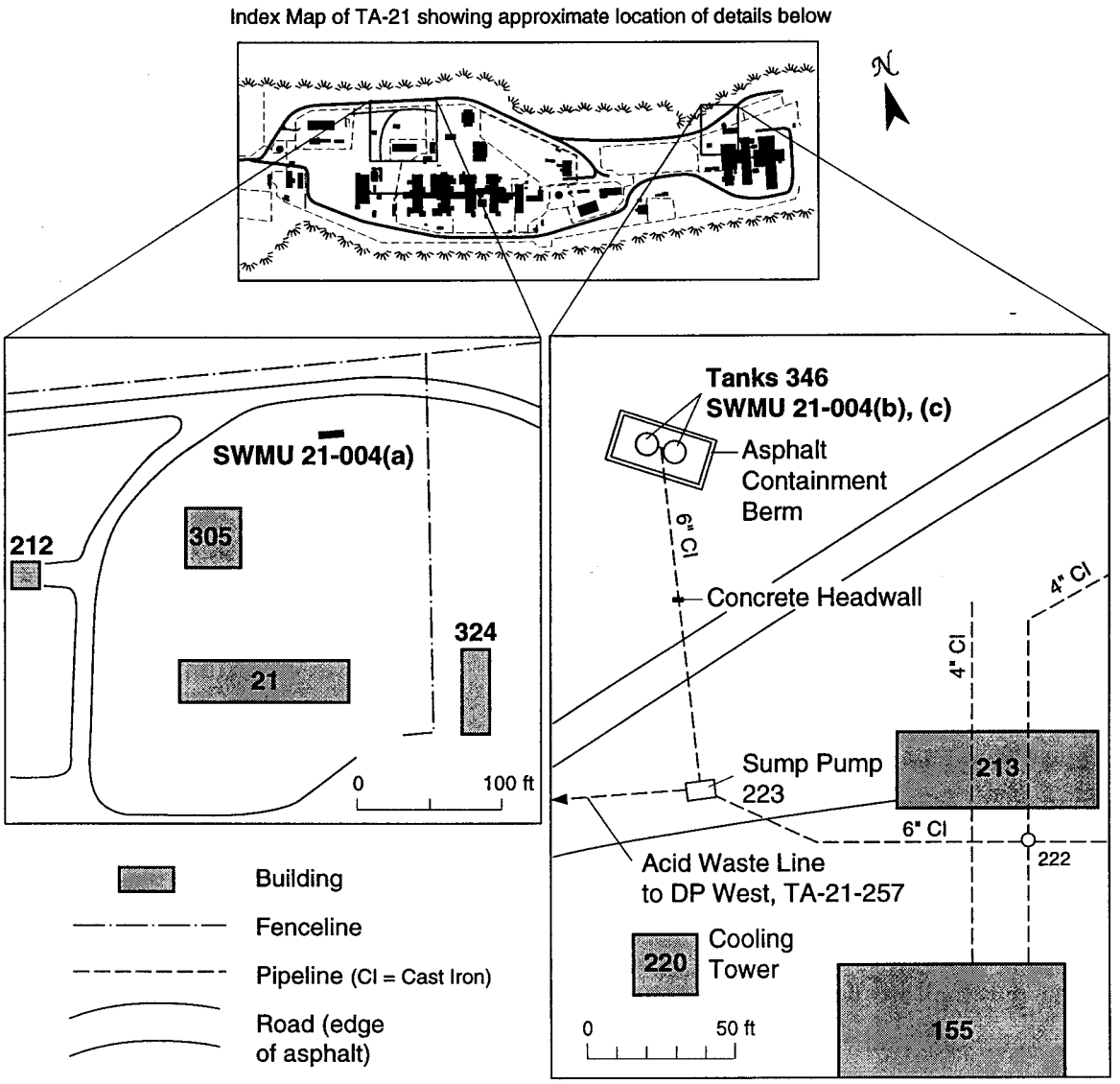

Fig. 5.1.1-1. Location of PRSs 21-004(a–c).

Both tanks were moved to their present location from TA-53 in 1979, and are still in use today. They were connected to a pre-existing 6-in. drain line, PRS 21-004(d), originating from sump pump TA-21-223. The sump pump is connected to the main TA-21 acid waste line and pumps liquid waste produced at DP East to building TA-21-257 at DP West for treatment (Fig. 5.1.1-1). The two tanks were installed to receive liquid waste from the sump in the event of an overflow.

Waste potentially reaching PRSs 21-004(b-c) is liquid industrial waste from DP East. This waste generally consists of diluted laboratory wastes and liquids from chilled water systems originating at DP East. The waste discharged to the tanks may have been contaminated with tritium, polonium, and actinium , mercury, plutonium-239, and plutonium-240 (Buchholtz 1991, 01-0028; Merrill 1990, 01-0030; DOE 1989, 01-0031). Other contaminants that may be present in the waste received by the tanks include uranium and thorium because materials containing these radionuclides were stored at DP East at the time of the TA-21 site reconnaissance walk-through (Weston 1990, 01-0027). Chemical contaminants released to these tanks have not been documented and there is no information suggesting that either tank released contaminants to the environment (LANL 1991, 0689).

Tanks TA-21-346 are reported to have been pumped out on two occasions between 1979 and 1991. This liquid waste was sent back into sump TA-21-223. No leaks from the tanks or releases to the berm or the environment have occurred (Buchholtz 1991, 01-0028). No leaks on the tanks or stains on the asphalt berm were observed during the TA-21 site reconnaissance walk-through (Weston 1990, 01-0027).

5.1.2 Site Description

The mesa top at TA-21 is mantled with a thin layer of reworked colluvium and fill material that ranges from less than 1 ft to as much as 10-ft thick. At PRSs 21-004(a–c), the mesa is characterized by heavy commercial and urban development and wildlife habitats are urban plant and animal communities.

For a description of geological setting, soils, and hydrology pertinent to the location of PRSs 21-004(a–c), see Section 2.0 of this report.

5.1.3 Previous Investigations

5.1.3.1 PRS 21-004(a)

No previous investigations have been performed at PRS 21-004(a).

5.1.3.2 PRSs 21-004(b,c)

No chemical or radiological analyses were performed on the liquid waste contained in the tanks TA-21-346 (Buchholtz 1991, 01-0028). Some sample analysis results are available for the outfall, PRS 21-004(d), which predated the RFI at PRSs 21-004(b,c). See section 15.8 of the RFI work plan (LANL 1991, 0689). Mercury, plutonium-239/240, and tritium were found present at concentrations above background level in the outfall [PRS 21-004(d)] (LANL 1991, 0689). The subsequent RFI report detailing information on PRS 21-004(d) is Phase Report 1C (LANL 1994, 1260).

5.1.4 Field Investigations

5.1.4.1 Investigative Approach

5.1.4.1.1 PRS 21-004(a)

The TA-21 work plan, specified the Phase I investigative approach for PRS 21-004(a) would be as follows (LANL 1991, 0689).

- Survey the outside of tank TA-21-335, the concrete pad, and the exposed drain line inlet for radioactivity above background levels.
- Collect three replicate filter-paper swipes for radioactive contamination along the bottom of the interior of tank TA-21-335 if it is dry or three replicate liquid samples if it contains liquid or sludge.
- If the tank is dry, screen swipe samples in a MRAL for alpha radiation and gamma radiation by gamma spectroscopy. If the tank is not dry, screen liquid samples in the MRAL for alpha radiation, gamma radiation by gamma spectroscopy, and VOCs.

5.1.4.1.1.1 Deviations From Work Plan

Deviations from the planned approach at tank PRS 21-004(a), TA-21-335 follow.

- While collecting swipe samples from the interior of the tank, two additional swipes were collected from the inside and outside of the tank valve.
- Samples of the interior of the tank were screened by the field crew using a portable alpha radiation detector rather than the MRAL because the MRAL was not equipped to perform these analyses on swipe samples. Because the radiological survey of the exterior showed only a slight increase in gamma radiation in a few locations and the swipes detected no alpha radiation in the interior of the tank, analyses at the MRAL probably would not have provided any new information about the tank.

5.1.4.1.2 PRSs 21-004(b,c)

The TA-21 work plan, specified Phase I investigative approach for PRSs 21-004(b,c), tanks TA-21-346, as follows (LANL 1991, 0689).

- Survey the area around the containment berm at the PRSs 21-004(b,c) for radioactivity above background levels.
- Drill two 5-ft boreholes on the north side of PRSs 21-004(b,c) and collect four samples, one from each 2.5-ft interval. Collect one field duplicate, rinsate blank, field blank, and trip blank as QA/QC samples.
- Screen all four borehole samples using hand-held instruments for radioactivity, organic vapors, and combustible gas/oxygen; perform lithological logging of the core; and screen samples in a mobile laboratory for gross alpha radiation, gamma radiation by gamma spectroscopy, and VOCs.
- Analyze two borehole samples for radionuclides, metals, SVOCs, and VOCs.

Field activities at the three aboveground tanks were conducted using procedures listed in the site-specific health and safety plan (LANL 1994, 01-0024).

5.1.4.1.2.1 Deviations From Work Plan

Deviations from the planned approach at PRSs 21-004(b,c), TA-21-346 follow.

- Borehole core was not logged for lithological properties because it was determined that the shallow depth of the soil samples provided no meaningful data.
- No QA/QC samples were required with the borehole samples because only two samples were sent offsite for analysis at a fixed laboratory.
- Borehole samples were not sent to the MRAL for gamma spectroscopy; however, gamma spectroscopy was included in the laboratory analyses requested for samples AAB9181 and AAB9184.
- Additional analyses on borehole samples for gross beta radiation, gross gamma radiation, tritium, and moisture were performed at the MRAL. The additional MRAL screening for gross beta and gamma radiation was performed to meet the requirements of analytical laboratories that received the samples.

5.1.4.2 Radiological Survey

5.1.4.2.1 PRS 21-004(a)

September 30, 1994, the field crew surveyed for radiation at 11 locations around tank TA-21-335 (Fig. 5.1.4-1). Locations surveyed were the outside the tank (locations 5–8), on the concrete pad (locations 9–11), along the inlet line (locations 1–4), and at the valve (location 6).

Results of the radiological survey at TA-21-335 are in Table 5.1.4-1. At locations 6, 9, and 10, gamma radiation levels were slightly greater than the upper limit of background when measured by a Ludlum 44-10™ NaI scintillation detector but not when measured with other gamma radiation detectors. All other survey results were less than or equal to the upper limit of background.

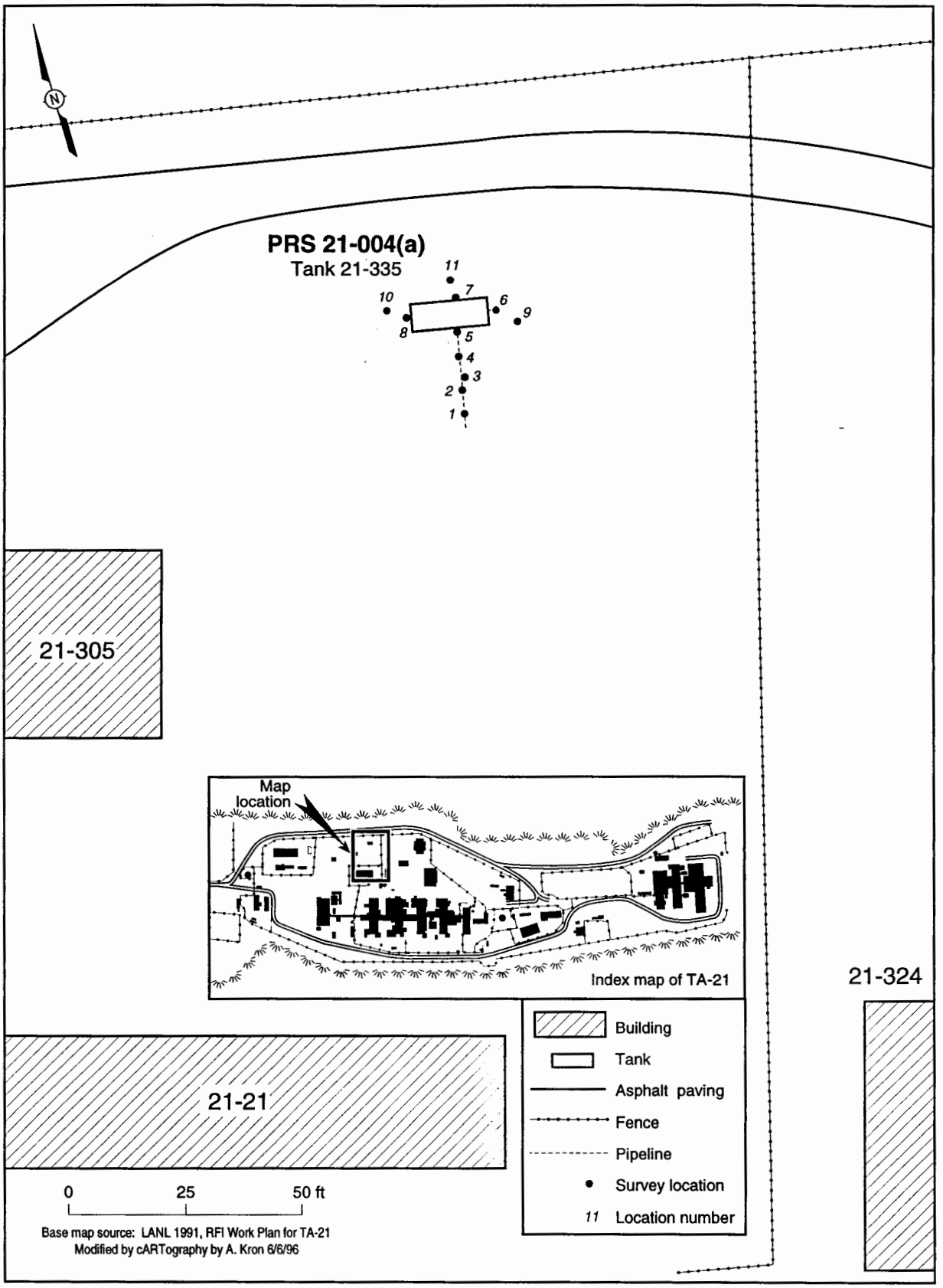

Fig. 5.1.4-1. PRS 21-004(a) radiological survey locations.

TABLE 5.1.4-1

RADIOLOGICAL SURVEY RESULTS OF PRS 21-004(a)

	SCREENING INSTRUMENT			
SURVEY POINT	LOW-ENERGY GAMMA DETECTOR[a] (cpm)	GAMMA DETECTOR[b] (cpm)	GAMMA DETECTOR[c] (μr/hr)	ALPHA DETECTOR[d] (cpm)
Background[e]	21 200	19 000	20	21
1	15 000	15 000	14	2
2	19 000	18 000	17	6
3	19 000	18 000	17	6
4	20 000	19 000	18	0
5	19 000	19 000	17	4
6	21 000	21 000	19	14
7	19 000	19 000	17	8
8	20 000	19 000	17	10
9	21 000	20 000	17	14
10	20 000	20 000	17	6
11	18 000	17 000	15	2

[a] FIDLER G-5 sodium iodide (NaI) scintillation detector.
[b] Ludlum 44-10™ NaI scintillation detector.
[c] Ludlum 19™ NaI scintillation survey (μR) meter.
[d] Ludlum 43-1™ zinc sulfide (ZnS) scintillation detector.
[e] Values are for the upper limit of the background range, which was determined as average plus 3 standard deviations of measurements collected at several Los Alamos locations outside LANL boundaries.

5.1.4.2.2 PRSs 21-004(b,c)

September 22, 1994, the field crew surveyed for radiation at 42 locations at PRSs 21-004(b,c), Tanks TA-21-346 (Fig. 5.1.4-2). Results of the radiological survey state that no significant rad levels [were found] at the tanks and elevated alpha was found at fill dirt staging area next to tanks. This is the area to the southeast of the tanks. Alpha radiation results may also be elevated in areas to the west and northwest of the tanks. Gamma radiation levels may be slightly elevated beyond the upper limit of the background range as measured by a FIDLER G-5 NaI scintillation detector. This was determined as the average plus three sigma for measurements collected at several locations in Los Alamos County outside LANL boundaries. All other survey results appear to be less than or equal to the upper limit of background.

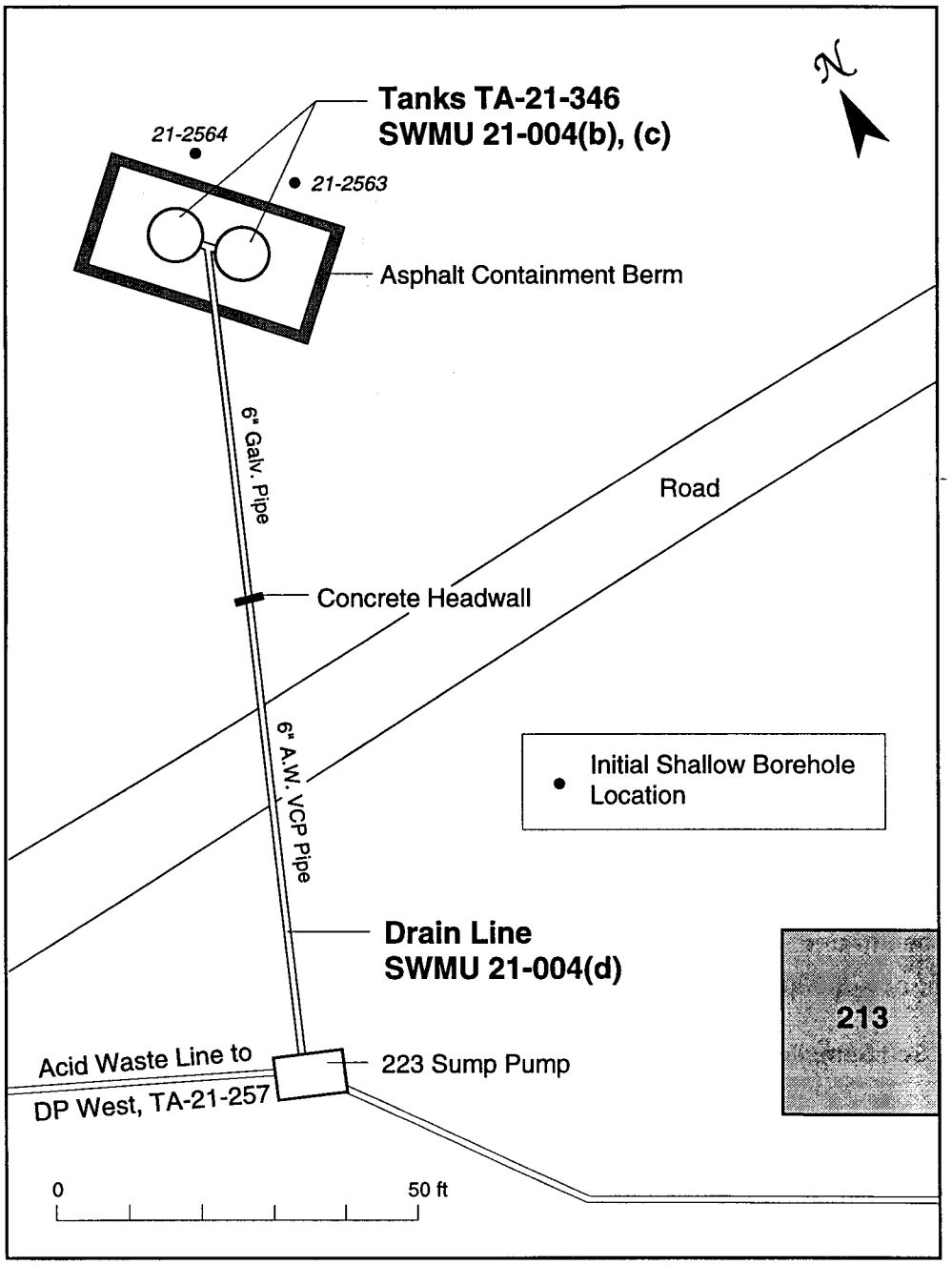

Fig. 5.1.4-2. PRSs 21-004(b,c) sample locations.

5.1.4.3 Field Screening

5.1.4.3.1 PRS 21-004(a)

October 3, 1994, the field crew removed the access port cover, visually inspected tank TA-21-335, and determined it was dry. Because the tank was dry, no VOC samples were collected. However, five swipe samples were collected: three from inside the tank and two from the valve of the tank. The field crew screened swipes for alpha radiation using a Ludlum Model 43-10™ alpha sample counter and found no removable alpha radiation.

Interior screening of the tank should determine no detectable radiological contamination and radiological survey results from around the tank suggest no radiological contamination. It was determined that the investigation of PRS 21-004(a) was complete at this point.

5.1.4.3.2 PRSs 21-004(b,c)

During drilling, each borehole was screened for combustible gases/oxygen and organic vapors; none were detected. Samples collected from each borehole were screened in the field, once for organic vapors and twice for radioactivity. Field screening was performed to meet worker health and safety requirements. The MRAL screened soil samples for gross alpha, beta, and gamma radiation, tritium, and percent moisture to meet requirements of off-site fixed analytical laboratories and Department of Transportation (DOT) shipping requirements.

Results of soil screening for organic vapors and radiation indicated no organic vapors were detected and no samples had radiation levels greater than the action levels defined in the site-specific health and safety plan, i.e., $\geq$ 500 cpm alpha radiation, or $\geq$ 5 000 cpm beta/gamma radiation, or $\geq$ 5 000 μR/hr gamma radiation (LANL 1994, 01-0024).

5.1.4.4 Soil Sampling

5.1.4.4.1 PRS 21-004(a)

No soil samples were collected at this site as described in Section 5.1.4.3.1 of this report.

5.1.4.4.2 PRSs 21-004(b,c)

September 23, 1994, the field crew drilled two 5-ft boreholes and collected samples at 2.5-ft intervals. The samples were screened, then two soil samples were submitted under chain-of-custody to the SMO and sent off-site to fixed analytical laboratories for further analysis. Two additional samples were analyzed at the MRAL for radiological constituents. For a summary of samples collected, sample locations, and analyses performed for each sample, see Table 5.1.4-2 and Fig. 5.1.4-2.

TABLE 5.1.4-2

SUMMARY OF SAMPLES COLLECTED AT PRSs 21-004(b,c)

SAMPLE INFORMATION				ANALYTICAL SUITE AND REQUEST NUMBER				
LOCATION ID	SAMPLE ID	DEPTH (ft)	MATRIX	TAL[a] METALS	RAD[b]	MRAL[c] RAD	SVOCs[d]	VOCs[e]
21-2563	AAB9181	0–2.5	Soil	20239	19906	21329	19363	19363
21-2563	AAB9182	2.5–5	Soil	NA[f]	NA	21329	NA	NA
21-2564	AAB9183	0–2.5	Soil	NA	NA	21329	NA	NA
21-2564	AAB9184	2.5–5	Soil	20239	19906	21329	19363	19363

[a] TAL = Target analyte metals. Target analyte metals include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.
[b] RAD = Fixed laboratory radiological analyses. Radiological analyses include americium-241, tritium, plutonium-isotopes, strontium-90, uranium, and gamma-emitting isotopes. Percent moisture was also determined.
[c] MRAL = Mobile radiological analytical laboratory.
[d] SVOCs = Semivolatile organic compounds.
[e] VOCs = Volatile organic compounds.
[f] NA = Not analyzed.

5.1.5 Background Comparisons

5.1.5.1 PRS 21-004(a)

Because no soil samples were collected from this PRS, this section does not apply.

5.1.5.2 PRSs 21-004(b,c)

5.1.5.2.1 Inorganics

Two soil samples collected from PRS 21-004(b,c) were analyzed for 24 inorganic chemicals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, uranium, vanadium, and zinc). The results for these analyses were then compared to background screening values to identify any constituents present at concentrations greater than natural background. None of the inorganics detected in soil exceeded their respective background screening values; therefore, none of the inorganic constituents were carried forward through the screening assessment process.

5.1.5.2.2 Radionuclides

Daughters of the natural series of uranium and thorium that were reported for PRSs 21-004(b,c) include lead-212, lead-214, radium-223, radium-224, radium-226, radon-219, thallium-208, and thorium-234. The activity of the daughters was consistent with the parent activities; therefore, all daughter products are eliminated as COPCs.

One fission product was reported for PRSs 21-004(b,c), iodine-129 (half life = 1.57×10^7 yrs). The detection of this isotope is somewhat questionable because there is an interference from bismuth-212 (daughter of uranium-238). Because there is the possibility of an interference and the detected value is quite low, iodine-129 was eliminated as a COPC. For a discussion on the elimination of short-lived activation/fission products and daughter products, see Section 3.2.2 of this report.

For PRSs 21-004(b,c), no primary radionuclides were found to exceed their respective background screening values; therefore, none of these radionuclides were carried forward through the screening assessment process.

5.1.6 Evaluation of Organic Chemicals

5.1.6.1 PRS 21-004(a)

Because no soil samples were collected from this PRS, this section does not apply.

5.1.6.2 PRSs 21-004(b,c)

Two soil samples were collected from PRSs 21-004(b,c) and analyzed for SVOCs. No analytes were detected above their reporting limit in the soil samples. Of the organics that were not detected in any sample collected from PRSs 21-004(b,c), seven had EQLs greater than their respective SALs (i.e., benzo(a)pyrene, bis-2-chloroethyl ether, dibenzo(a,h)anthracene, dibromoethane, hexachlorobenzene, N-nitroso-n-propylamine, and N-nitrosodimethylamine). In addition, 31 others do not have SALs to which the EQLs can be compared. All were analyzed by standard EPA methods, and no EQLs were elevated due to dilutions to overcome matrix interferences. These 38 organics are not expected to be present at this site based on available knowledge of historical operations [no releases to the environment and the previous sampling results at PRS 21-004(d)], and are therefore not carried forward through the screening assessment process. No organic chemicals were carried forward through the screening assessment process.

5.1.7 Human Health Assessment

5.1.7.1 Screening Assessment

5.1.7.1.1 PRS 21-004(a)

Because there were no detected contaminants on the swipes collected from this PRS, this section does not apply.

5.1.7.1.2 PRSs 21-004(b,c)

None of the chemicals detected at PRSs 21-004(b,c) were carried forward through the screening assessment process. Based on this evaluation, a human health screening assessment is not required for this site.

5.1.7.2. Risk Assessment

5.1.7.2.1 Risk Assessment for PRS 21-004(a)

Because there were no detected contaminants on the swipes collected from this PRS, this section does not apply.

5.1.7.2.2 Risk Assessment for PRSs 21-004(b,c)

No human health risk assessment was performed for PRSs 21-004(b,c) because no COPCs were identified.

5.1.8 Ecological Assessment

In accordance with conversations between LANL ER Project personnel, NMED, and EPA Region 6 Officials, further ecological risk assessment at this site will be deferred until the site can be assessed as part of the new ecological exposure unit (Ecozone) methodology that is being developed by LANL in conjunction with EPA and the NMED.

5.1.8.1 Ecotoxicological Screening Assessment

No ecotoxicological screening assessment was performed for PRSs 21-004(a–c) because of heavy urban and commercial development at the sites.

5.1.8.2 Ecological Risk Assessment

No ecological risk assessment was necessary for PRSs 21-004(a–c) because of heavy urban and commercial development at the sites.

5.1.9 Extent of Contamination

Extent of contamination is not applicable for PRSs 21-004(a–c) because no COPCs were retained by the human health screening assessment.

5.1.10 Conclusions and Recommendations

Field activities and subsequent laboratory analyses results at PRSs 21-004(a–c) determined that no COPCs should be retained. Therefore, PRSs 21-004(a–c) are recommended for NFA based on LANL's NFA Criteria Policy, criterion 4 (which states that the PRS has been characterized in accordance with current applicable state or federal regulations, and that COPCs are not present in concentrations that would pose an unacceptable risk under the present and projected future land use).

5.2 PRS 21-028(d)

PRS 21-028(d) is currently regulated as a RCRA less than 90-day storage area. However, use of this area predates RCRA definitions, and the concern is spills from waste containers that predate RCRA. The site was investigated to confirm that there have been no environmental releases prior to the 1994 sampling campaign. Any releases occurring after that date would be reported under the Laboratory's current spill reporting policy.

5.2.1 History

PRS 21-028(d) is a less than 90-day, 3-ft square storage site located on a concrete loading dock on the northwest side of building TA-21-209. TA-21-209 is currently used for high-temperature chemistry and research involving tritium. This area is assumed to have been in use since 1965, the date when construction was completed (Nyhan 1990, 01-0033). Materials that had been stored on the loading dock include:

- 55-gal. drums of lithium-deuterium waste;
- 30-gal. and 55-gal. drums of waste containing natural uranium, natural thorium, uranium-235, uranium-238, thorium-228, thorium-230, and thorium-232; and
- gas cylinders of tritium-contaminated hydrogen and argon gas (Weston 1990, 01-0027).

Containers not specifically labeled as waste but stored in the same area include:

- cylinders of deuterium, argon, nitrogen, helium, and compressed hydrogen;
- 55-gal. drums of oil;
- acetone, convoil 20, ethanol, ethyl alcohol; and
- various solvents stored in a chemical safety cabinet (Weston 1990, 01-0027).

There is no information suggesting that contaminants have been released from these container storage areas to the environment. If such releases had occurred, contaminants at this less than 90-day storage area, PRS 21-028(d), may have included radioactive wastes.

5.2.2 Site Descriptions

The mesa top at TA-21 is mantled with a thin layer of reworked colluvium and fill material that ranges from less than 1 ft to as much as 10-ft thick. At PRS 21-0028(d), the mesa is characterized by heavy commercial and urban development and wildlife habitats are urban plant and animal communities.

For a description of geological setting, soils, and hydrology pertinent to the location of PRS 21-028(d), see Section 2.0 of this report.

5.2.3 Previous Investigations

No data exist regarding contamination on or around the loading dock of TA-21-209. No previous spills were documented and no stains were noted on the dock or on the asphalt surrounding the dock (Weston 1990, 01-0027).

5.2.4 Field Investigation

5.2.4.1 Investigative Approach

The TA-21 work plan, specified the Phase I investigative approach for PRS 21-028(d) as follows (LANL 1991, 0689).

- Perform a radiological survey of the area in front of the loading dock to provide a basis for choosing sampling locations.
- Screen samples for radioactivity and organic vapor. Analyze all the samples for radionuclides, TAL metals, SVOCs, and VOCs.

- Collect four samples from the area in front of the loading dock at locations having the highest radiation readings within the top 6 in. of soil (after removing asphalt and base material) and submit the samples to a fixed laboratory for chemical analysis.

5.2.4.1.1 Deviations From Work Plan

Deviations from the planned approach in the TA-21 work plan follow.

- Because of miscommunication between team members, samples were not collected in all cases at locations where the radiological survey indicated elevated radiation levels. However, elevated radiation levels identified by the survey were not considered to be significantly greater than background radiation.

- The field crew was unable to remove all asphalt before collecting samples. The presence of asphalt in the soil samples could affect analyses results for SVOCs.

- The field crew did not remove fill material before collecting samples because the area was paved when the loading docks were built in 1965. Sampling the fill material was appropriate to ascertain if contaminants had leached through the asphalt. An aerial photograph dated June 28, 1965, confirms that the areas adjacent to the TA-21-209 loading dock were paved prior to the date of the photograph (Koogle and Poules Engineers, 01-0032).

- The procedure for screening samples for radioactivity was changed. Samples were to be screened by field crew members for radioactivity but not by LANL MRAL personnel. Additional mobile laboratory screening was performed to meet DOT shipping requirements and requirements of the fixed analytical laboratories that received the samples.

- It was deemed unnecessary to screen or analyze for organic vapors because samples were from the surface (top 0–6 in.). As a result, sample screening for organic vapor was omitted.

5.2.4.2 Radiological Surveys

September 30, 1994, gamma and alpha radiation surveys were conducted at 12 locations for PRS 21-028(d). Radiological survey locations are shown in Fig. 5.2.4-1.

Results of the radiological survey at PRS 21-028(d) were recorded by the field crew on data forms and are in Table 5.2.4-1. Gamma radiation levels as measured by a Ludlum 44-10™ NaI scintillation detector, were slightly greater than the upper limit of background at locations 2 and 3. All other survey results were less than or equal to the upper limit of background.

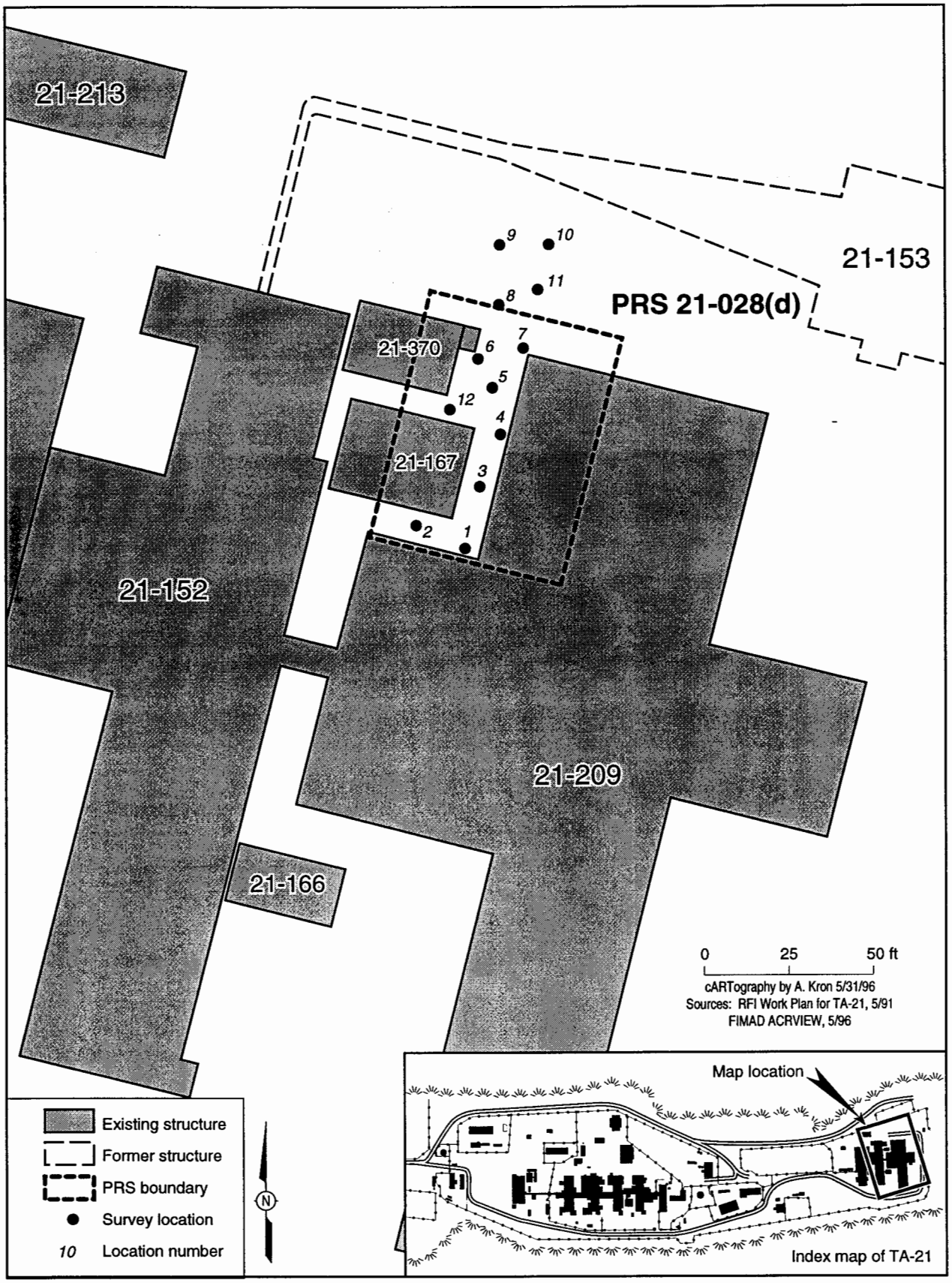

Fig. 5.2.4-1. PRS 21-028(d) radiological survey locations.

TABLE 5.2.4-1

PRS 21-028(d) RADIOLOGICAL SURVEY RESULTS

	INSTRUMENT READING			
SURVEY POINT	LOW-ENERGY GAMMA DETECTOR[a] (cpm)	GAMMA DETECTOR[b] (cpm)	GAMMA DETECTOR[c] (μr/hr)	ALPHA DETECTOR[d] (cpm)
Background[e]	21 200	19 000	20	21
1	18 000	19 000	18	6
2	20 000	20 000	20	4
3	19 000	20 000	18	4
4	18 000	18 000	18	4
5	17 000	17 000	15	0
6	17 000	16 000	15	0
7	17 000	15 000	14	4
8	15 000	14 000	14	8
9	13 000	12 000	13	0
10	13 000	12 000	11	12
11	15 000	14 000	14	4
12	18 000	17 000	16	6

[a] FIDLER G-5 sodium iodide (NaI) scintillation detector.
[b] Ludlum 44-10™ NaI scintillation detector.
[c] Ludlum 19™ NaI scintillation survey (μR) meter.
[d] Ludlum 43-1™ zinc sulfide (ZnS) scintillation detector.
[e] Values are for the upper limit of the background range, which was determined as the average plus 3 standard deviations for measurements collected at several locations in Los Alamos County outside LANL boundaries.

5.2.4.3 Field Screening

Samples were screened twice for radioactivity, once in the field to meet worker health and safety requirements and again by the MRAL to meet analytical laboratories' requirements and DOT shipping requirements.

Results of soil screening for radiation indicated no samples had radiation levels greater than the action defined in the site-specific health and safety plan i.e., ≥500 cpm alpha radiation or ≥5 000 cpm beta/gamma radiation, or ≥5 000 μR/hr gamma radiation (LANL 1994, 01-0024).

5.2.4.4 Soil Sampling

October 3, 1994, the field crew cleared the asphalt and collected samples from the top 6 in. of soil at the four locations shown in Fig. 5.2.4-2. Of the 12 original radiological survey locations at PRS 21-028(d), samples were inadvertently not collected at survey locations 2 and 3 where gamma radiation levels were slightly greater than the upper limit of background. Sample collection logs note that the asphalt had deteriorated and small pieces of asphalt were probably collected along with each soil sample. After soil samples were screened, soil samples were submitted to the SMO under chain-of-custody and were delivered to fixed laboratories for further analysis.

In addition to soil samples collected for COPC analyses, the following samples were collected for PRS 21-028(d) and then submitted to the SMO for QA/QC purposes.

- One rinsate blank (sample AAC0155) was collected after soil sample AAC0150 was collected at the less than 90 day storage area , location 21-2513.
- One field blank was collected (sample AAC0156) in association with all soil samples.
- One trip blank (sample AAC0157) was collected in association with all soil samples.
- One field duplicate (sample AAB9193) was collected after soil sample AAC0150 was collected at the less than 90 day storage area, location 21-2513.

For a summary of samples collected, locations at which samples were collected, and analyses performed for each sample, see Table 5.2.4-2 and Fig. 5.2.4-2.

TABLE 5.2.4-2

SUMMARY OF SAMPLES COLLECTED AT PRS 21-028(d)

SAMPLE INFORMATION				ANALYTICAL SUITE AND REQUEST NUMBER				
LOCATION ID	SAMPLE ID	DEPTH (in.)	MATRIX	TAL[a] METALS	RAD[b]	MRAL[c] RAD	SVOCs[d]	VOCs[e]
21-2513	AAB9193	0–6	Soil	20246	20097	21323	19413	19413
21-2513	AAC0150	0–6	Soil	20246	20097	21323	19413	19413
21-2514	AAC0151	0–6	Soil	20246	20097	21323	19413	19413
21-2515	AAC0152	0–6	Soil	20246	20097	21323	19413	19413
21-2516	AAC0153	0–6	Soil	20246	20097	21323	19413	19413
Rinsate blank	AAC0155	n/a[f]	Water	20246	20097	21323	19413	19413
Field blank	AAC0156	n/a	Water	20246	NA[g]	NA	19413	19413
Trip blank	AAC0157	n/a	Water	NA	NA	NA	19413	19413

[a] TAL = Target analyte metals. Target analyte metals include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

[b] RAD = Fixed laboratory radiological analyses. Radiological analyses include americium-241, tritium, plutonium isotopes, strontium-90, uranium, and gamma-emitting isotopes. Percent moisture was also determined.

[c] MRAL = Mobile radiological analytical laboratory.

[d] SVOCs = Semivolatile organic compounds.

[e] VOCs = Volatile organic compounds.

[f] n/a = Not applicable.

[g] NA = Not analyzed.

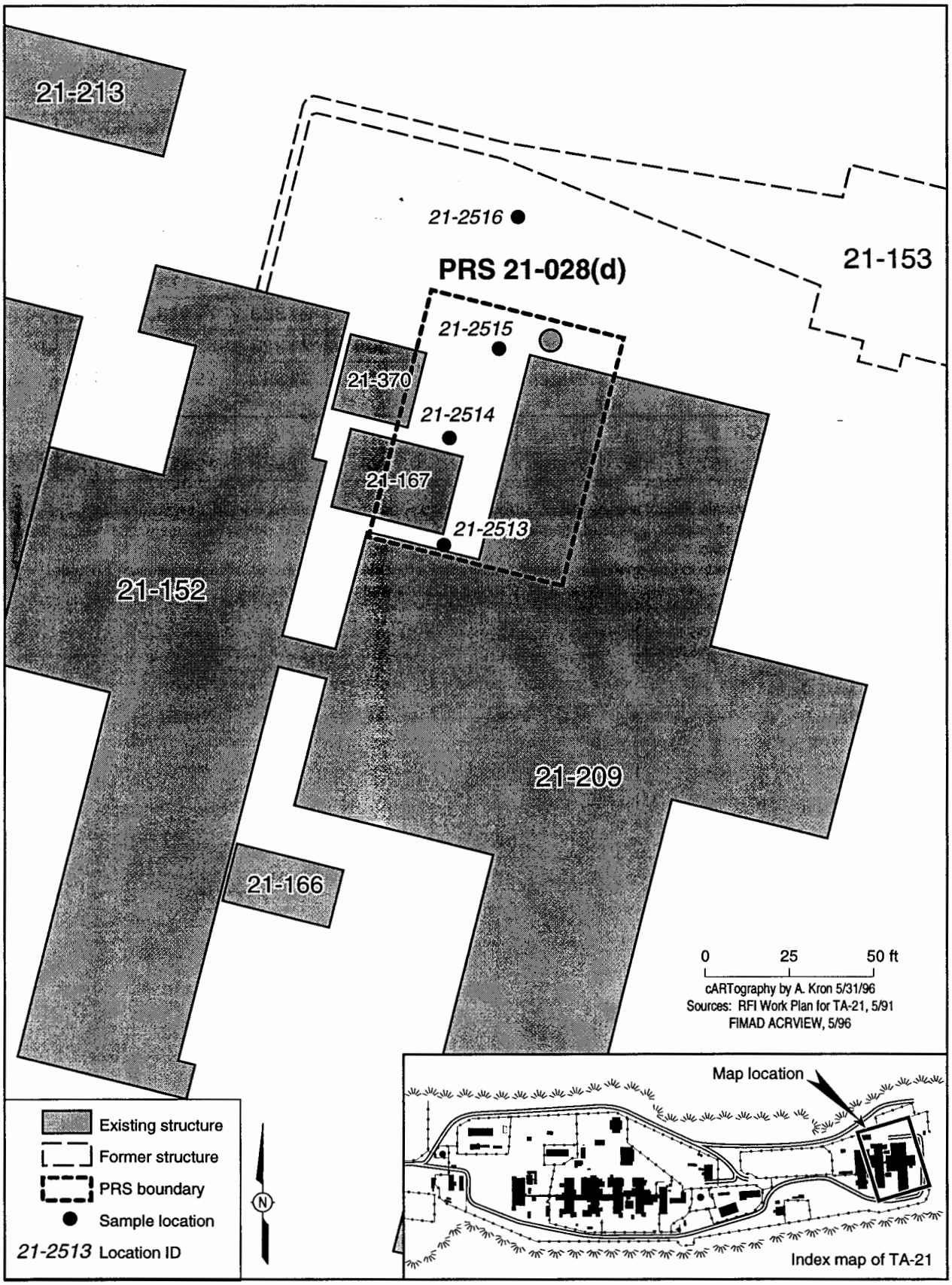

Fig. 5.2.4-2. PRS 21-028(d) sample locations.

5.2.5 Background Comparisons

5.2.5.1 Inorganics

Five soil samples collected from PRS 21-028(d) were analyzed for 24 inorganic chemicals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, uranium, vanadium, and zinc). The results for these analyses were then compared with background screening values to identify any constituents present at concentrations greater than natural background. As shown in Table 5.2.5-1, calcium, copper, lead, mercury, sodium, uranium, and zinc were present at levels greater than their respective background screening values. (All data associated with the samples presented in Table 5.2.5.1 are presented in Appendix D, Table D-1). These seven inorganics were carried forward through the screening assessment process.

5.2.5.2 Radionuclides

Six short-lived activation/fission products reported for PRS 21-028(d) include cerium-144, cesium-134, cobalt-57, manganese-54, ruthenium-106, and sodium-22. There were no reported parent concentrations of these radionuclides. All were eliminated as COPCs. The basis for eliminating short-lived activation/fission products as COPCs is discussed in Section 3.2.2 of this report.

Daughters of naturally occurring radionuclides (uranium and thorium) that were reported for PRS 21-028(d) include actinium-228, bismuth-211, bismuth-212, bismuth-214, lead-210, lead-211, lead-212, lead-214, protactinium-231, protactinium-234, protactinium-234m, radium-223, radium-224, radon-219, thallium-208, thorium-227, and thorium-234. All sample values for lead-211, protactinium-234, and radon-219 were MDAs. The activity of the daughters was consistent with the parent activities; therefore, all daughter products were eliminated as COPCs.

For PRS 21-028(d), tritium and uranium-235 were detected at concentrations exceeding background screening values. (All data associated with the samples presented in Table 5.2.5.1 are presented in Appendix D, Table D-1). Concentrations of these two radionuclides are presented in Table 5.2.5-1. Tritium and uranium-235 are carried forward through the screening assessment process. Note that uranium-235 was identified based on gamma spectroscopy results which have limited utility quantifying uranium-235 because of the interference from other gamma-emitting isotopes with similiar signatures.

TABLE 5.2.5-1

PRS 21-028(d) INORGANICS AND RADIONUCLIDES WITH CONCENTRATIONS IN SOIL THAT EXCEED BACKGROUND SCREENING VALUES

LOCATION ID	SAMPLE ID	DEPTH (ft)	CALCIUM (mg/kg)	COPPER (mg/kg)	LEAD (mg/kg)	MERCURY (mg/kg)	SODIUM (mg/kg)	URANIUM (mg/kg)	ZINC (mg/kg)	URANIUM-235 (pCi/g)	TRITIUM (pCi/g)
UTL[a]	n/a[b]	n/a	6 120	15.5	23.3	0.1	915	5.45	50.8	0.084	0.82
SAL[c]	n/a	n/a	N/A[d]	2 800	400	23	N/A	230	2 300	10	260
21-2513	AAB9193	0-0.5	6 290	17	28.2	–[e]	2 100(J)[f]	–	172	–	54.90(J)
21-2513	AAC0150	0-0.5	6 390	18.2	–	0.22(J)	2 230(J)	–	138	0.255	64.88(J)
21-2514	AAC0151	0-0.5	–	34.5	39.7	0.27(J)	–	–	106	0.22	130.15(J)
21-2515	AAC0152	0-0.5	–	–	–	0.34(J)	1 360(J)	13.8(J)	–	–	60.64(J)
21-2516	AAC0153	0-0.5	6 420	–	–	–	1 400(J)	–	–	0.123	1.77(J)

[a] UTL = Upper tolerance limit. UTL is the background screening value.
[b] n/a = Not applicable.
[c] SAL = Screening action level.
[d] N/A = Not available.
[e] – = Analyte not detected or detected at a concentration less than UTL.
[f] J = Estimated quantity.

5.2.6 Evaluation of Organic Chemicals

Five soil samples were collected from PRS 21-028(d) and analyzed for VOCs and SVOCs. Benzo(b)fluoranthene, fluoranthene, phenanthrene, and pyrene were all detected above their respective reporting limits for at least one sample. The organics that were detected above their reporting limits are shown in Table 5.2.6-1. For all sample data associated with each sample with at least one or more analyte detected above its EQL, see Appendix D, Table D-2.

TABLE 5.2.6-1

PRS 21-028(d) ORGANICS WITH CONCENTRATIONS IN SOIL THAT EXCEED EQLS[a]

LOCATION ID	SAMPLE ID	BENZO(b)FLUORANTHENE (mg/kg)	FLUORANTHENE (mg/kg)	PHENANTHRENE (mg/kg)	PYRENE (mg/kg)
SAL[b]	n/a[c]	0.61	2 600	N/A[d]	2 000
21-2513	AAB9193	0.38	0.87	0.81	0.74(J)[e]
21-2513	AAC0150	–[f]	0.57	0.49	–

[a] EQLs = Estimated quantitation limits.
[b] SAL = Screening action level.
[c] n/a = Not applicable.
[d] N/A = Not available.
[e] J = Estimated quantity.
[f] – = Analyte not detected or detected at a concentration less than EQL.

No other analytes were detected above their reporting limits in any of the soil samples. However, seven nondetected organics had EQLs greater than their respective SALs (i.e., benzo(a)pyrene, bis-2-chloroethyl ether, dibenzo(a,h)anthracene, hexachlorobenzene, N-nitrosodi-n-propylamine, N-nitrosodimethylamine, and vinyl chloride). In addition, 30 other organics do not have SALs with which the EQLs can be compared. All were analyzed by standard EPA methods, and no EQLs were elevated because of dilutions to overcome matrix interferences. These 37 organics are not expected to be present at this site based on available knowledge of historical operations and are therefore not carried forward through the screening assessment process. The organics detected above their respective EQLs (benzo(b)fluoranthene, fluoranthene, phenanthrene, and pyrene) are all carried forward through the screening assessment process. Figure 5.2.6-1 shows contaminants over background.

5.2.7 Human Health Assessment

5.2.7.1 Screening Assessment

COPCs detected at levels greater than background UTLs, EQLs, MDAs, or with no background data for comparison were compared to their respective SALs. Each COPC may fall into one of the following categories: COPC detected at a concentration greater than or equal to its SAL, COPC has no SAL, or COPC was detected at a concentration below its SAL.

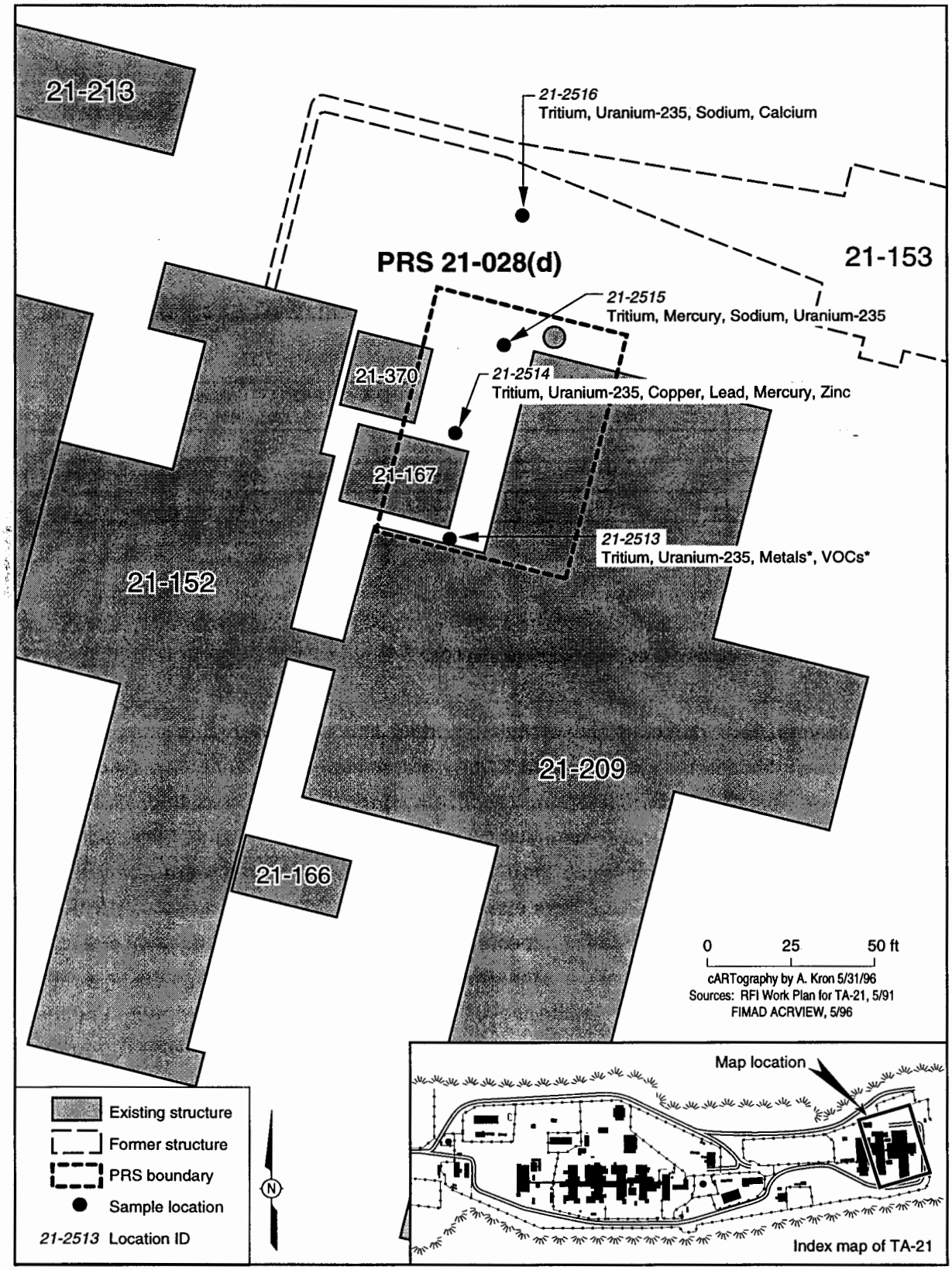

Fig. 5.2.6-1. PRS 21-028(d) sample locations with inorganics, organics, and radionuclides above background screening levels.

No chemicals fall into the greater than or equal to SAL category. However, phenanthrene, calcium, and sodium fall into the no SAL category.

Phenanthrene is a polyaromatic hydrocarbon (PAH). Different PAHs are naturally found together in the environment, because they are products of incomplete combustion such as automobile exhaust, forest fires, and wood-burning stoves. The other detected PAHs (benzo(b)fluoranthene, fluoranthene, and pyrene) that have SALs for comparison, were detected below their respective SALs. Phenanthrene is not among the list of chemicals known to be stored in the less than 90-day storage site and is not expected to be at the site due to laboratory processes. However, an asphalt surface existed above the soil that was sampled, the PAHs are a likely artifact of that surface. Phenanthrene is, therefore, eliminated for the above reasons.

Calcium and sodium have no SALs because there are no calculated SALs for these essential nutrients. However, calcium and sodium concentrations are compared to the recommended daily allowance (RDA) for children and adults. The greatest concentration of calcium detected at PRS 21-028(d) was 6 390 mg/kg. At a soil ingestion rate of 200 mg/day for a child, the amount ingested per day would be approximately 1.3 mg. This amount is considerably less than the RDA of 800 mg/day. At a soil ingestion rate of 100 mg/day for an adult, the amount ingested per day would be approximately 0.6 mg. This amount is considerably less than the RDA of 1 200 mg/day. Therefore, calcium is eliminated as a COPC.

The greatest concentration of sodium detected at PRS 21-028(d) was 2 230 mg/kg. At a soil ingestion rate of 200 mg/day for a child, the amount ingested per day would be approximately 0.4 mg. This amount is considerably less than the RDA of 46 mg/day. At a soil ingestion rate of 100 mg/day for an adult, the amount ingested per day would be approximately 0.2 mg. This amount is considerably less than the RDA of 500 mg/day. Therefore, sodium is eliminated as a COPC.

Ten chemicals, benzo(b)fluoranthene, fluoranthene, pyrene, copper, lead, mercury, uranium, zinc, uranium-235, and tritium were detected in concentrations below their respective SALs. To evaluate an MCE for this data set, COPCs detected below their respective SALs were grouped according to their toxicological effects (noncarcinogenic, carcinogenic, or radioactive). SALs for all chemicals were normalized to one and summed as described in Section 3.4.1. Because there is only one carcinogen, benzo(b) fluoranthene, the MCE for carcinogens is not performed. Results of the analysis based on noncarcinogenic effects and radioactivity are shown in Table 5.2.7-1. Results of the MCE based on noncarcinogenic effects are less than one at 0.3, indicating that potential resultant adverse human health effects from exposure are

unlikely. The results of the MCE based on radioactivity is less than one at 0.5, indicating that potential adverse human health effects from exposure are unlikely. Therefore, all of the chemicals with concentrations below their respective SALs are eliminated as COPCs.

TABLE 5.2.7-1

MULTIPLE CHEMICAL EVALUATION (MCE)

CHEMICAL	SAMPLE VALUE (mg/kg)	SAL[a] (mg/kg)	NORMALIZED VALUE
NONCARCINOGENIC EFFECTS			
Copper	34.5	2 800	0.01
Fluoranthene	0.87	2 600	0.0003
Lead	39.7	400	0.1
Mercury	0.34(J)[b]	23	0.02
Pyrene	0.74	2 000	0.0004
Uranium	13.8(J)	230	0.1
Zinc	172	2 300	0.1
		NORMALIZED SUM	0.3
RADIONUCLIDES			
	pCi/g	pCi/g	pCi/g
Uranium-235	0.255	10	0.03
Tritium	130.15(J)	260	0.5
		NORMALIZED SUM	0.5

[a] SAL = Screening action level
[b] J = Estimated quantity.

At the conclusion of the screening assessment for PRS 21-028(d), no chemicals were retained as COPCs.

5.2.7.2 Risk Assessment

No human health risk assessment was performed for PRS 21-028(d) because no COPCs were identified.

5.2.8 Ecological Assessment

In accordance with conversations between LANL ER Project personnel, NMED, and EPA Region 6 Officials, further ecological risk assessment at this site will be deferred until the site can be assessed as part of the new ecological exposure unit (Ecozone) methodology that is being developed by LANL in conjunction with EPA and the NMED.

5.2.8.1 Ecotoxicological Screening Assessment

No ecotoxicological screening assessment was performed for PRS 21-028(d) because of heavy urban and commercial development at the site.

5.2.8.2 Ecotoxicological Risk Assessment

No ecological risk assessment was necessary for PRS 21-028(d) because of heavy urban and commercial development at the site.

5.2.9 Extent of Contamination

Extent of contamination is not applicable for PRS 21-028(d) because no COPCs were retained by the human health screening assessment.

5.2.10 Conclusions and Recommendations

No chemicals resulting from activities at PRS 21-028(d) were retained as COPCs by the screening process. Therefore, PRS 21-028(d) is recommended for NFA based on LANL's NFA Criteria Policy, criterion 4 (which states that the PRS has been characterized in accordance with current applicable state or federal regulations, and that COPCs are not present in concentrations that would pose an unacceptable risk under the present and projected future land use).

5.3 PRS 21-028(e)

5.3.1 History

PRS 21-028(e) is three satellite container storage areas. One storage area is located on a loading dock on the north side of building TA-21-210. Two storage areas are inside TA-21-210. This RFI considered only the area outside TA-21-210. The other two areas inside TA-21-210 were recommended for NFA in Chapter 20 of the TA-21 work plan (LANL 1991, 0689).

This area is assumed to have been in use since 1965, the date of construction (Nyhan 1990, 01-0033). TA-21-210 is being used for geological core analysis and, in the past, was listed as office space for plutonium research (Weston 1990, 01-0027; LANL 1991, 0689).

Reported materials stored on the north dock are alcohol, acetone, freon, acetone-contaminated wipes, and vacuum pump oil (LANL 1991, 0689).

During the TA-21 site reconnaissance walk-through, light cutting oil, dark cutting oil, sulfur-free cutting oil, and gas cylinders of helium and nitrogen were also observed on the dock. In addition, a chemical safety cabinet containing gasoline, freon, and acetone was located just east of the dock on the ground (Weston 1990, 01-0027). Of the materials listed above, only the acetone-contaminated wipes label indicates generated waste.

There is no information suggesting that contaminants have been released from the container storage area to the environment.

5.3.2 Site Description

The mesa top at TA-21 is mantled with a thin layer of reworked colluvium and fill material that ranges from less than 1 ft to as much as 10-ft thick. At PRS 21-028(e), the mesa is characterized by heavy commercial and urban development and wildlife habitats are urban plant and animal communities.

For a description of geological setting, soils, and hydrology pertinent to the location of PRS 21-028(e), see Section 2.0 of this report.

5.3.3 Previous Investigations

No data exist regarding contamination on or around the TA-21-210 loading dock.

No previous spills were documented and no stains were noted on the dock or on the asphalt surrounding the dock (Weston 1990, 01-0027). However, acetone-contaminated wipes were present. The source term would include those wastes as an indicator of the wastes that have historically been stored in those locations.

5.3.4 Field Investigation

5.3.4.1 Investigative Approach

The TA-21 work plan specified Phase I investigative approach for PRS 21-028(e) as follows (LANL 1991, 0689).

- Perform a radiological survey of the area in front of the loading dock to provide a basis for choosing sampling locations.
- Screen samples for radioactivity and organic vapor. Analyze all of the samples for radionuclides, TAL metals, SVOCs, and VOCs.

- Collect four samples from the area in front of the loading dock at locations having the highest radiation readings within the top 6 in. of soil (after removing asphalt).

5.3.4.1.1 Deviations From Work Plan

Deviations from the planned approach in the TA-21 work plan follow.

- Of the original 12 locations radiologically surveyed, one sample was not collected at location 6. This sample was not collected because it was located directly on the dock itself.

- The field crew was unable to remove all asphalt before collecting samples. The presence of asphalt in the soil samples could affect analyses results for SVOCs.

- The field crew did not remove fill material before collecting samples because the area was uncertain if contaminants had leached through the asphalt. If the areas were paved when the loading docks were built in 1965, sampling the fill material was appropriate. An aerial photograph dated June 28, 1965, confirms that the areas adjacent to the TA-21-210 loading dock were paved prior to the date of the photograph (Koogle and Poules Engineers, 01-0032).

- The procedure for screening samples for radioactivity was changed. Samples were to be screened by field crew members for radioactivity but not by LANL MRAL personnel. Additional mobile laboratory screening was performed to meet the requirements of fixed analytical laboratories that received the samples.

- It was deemed unnecessary to screen for organic vapors because samples were from the surface (top 0–6 in.). As a result, sample screening for organic vapor was omitted.

5.3.4.2 Radiological Survey

September 30, 1994, gamma and alpha radiation surveys were conducted at 12 locations for the satellite container storage area. Radiological survey locations are shown in Fig. 5.3.4-1.

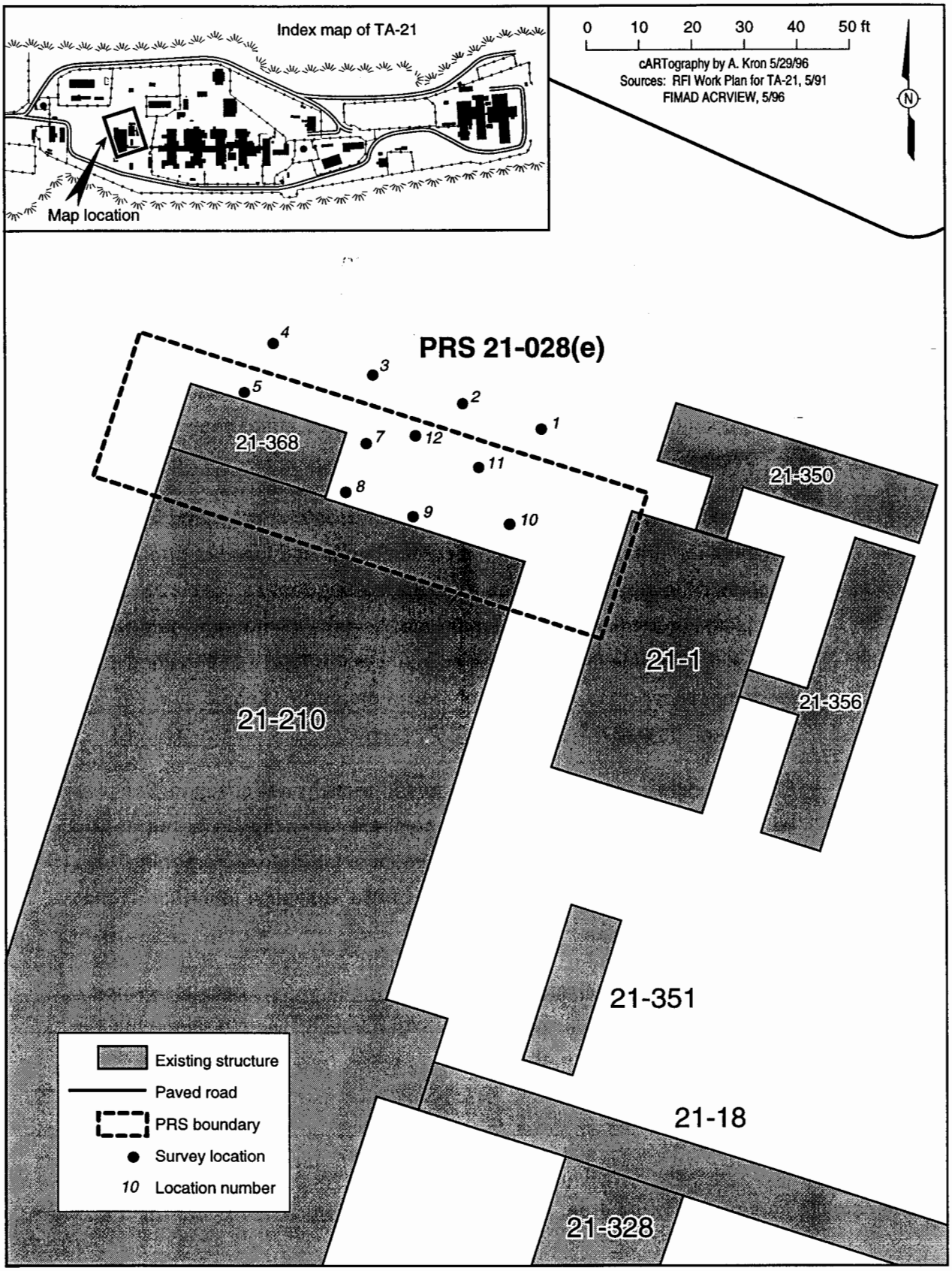

Fig. 5.3.4-1. PRS 21-028(e) radiological survey locations.

Results of the radiological survey at the satellite container storage area are in Table 5.3.4-1. At location 6, alpha radiation levels as measured by a Ludlum 43-1™ Zinc Sulfide scintillation detector were slightly greater than the upper limit of background. At location 8, gamma radiation levels as measured by a Ludlum 44-10™ NaI scintillation detector and a Ludlum 19™ NaI scintillation survey meter were slightly greater than the upper limit of background. All other survey results were less than or equal to the upper limit of background.

TABLE 5.3.4-1

PRS 21-028(e) RADIOLOGICAL SURVEY RESULTS

SURVEY POINT	LOW-ENERGY GAMMA DETECTOR[a] (cpm)	GAMMA DETECTOR[b] (cpm)	GAMMA DETECTOR[c] (μr/hr)	ALPHA DETECTOR[d] (cpm)
Background[e]	21 200	19 000	20	21
1	13 000	13 000	12	4
2	15 000	13 000	14	0
3	15 000	14 000	15	0
4	14 000	14 000	14	6
5	18 000	17 000	16	2
6	13 000	15 000	15	22
7	18 000	18 000	18	2
8	20 000	22 000	22	0
9	19 000	18 000	18	2
10	17 000	18 000	16	4
11	16 000	14 000	14	0
12	15 000	15 000	15	0

[a] FIDLER G-5 sodium iodide (NaI) scintillation detector.
[b] Ludlum 44-10™ NaI scintillation detector.
[c] Ludlum 19™ NaI scintillation survey (μR) meter.
[d] Ludlum 43-1™ zinc sulfide (ZnS) scintillation detector.
[e] Values are for the upper limit of the background range, which was determined as average plus three sigmas of measurements collected at several Los Alamos locations outside LANL boundaries

5.3.4.3 Field Screening

Samples were not screened for organic vapors. Samples were screened twice for radioactivity once in the field to meet worker health and safety requirements and again by the MRAL to meet analytical laboratories' requirements and DOT shipping requirements.

Results of soil screening for radiation indicated no samples had radiation levels greater than the action levels defined in the site-specific health and safety plan i.e., ≥500 cpm alpha radiation, or ≥5 000 cpm beta/gamma radiation, or ≥5 000 µR/hr gamma radiation (LANL 1994, 01-0024).

5.3.4.3 Soil Sampling

October 3, 1994, the field crew cleared the asphalt and collected samples from the top 6 in. of soil at the eight locations shown in Fig. 5.3.4-1. Of the 12 original locations radiologically surveyed at the satellite container storage area, PRS 21-028(e), a sample was collected at survey location 8 (sample location 21-2510) where gamma radiation levels were slightly greater than the upper limit of background. For a summary of samples collected, locations at which samples were collected, and analyses performed for each sample, see Table 5.3.4-2 and Fig. 5.3.4-2.

Sample collection logs note that the asphalt had deteriorated and small pieces of asphalt were probably collected along with each soil sample.

TABLE 5.3.4-2

SUMMARY OF SAMPLES COLLECTED AT PRS 21-028(e)

SAMPLE INFORMATION				ANALYTICAL SUITE AND REQUEST NUMBER				
LOCATION ID	SAMPLE ID	DEPTH (in.)	MATRIX	TAL[a] METALS	RAD[b]	MRAL[c] RAD	SVOCs[c]	VOCs[d]
21-2509	AAC0146	0–6	Soil	20246	20097	21323	19413	19413
21-2510	AAC0147	0–6	Soil	20246	20097	21323	19413	19413
21-2511	AAC0148	0–6	Soil	20246	20097	21323	19413	19413
21-2512	AAC0149	0–6	Soil	20246	20097	21323	19413	19413
Rinsate blank	AAC0155	n/a[f]	Water	20246	20097	21323	19413	19413
Field blank	AAC0156	n/a	Water	20246	NA[g]	NA	19413	19413
Trip blank	AAC0157	n/a	Water	NA	NA	NA	19413	19413

[a] TAL = Target analyte metals. Target analyte metals include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.
[b] RAD = Fixed laboratory radiological analyses. Radiological analyses include americium-241, tritium, plutonium isotopes, strontium-90, uranium and gamma-emitting isotopes. Percent moisture was also determined.
[c] MRAL = Mobile radiological analytical laboratory.
[d] SVOCs = Semivolatile organic compounds.
[e] VOCs = Volatile organic compounds.
[f] n/a = Not applicable.
[g] NA = Not analyzed.

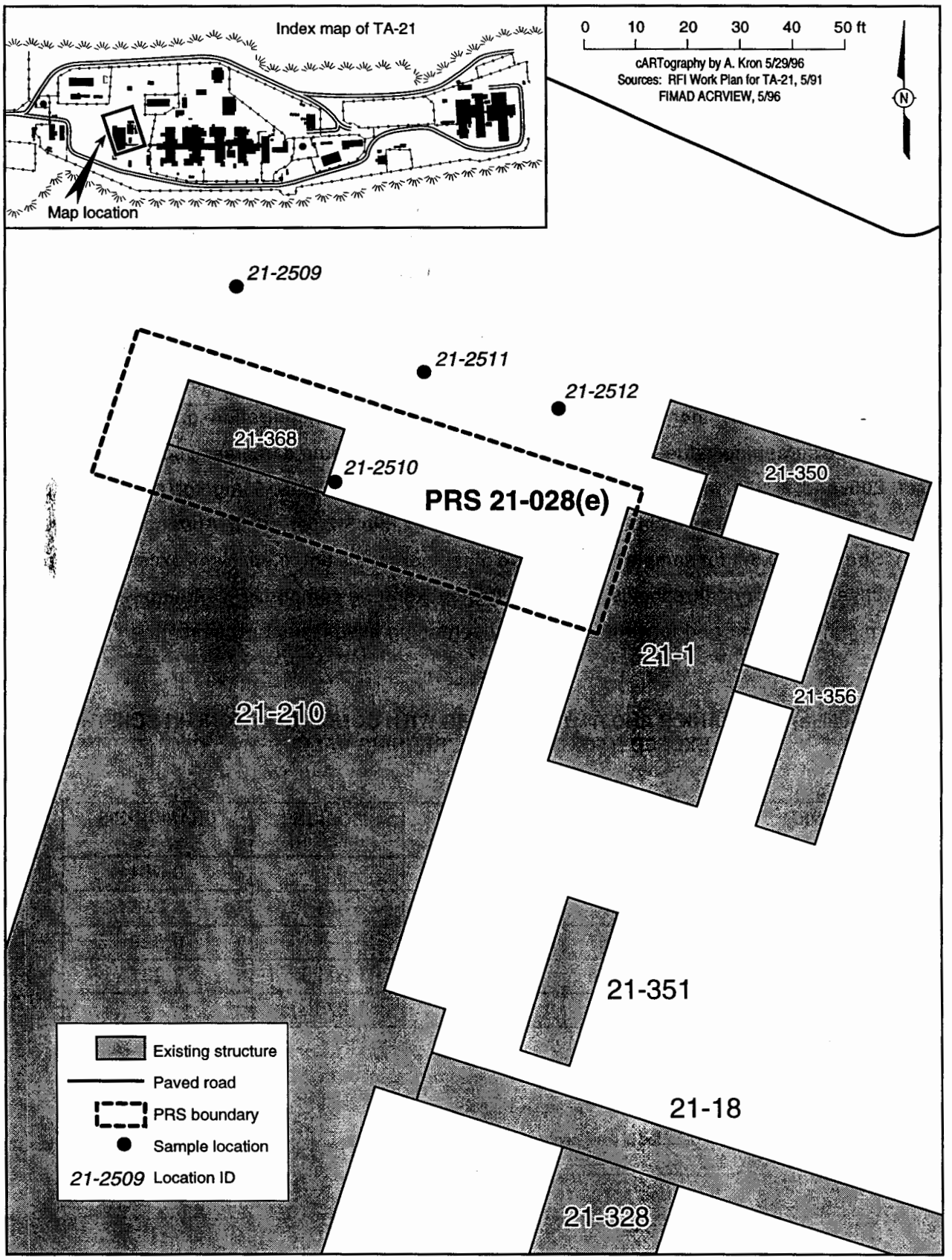

Fig. 5.3.4-2. PRS 21-028(e) sample locations.

5.3.5 Background Comparisons

5.3.5.1 Inorganics

Four soil samples collected from PRS 21-028(e) were analyzed for 24 inorganic chemicals [aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, uranium, vanadium, and zinc]. The data for chromium and nickel were rejected; therefore they can not be compared with background. However, they are eliminated from the COPC list because they are not expected to be present at the site. The analyses results from the remaining 22 inorganic chemicals were then compared with background screening values to identify any constituent that were present at concentrations greater than natural background. Sodium was the only inorganic constituents present at a concentration greater than its background screening value. Sodium was present in two of the four samples at concentrations of 1 200 and 1 270 mg/kg, which are above its UTL value of 915 mg/kg, as shown in Table 5.3.5-1. (All data associated with the samples in Table 5.2.5.1 are in Appendix D, Table D-1). See Fig. 5.3.5-1 for sample locations. No other inorganics detected in soil exceeded their respective background thresholds. Based on this background comparison, sodium is the only inorganic that was carried forward through the screening assessment process.

TABLE 5.3.5-1

PRS 21-028(e) INORGANICS AND RADIONUCLIDES WITH CONCENTRATIONS IN SOIL THAT EXCEED BACKGROUND SCREENING VALUES

LOCATION ID	SAMPLE ID	DEPTH (ft)	SODIUM (mg/kg)	URANIUM-235 (pCi/g)
UTL[a]	n/a[b]	n/a	915	0.084
SAL[c]	n/a	n/a	N/A[d]	10
21-2510	AAC0147	0-0.5	–[e]	0.339
21-2511	AAC0148	0-0.5	1 200(J)[f]	0.237
21-2512	AAC0149	0-0.5	1 270(J)	–

[a] UTL = Upper tolerance limit, background screening value.
[b] n/a = Not applicable.
[c] SAL = Screening action level.
[d] N/A = Not available.
[e] - = Analyte not detected or detected at a concentration less than UTL.
[f] J = Estimated quantity.

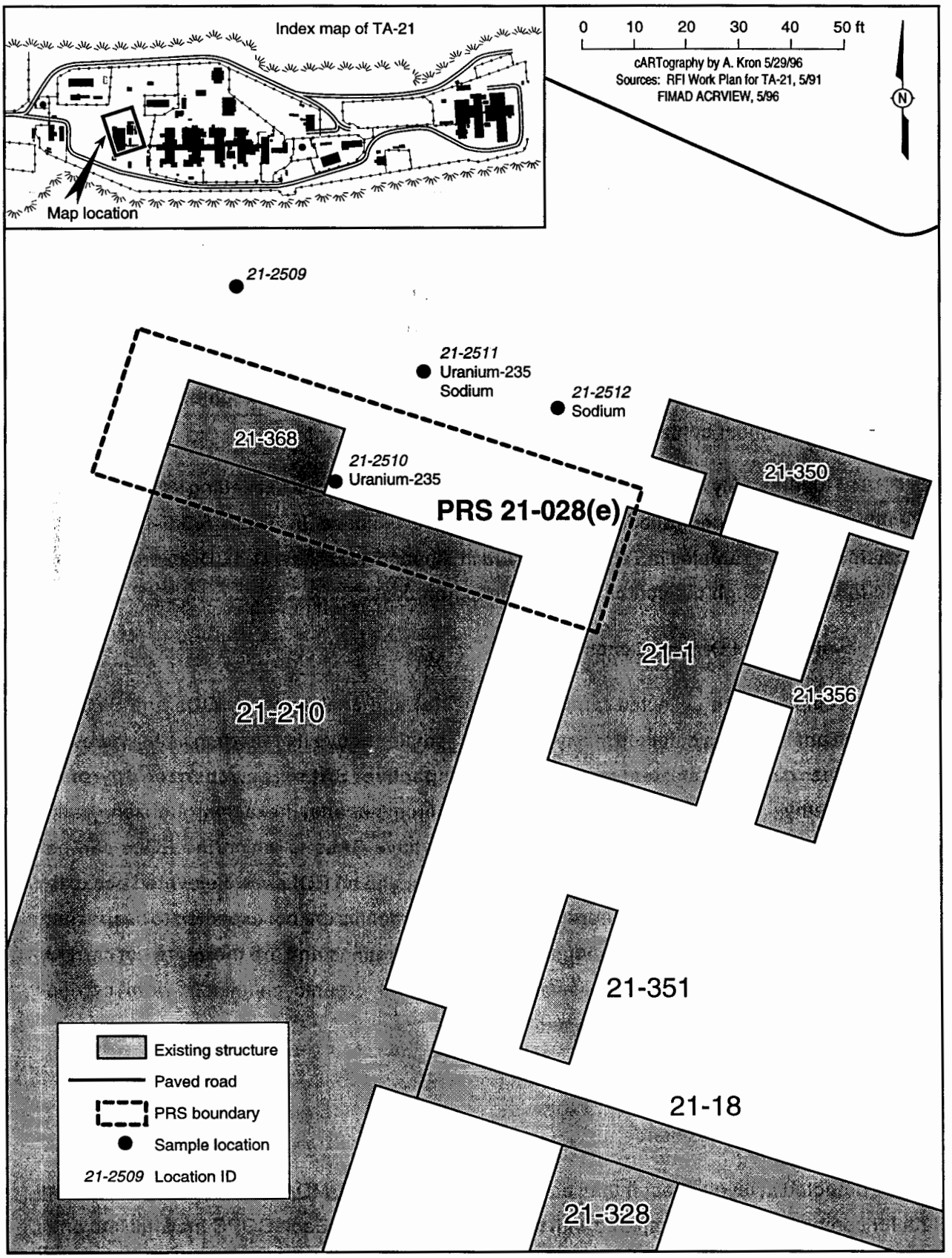

Fig. 5.3.5-1. PRS 21-028(e) sample locations with inorganics, organics, and radionuclides above background screening values.

5.3.5.2 Radionuclides

Six short-lived activation/fission products reported for PRS 21-028(e) include cerium-144, cesium-134, cobalt-57, manganese-54, ruthenium-106, and sodium-22. There were no reported parent concentrations of these radionuclides. All are eliminated as COPCs.

Daughters of naturally occurring radionuclides (uranium and thorium) that were reported for PRS 21-028(e) include actinium-228, bismuth-211, bismuth-212, bismuth-214, lead-210, lead-211, lead-212, lead-214, protactinium-231, protactinium-234, protactinium-234m, radium-223, radium-224, radon-219, thallium-208, thorium-227, and thorium-234. All sample values for lead-211, protactinium-234, and radon-219 were below MDA. The activity of the daughters was consistent with the parent activities; therefore, all daughter products are eliminated as potential contaminants.

For PRS 21-028(e), only uranium-235 was detected at concentrations exceeding its background screening value. Concentrations of uranium-235 are included in Table 5.3.5-1 (All data associated with the samples in Table 5.2.5.1 are in Appendix D, Table D-3). Uranium-235 was carried forward through the screening assessment process.

5.3.6 Evaluation of Organic Constituents

Four soil samples were collected from PRS 21-028(e) and analyzed for VOCs and SVOCs. None of the analytes was detected in any of the soil samples above its reporting limit. However, six organics had EQLs greater than their respective SALs (i.e., benzo(a)pyrene, bis-2-chloroethyl ether, dibenzo(a,h)anthracene, dibromoethane, hexachlorobenzene, and vinyl chloride). In addition, 30 other organics do not have SALs to which the EQLs can be compared. All were analyzed by standard EPA methods, and no EQLs were elevated because of dilutions to overcome matrix interferences. These 36 organics are not expected to be present at this site based on available knowledge of historical operations and are therefore not carried forward through the screening assessment process. No organic chemicals were carried forward through the screening assessment process.

5.3.7 Human Health Assessment

5.3.7.1 Screening Assessment

COPCs detected at levels greater than background UTLs, EQLs, MDAs, or with no background data for comparison were compared with their respective SALs. Each COPC may fall into one of the following categories: COPC detected at a concentration greater than or equal to its SAL, COPC has no SAL, or COPC was detected at a concentration below its SAL.

No chemicals fall into the greater than or equal to SAL category.

Sodium falls into the no SAL category because there is no calculated SAL. However, sodium is compared to the RDA for children and adults. The greatest concentration of sodium detected at PRS 21-028(e) was 1 270 mg/kg. At a soil ingestion rate of 200 mg/day for a child, the amount ingested per day would be approximately 0.3 mg. This amount is considerably less than the RDA of 46 mg/day. At a soil ingestion rate of 100 mg/day for an adult, the amount ingested per day would be approximately 0.1 mg. This amount is considerably less than the RDA of 500 mg/day. Therefore, sodium is eliminated as a COPC.

Only one chemical, uranium-235 was detected below SAL and it is therefore eliminated as a COPC.

At the conclusion of this screening assessment for PRS 21-028(e), no chemicals remain as COPCs.

5.3.7.2 Risk Assessment

No human health risk assessment was performed for PRS 21-028(e) because no COPCs were identified.

5.3.8 Ecological Assessment

In accordance with conversations between LANL ER Project personnel, NMED, and EPA Region 6 Officials, further ecological risk assessment at this site will be deferred until the site can be assessed as part of the new ecological exposure unit (Ecozone) methodology that is being developed by LANL in conjunction with EPA and the NMED.

5.3.8.1 Ecotoxicological Screening Assessment

No ecotoxicological screening assessment was performed for PRS 21-028(e) because of heavy urban and commercial development at the site.

5.3.8.2 Ecological Risk Assessment

No ecological risk assessment was necessary for PRS 21-028(e) because of heavy urban and commercial development at the site.

5.3.9 Extent of Contamination

Extent of contamination is not applicable for PRS 21-028(e) because no COPCs were retained by the human health screening assessment.

5.3.10 Conclusions and Recommendations

No chemicals resulting from activities at PRS 21-028(e) were retained as COPCs by the screening process. Therefore, PRS 21-028(e) is recommended for NFA based on LANL's NFA Criteria Policy, criterion 4 (which states that the PRS has been characterized in accordance with current applicable state or federal regulations, and that COPCs are not present in concentrations that would pose an unacceptable risk under the present and projected future land use).

6.0 REFERENCES

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APPENDIX A ANALYTICAL DATA

All analytical data are available in the Facility for Information Management, Analysis, and Display (FIMAD). If FIMAD is not accessible, data will be provided upon request. A hard copy of the data is available from the Records Processing Facility (RPF) under "Analytical Data for the Phase I Investigation for Technical Area (TA) 21, potential release sites (PRSs) 21-004(a-c) and 21-028(d,e).

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APPENDIX B DATA QUALITY EVALUATION TABLES

TABLE B-1

DATA QUALITY EVALUATION TABLE FOR PRSs 21-004(b,c)

REQUEST NUMBER	SAMPLE ID	MATRIX	ANALYTE SUITE	QUALITY CONTROL COMMENTS
19363	AAB9181	Soil	SVOCs[a]	1,2-dichlorobenzene qualified (R)[b] for recovery of <10% in QC[c] sample. Six analytes qualified (UJ)[d] for low recoveries in the QC sample (10–50%)
19363	AAB9184	Soil	SVOCs	1,2-dichlorobenzene qualified (R) for recovery of <10% in QC sample. Six analytes qualified (UJ) for low recoveries in the QC sample (10–50%)
19906	AAB9181	Soil	RAD[e]	Strontium-90 and tritium are qualified (J)[f] for low recoveries in the QC samples (40–50%, and 79% respectively). Uranium qualified (J) for low and high recoveries in the QC samples and for high variance in duplicate analyses.
19906	AAB9184	Soil	RAD	Plutonium-238, strontium-90, and tritium are qualified (J) for low recoveries in the QC samples (70%, 40–50%, and 79% respectively). Uranium qualified (J) for low and high recoveries in the QC samples and for high variance in duplicate analyses.
20239	AAB9181	Soil	TAL[g] metals	Mercury qualified (UJ) for missed holding times. Detects for vanadium, sodium, and potassium are qualified (J) for high recoveries in the LCS[h] and QC sample (>120%)

[a] SVOCs = Semivolatile organic compounds.
[b] R = Rejected quantity.
[c] QC = Quality control.
[d] UJ = Undetected estimated quantity.
[e] RAD = Radiochemical analyses. Radiological chemicals analyzed for these PRSs included americium-241, tritium, plutonium-238, plutonium-239, strontium-90, and total uranium. Sample analyses also included gamma-emitting isotopes by gamma scan and percent moisture.
[f] J = Estimated quantity.
[g] TAL = Target analyte list. TAL metals included aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.
[h] LCS = Laboratory control sample.

TABLE B-2

DATA QUALITY EVALUATION TABLE FOR PRS 21-028(d)

REQUEST NUMBER	SAMPLE ID	MATRIX	ANALYTE SUITE	QUALITY CONTROL COMMENTS
19413	AAC0150	Soil	SVOCs[a]	Twenty-one analytes are qualified (UJ)[b] for low recoveries in the QC[c] sample (10–50%).
19413	AAC0151	Soil	SVOCs	Twenty-one analytes are qualified (UJ) for low recoveries in the QC sample (10–50%).
19413	AAC0152	Soil	SVOCs	Twenty-one analytes are qualified (UJ) for low recoveries in the QC sample (10–50%).
19413	AAC0153	Soil	SVOCs	Twenty-one analytes are qualified (UJ) for low recoveries in the QC sample (10–50%).
19413	AAC0155	Water	SVOCs	Acid compound data are qualified (R)[d] for <10% surrogate recovery of 2-fluorophenol. All other data are valid.
19413	AAC0152	Soil	VOCs[e]	High surrogate recovery for BFB[f] (121%). There were no sample detects, therefore the data are n qualified. All data are valid without qualification. Methylene chloride found in method blank. EQL[g] was raised appropriately.
19413	AAC0153	Soil	VOCs	High surrogate recovery for BFB (131%). There were no sample detects, therefore the data are n qualified. All data are valid without qualification.
20097	AAC0150	Soil	RAD[h]	Strontium-90 and uranium qualified (J)[i] for low recovery in QC sample (57%). Tritium detects qualified (J) for high recovery in LCS[j] (126%).
20097	AAC0151	Soil	RAD	Strontium-90 and uranium qualified (J) for low recovery in QC sample (57%). Tritium detects qualified (J) for high recovery in LCS (126%).
20097	AAC0152	Soil	RAD	Strontium-90 and uranium qualified (J) for low recovery in QC sample (57%). Tritium detects qualified (J) for high recovery in LCS (126%).
20097	AAC0153	Soil	RAD	Strontium-90 and uranium qualified (J) for low recovery in QC sample (57%). Tritium detects qualified (J) for high recovery in LCS (126%).
20097	AAC0155	Water	RAD	Strontium-90 and uranium qualified (J) for low recovery in QC sample (57%). Tritium detects qualified (J) for high recovery in LCS (126%).
20246	AAC0150	Soil	TAL[k] metals	Mercury qualified (J) or (UJ) for missed holding time. Sodium detects qualified (J) for high recover in QC sample (125%). Chromium and nickel qualified (R) for <5% recovery in the QC sample.
20246	AAC0151	Soil	TAL metals	Mercury qualified (J) or (UJ) for missed holding time. Sodium detects qualified (J) for high recover in QC sample (125%). Chromium and nickel qualified (R) for <5% recovery in the QC sample.

TABLE B-2 (CONTINUED)

DATA QUALITY EVALUATION TABLE FOR PRS 21-028(d)

REQUEST NUMBER	SAMPLE ID	MATRIX	ANALYTE SUITE	QUALITY CONTROL COMMENTS
20246	AAC0152	Soil	TAL metals	Mercury qualified (J) or (UJ) for missed holding time. Sodium detects qualified (J) for high recove in QC sample (125%). Chromium and nickel qualified (R) for <5% recovery in the QC sample.
20246	AAC0153	Soil	TAL metals	Mercury qualified (J) or (UJ) for missed holding time. Sodium detects qualified (J) for high recove in QC sample (125%). Chromium and nickel qualified (R) for <5% recovery in the QC sample.
20246	AAC0155	Water	TAL metals	Mercury qualified (J) or (UJ) for missed holding time. Sodium detects qualified (J) for high recove in QC sample (125%).
20246	AAC0156	Water	TAL metals	Mercury qualified (J) or (UJ) for missed holding time. Sodium detects qualified (J) for high recove in QC sample (125%). Chromium and nickel qualified (R) for <5% recovery in the QC sample.

[a] SVOCs = Semivolatile organic compounds.
[b] UJ = Undetected estimated quantity.
[c] QC = Quality control.
[d] R = Rejected quantity.
[e] VOCs = Volatile organic compounds.
[f] BFB = Bromofluorobenzene.
[g] EQL = Estimated quantitation limit.
[h] RAD = Radiochemical analyses. Radiological chemicals analyzed for these PRSs included americium-241, tritium, plutonium-238, plutonium-239, strontium-90, and total uranium. Sample analyses also included gamma-emitting isotopes by gamma scan and percent moisture.
[i] J = Estimated quantity.
[j] LCS = Laboratory control sample.
[k] TAL = Target analyte list. TAL metals included aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

TABLE B-3

DATA QUALITY EVALUATION TABLE FOR PRS 21-028(e)

REQUEST NUMBER	SAMPLE ID	MATRIX	ANALYTE SUITE	QUALITY CONTROL (QC) COMMENTS
19413	AAB9193	Soil	SVOCs[a]	Twenty-one analytes are qualified (UJ)[b] for low recoveries in the QC[c] sample (10–50%).
19413	AAC0146	Soil	SVOCs	Twenty-one analytes are qualified (UJ) for low recoveries in the QC sample (10–50%).
19413	AAC0147	Soil	SVOCs	Twenty-one analytes are qualified (UJ) for low recoveries in the QC sample (10–50%).
19413	AAC0148	Soil	SVOCs	Twenty-one analytes are qualified (UJ) for low recoveries in the QC sample (10–50%).
19413	AAC0149	Soil	SVOCs	Twenty-one analytes are qualified (UJ) for low recoveries in the QC sample (10–50%).
19413	AAC0146	Soil	VOCs[d]	High surrogate recovery for BFB[e] (126%). There were no sample detects, therefore the data are n qualified. All data are valid without qualification.
20097	AAB9193	Soil	RAD[f]	Strontium-90 and uranium qualified (J)[g] for low recovery in QC sample (57%). Tritium detects qualified (J) for high recovery in LCS[h] (126%).
20097	AAC0146	Soil	RAD	Strontium-90 and uranium qualified (J) for low recovery in QC sample (57%). Tritium detects qualified (J) for high recovery in LCS (126%).
20097	AAC0147	Soil	RAD	Strontium-90 and uranium qualified (J) for low recovery in QC sample (57%). Tritium detects qualified (J) for high recovery in LCS (126%).
20097	AAC0148	Soil	RAD	Strontium-90 and uranium qualified (J) for low recovery in QC sample (57%). Tritium detects qualified (J) for high recovery in LCS (126%).
20097	AAC0149	Soil	RAD	Strontium-90 and uranium qualified (J) for low recovery in QC sample (57%). Tritium detects qualified (J) for high recovery in LCS (126%).
20246	AAB9193	Soil	TAL[i] metals	Mercury qualified (J) or (UJ) for missed holding time. Sodium detects qualified (J) for high recover in QC sample (125%). Chromium and nickel qualified (R)[j] for <5% recovery in the QC sample.
20246	AAC0146	Soil	TAL metals	Mercury qualified (J) or (UJ) for missed holding time. Sodium detects qualified (J) for high recover in QC sample (125%). Chromium and nickel qualified (R) for <5% recovery in the QC sample.
20246	AAC0147	Soil	TAL metals	Mercury qualified (J) or (UJ) for missed holding time. Sodium detects qualified (J) for high recover in QC sample (125%). Chromium and nickel qualified (R) for <5% recovery in the QC sample.
20246	AAC0148	Soil	TAL metals	Mercury qualified (J) or (UJ) for missed holding time. Sodium detects qualified (J) for high recover in QC sample (125%). Chromium and nickel qualified (R) for <5% recovery in the QC sample.

TABLE B-3 (CONTINUED)

DATA QUALITY EVALUATION TABLE FOR PRS 21-028(e)

REQUEST NUMBER	SAMPLE ID	MATRIX	ANALYTE SUITE	QUALITY CONTROL (QC) COMMENTS
20246	AAC0149	Soil	TAL metals	Mercury qualified (J) or (UJ) for missed holding time. Sodium detects qualified (J) for high recover in QC sample (125%). Chromium and nickel qualified (R) for <5% recovery in the QC sample.

[a] SVOCs = Semivolatile organic compounds.
[b] UJ = Undetected estimated quantity.
[c] QC = Quality control.
[d] VOCs = Volatile organic compounds.
[e] BFB = Bromofluorobenzene.
[f] RAD = Radiochemical analyses. Radiological chemicals analyzed for these PRSs included americium-241, tritium, plutonium-238, plutonium-239, strontium-90, and total uranium. Sample analyses also included gamma-emitting isotopes by gamma scan and percent moisture.
[g] J = Estimated quantity.
[h] LCS = Laboratory control sample.
[i] TAL = Target analyte list. TAL metals included aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.
[j] R = Rejected quantity.

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APPENDIX C RISK ASSESSMENT CALCULATIONS

No risk assessment was performed for potential release sites 21-004(a-c) or 21-028(d,e).

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APPENDIX D SAMPLE DATA TABLES

The following inorganic and radionuclide analyses data tables provide all data for all samples with one or more analytes greater than background screening values. The organic analyses data tables provide all data for all samples with one or more analytes greater than the estimated quantitation limit (EQL). Tables showing only those concentrations of inorganic and radionuclide analytes greater than background screening values and concentrations of organic analytes greater than EQLs, are in Section 5.0 of this RFI report.

TABLE D-1

PRS 21-028(d) INORGANICS AND RADIONUCLIDES WITH CONCENTRATIONS IN SOIL THAT EXCEED BACKGROUND SCREENING VALUES

LOCATION ID	SAMPLE ID	DEPTH (ft)	CALCIUM (mg/kg)	COPPER (mg/kg)	LEAD (mg/kg)	MERCURY (mg/kg)	SODIUM (mg/kg)	URANIUM (mg/kg)	ZINC (mg/kg)	URANIUM-235 (pCi/g)	TRITIUM (pCi/g)
UTL[a]	n/a[b]	n/a	6 120	15.5	23.3	0.1	915	5.45	50.8	0.084	0.82
SAL[c]	n/a	n/a	N/A[d]	2 800	400	23	N/A	230	2 300	10	260
21-2513	AAB9193	0-0.5	6 290	17	28.2	<0.1[e](UJ)[f]	2 100(J)[g]	2.5(J)	172	0.059	54.90(J)
21-2513	AAC0150	0-0.5	6 390	18.2	19.6	0.22(J)	2 230(J)	1.59(J)	138	0.255	64.88(J)
21-2514	AAC0151	0-0.5	2 360	34.5	39.7	0.27(J)	<713	1.58(J)	106	0.22	130.15(J)
21-2515	AAC0152	0-0.5	<718	<4.5	7.7	0.34(J)	1 360(J)	13.8(J)	29.5	0.0072	60.64(J)
21-2516	AAC0153	0-0.5	6 420	10.1	13.2	<0.09(UJ)	1 400(J)	1.49(J)	43.6`	0.123	1.77(J)

[a] UTL = Upper tolerance limit. UTL is the background screening value.
[b] n/a = Not applicable.
[c] SAL = Screening action level.
[d] N/A = Not available.
[e] All values preceeded by < denote analyte was not detected above the detection limit. The numerical value specifies the detection limit.
[f] UJ = Undetected estimated quantity.
[g] J = Estimated quantity.

TABLE D-2

PRS 21-028(d) ORGANICS WITH CONCENTRATIONS IN SOIL THAT EXCEED EQLs[a]

LOCATION ID	SAMPLE ID	BENZO(B)FLUORANTHENE (mg/kg)	FLUORANTHENE (mg/kg)	PHENANTHRENE (mg/kg)	PYRENE (mg/kg)
SAL[b]	n/a[c]	0.61	2 600	N/A[d]	2 000
21-2513	AAB9193	0.38	0.87	0.81	0.74(J)[e]
21-2513	AAC0150	<0.36[f]	0.57	0.49	0.51(UJ)[g]
21-2514	AAC0151	<0.35	<0.35	<0.35	<0.35(UJ)
21-2515	AAC0152	<0.36	<0.36	<0.36	<0.36(UJ)
21-2516	AAC0153	<0.35	<0.35	<0.35	<0.35(UJ)

[a] EQLs = Estimated quantitation limits.
[b] SAL = Screening action level.
[c] n/a = Not applicable.
[d] N/A = Not available.
[e] J = Estimated quantity.
[f] All values preceeded by < denote analyte was not detected above the detection limit. The numerical value specifies the detection limit.
[g] UJ = Undetected estimated quantity.

TABLE D-3

PRS 21-028(e) INORGANICS AND RADIONUCLIDES WITH CONCENTRATIONS IN SOIL THAT EXCEED BACKGROUND SCREENING VALUES

LOCATION ID	SAMPLE ID	DEPTH (ft)	SODIUM (mg/kg)	URANIUM-235 (pCi/g)
UTL[a]	n/a[b]	n/a	915	0.084
SAL[c]	n/a	n/a	N/A[d]	10
21-2509	AAC0146	0-0.5	<869[e]	0.043
21-2510	AAC0147	0-0.5	<841	0.339
21-2511	AAC0148	0-0.5	1 200(J)[f]	0.237
21-2512	AAC0149	0-0.5	1 270(J)	-0.0186

[a] UTL = Upper tolerance limit. UTL is the background screening value.
[b] n/a = Not applicable.
[c] SAL = Screening action level.
[d] N/A = Not available.
[e] All values preceeded by < denote analyte was not detected above the detection limit. The numerical value specifies the detection limit.
[f] J = Estimated quantity.