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FEB - 5 1996

Date: January 29, 1996
Refer to: EM/ER:96-033

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

SUBJECT: SAMPLING AND ANALYSIS PLANS FOR POTENTIAL RELEASE SITES (PRSs) 21-024(i), 21-024(c), AND 21-027(a)

Dear Mr. Neleigh:

The sampling plans are attached and are submitted in response to Comment 2 of the Notice of Deficiency (NOD) for former Operable Unit 1106, Resource Conservation and Recovery Act Facility Reports 1B, 1C and Addendum 1B - 1C. Los Alamos National Laboratory committed to submitting these three detailed Phase II Sampling and Analysis Plans by January 31, 1996. (An extension of time was requested and granted from the original due date of November 30, 1995 and the plans have undergone Laboratory and Department of Energy review.

If you have any questions, please call Garry Allen (505) 667-3394 or Bonnie Koch (505) 665-7202.

Sincerely,

Jorg Jansen, Program Manager
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CERTIFICATION

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

Document Title: **SAMPLING AND ANALYSIS PLANS FOR POTENTIAL RELEASE SITES (PRSs) 21-024(i), 21-024(c), AND 21-027(a)**

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Sampling and Analysis Plan for

Potential Release Site
21-024(i)
Septic System and Outfall

Field Unit 1

Environmental Restoration Project

January 1996

A Department of Energy
Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

LA-UR-95-4259

CONTENTS

EXECUTIVE SUMMARY iii

1.0 INTRODUCTION 1

1.1 Description and History 1

1.2 Physical Setting 4

2.0 OBJECTIVES AND APPROACH 4

2.1 Outfall Area 4

2.2 Septic Tank 5

3.0 SAMPLING AND ANALYSIS PLAN 6

3.1 Geodetic Survey 6

3.2 Field Survey 6

3.3 Field Screening 6

3.4 Sample Locations and Methods 7

3.4.1 Outfall Area 7

3.4.2 Septic Tank 10

3.4.2.1 Tank Interior 10

3.4.2.2 Tank Exterior 10

3.5 Laboratory Analyses 10

4.0 REFERENCES 12

LIST OF TABLES

Table 1 Phase II Sample Analyses for PRS 21-024(i) 8

LIST OF FIGURES

Fig. 1. Location of PRS 21-024(i). 2

Fig. 2. Locations of Phase I samples, Phase II survey grid, and proposed Phase II sample locations for PRS 21-024(i). 3

EXECUTIVE SUMMARY

This sampling and analysis plan describes the Phase II Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) at potential release site (PRS) 21-024(i), a septic system at Technical Area (TA) 21 that routed sewage from building TA-21-152, through a concrete septic system (abandoned in place in 1965), and to the surface at the southeast portion of building TA-21-209. A Phase I RFI conducted during 1992 and 1993 identified arsenic, lead, barium, chromium, vanadium, plutonium-239, uranium-234, uranium-235, and uranium-238 at concentrations above background in the outfall area and arsenic above SAL. A single borehole was drilled and sampled in an effort to characterize the area outside the septic tank. (Although radionuclides are not regulated under RCRA, they will be addressed in this sampling and analysis plan.) The objectives of Phase II sampling at PRS 21-024(i) are to 1) collect data necessary to determine the vertical and lateral extent of contamination in the outfall area, 2) collect data necessary to identify potential contamination on the interior and exterior of the septic tank and to determine the extent of contamination if any and, 3) collect data to support a risk assessment. The results of the risk assessment at the outfall area will be used to propose the site for no further action or to develop an appropriate corrective action.

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1.0 INTRODUCTION

This sampling and analysis plan describes the proposed Phase II Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) sampling at Potential Release Site (PRS) 21-024(i). This plan will be used in conjunction with the Technical Area (TA) 21 (Operable Unit 1106) RFI Work Plan (LANL 1991, 0689) and site-specific documents that outline activities (such as waste management and health and safety) associated with the Phase II RFI sampling.

1.1 Description and History

PRS 21-024(i) is a solid waste management unit (SWMU) listed in the Hazardous and Solid Waste Amendments (HSWA) Module of Los Alamos National Laboratory's (LANL's) RCRA Part B operating permit. PRS 21-024(i) is a septic system that routed sewage from building TA-21-152, beneath building TA-21-209 through a concrete septic system (abandoned in place in 1965), and to the surface at the southeast portion of TA-21-209 (Fig. 1). Blow-down from cooling towers at buildings TA-21-166 and TA-21-167 was also routed to this septic system. Effluent was discharged via a 6-in. vitrified-clay pipe (VCP) into a concrete septic tank (5 ft x 10 ft x unknown depth), then flowed through a 6-in. VCP onto a broad, gentle slope about 30 ft from the south edge of DP Mesa. Additional information is available in the RFI Work Plan for Operable Unit 1106 (LANL 1991, 0689).

Initial reconnaissance sampling was conducted at PRS 21-024(i) in 1988. Phase I activities at PRS 21-024(i) were conducted in 1992 and 1993 and included radiation surveys, surface and shallow subsurface sampling in the upper outfall area, and subsurface borehole sampling adjacent to the suspected septic tank location (Fig. 2). Samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, pesticides, polychlorinated biphenyls (PCBs), americium-241, cesium-137 (by gamma spectroscopy), isotopic plutonium, radium-226 (by gamma spectroscopy), strontium-90, isotopic thorium, isotopic uranium, total uranium, and tritium. The results are presented in detail in two RFI reports for TA-21 (LANL 1994, 1260; LANL 1995, 1261).

Results of the laboratory analyses for RCRA constituents indicate that only arsenic exists in the outfall area at concentrations greater than its screening action level (SAL). In the case of arsenic, the SAL is the upper tolerance limit of the background concentration. The extent of the arsenic contamination was not determined (EPA 1995, 01-0016). Figure 2 identifies the location of arsenic detected at levels exceeding SAL. Lead, barium, chromium, and vanadium are also considered chemicals of potential concern (COPCs) for the outfall area based on the results of a multiple constituent evaluation (LANL 1995, 1261) and will be further assessed in the Phase II investigation.

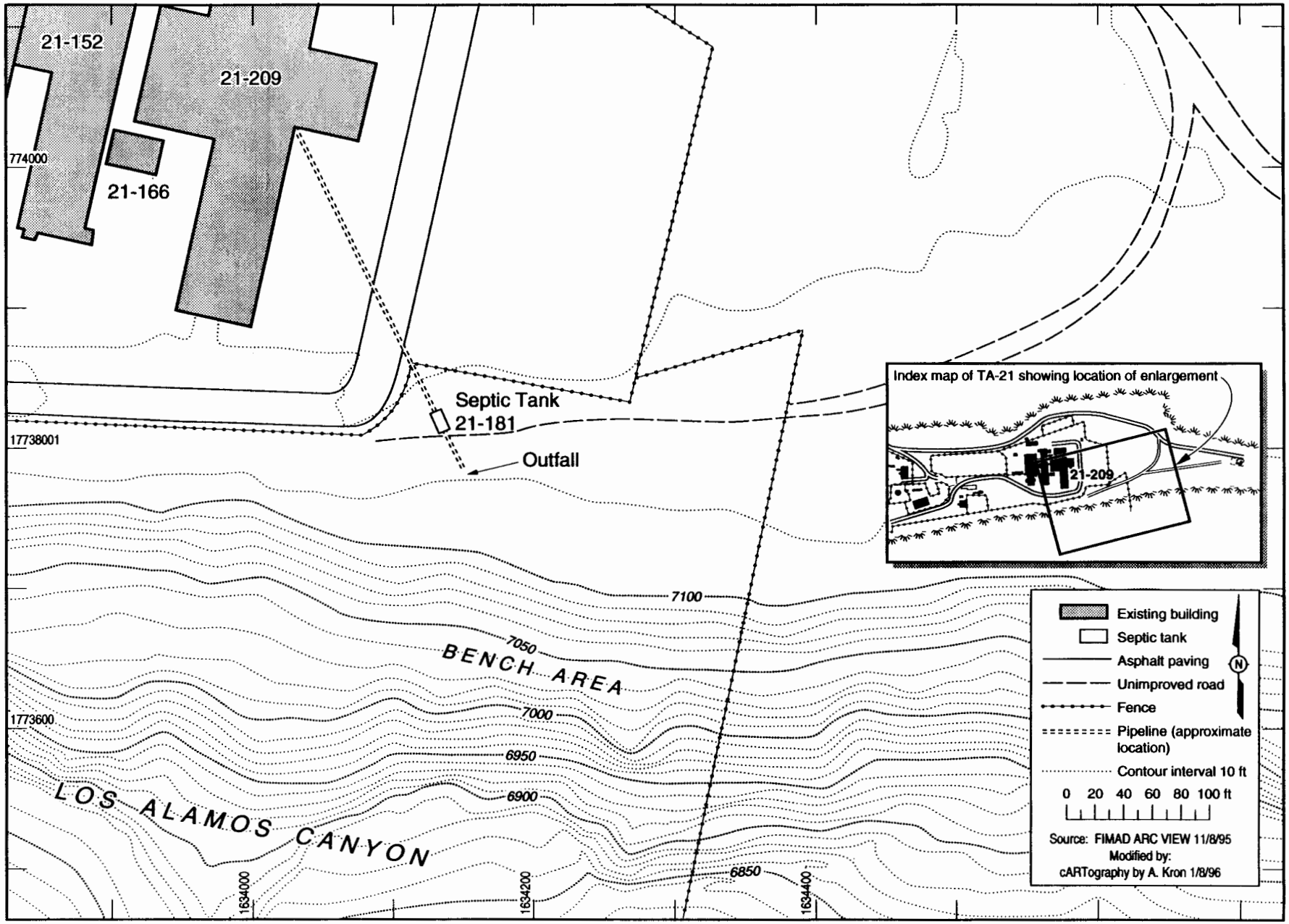

Fig. 1. Location of PRS 21-024(i).

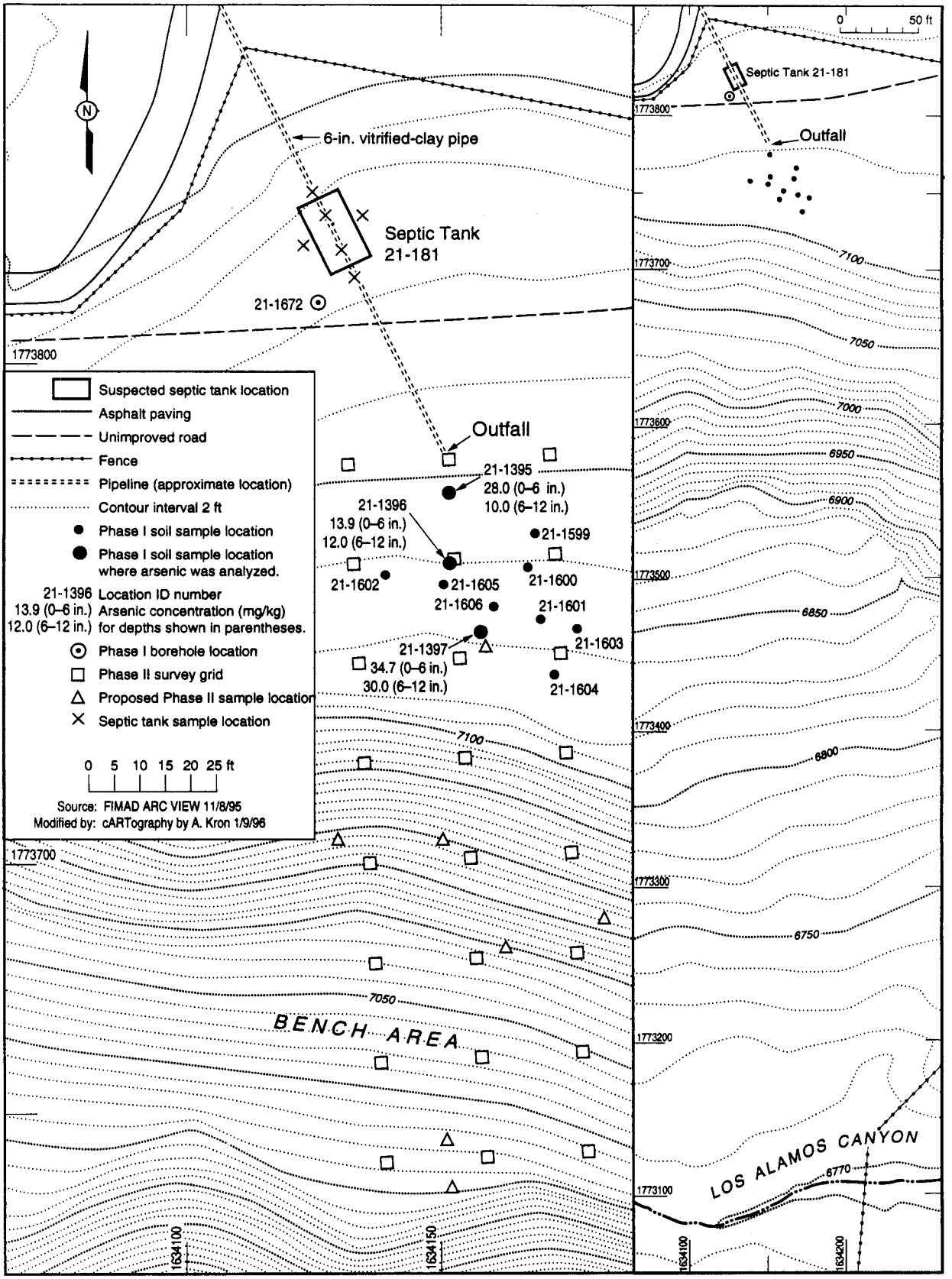

Fig. 2. Locations of Phase I samples, Phase II survey grid, and proposed Phase II sample locations for PRS 21-024(i).

Radioactive contamination was also detected in the outfall area. Plutonium-239, total uranium, and tritium were present at concentrations above background. Tritium was detected in a borehole drilled in the vicinity of the septic tank (LANL 1995, 1261). Tritium will be investigated as part of the Phase II sampling. Results of previous surface radiation surveys indicate the presence of significant alpha radiation within the drainage channel in the outfall area, but laboratory analyses did not identify sufficient concentrations of piutonium, uranium, thorium, or americium isotopes to be responsible for the alpha radioactivity measured in the area. Newly obtained historical information and further assessment of the gamma spectrometry data has lead to the preliminary conclusion that actinium-227 and its decay series progeny may be present in the outfall area and may be the source of the high alpha radioactivity.

1.2 Physical Setting

The entire septic system is believed to be in place. The exact location of the septic tank has not been confirmed. Based on engineering drawing ENG-R 1196, it is suspected to be located on the mesa top approximately 50 ft upgradient from the discharge point (Fig. 2).

The outfall pipe associated with PRS 21-024(i) discharged onto a gentle, mesa-top slope approximately 30 ft from the south edge of DP Mesa (Fig. 1). This slope is characterized by bedrock and small areas of very thin sediment accumulation and no vegetation. This gentle slope descends to a steep bedrock cliff (approximately 40 ft high) and eventually to a large, shallow, sloping bench (approximately 50 ft wide) that accommodates broader areas of sediment accumulation. The next cliff descends steeply, approximately 250 ft to the floor of Los Alamos Canyon. The drainage on the upper cliff and upper portion of the bench is well defined, but eventually spreads out onto the bench. Where the drainage is well defined, very little sediment is present.

2.0 OBJECTIVES AND APPROACH

2.1 Outfall Area

The Phase II sampling at PRS 21-024(i) is designed to collect data necessary to meet three primary objectives. The objectives are to characterize the drainage by collecting data necessary to bound the lateral and vertical extent of contamination in the outfall area, collecting data necessary to identify potential contamination, and collecting data to support a risk assessment. The conceptual exposure model upon which this risk assessment will be based is discussed in detail in Appendix K of the Installation Work Plan (LANL 1993, 1017).

The conceptual model for contaminant transport in the outfall area of PRS 21-024(i) is that historical and present migration of contaminants, both radioactive and inorganic chemicals, is dominated by physical redistribution of sediment on the slope rather than dissolution and precipitation of contaminants. Sediment (and contaminant) transport may also result in burial of contaminants and may require evaluation of contamination at depth. (Although radionuclides are not regulated under RCRA, they will be addressed in this sampling and analysis plan.)

Data from the Phase II investigation will supplement the Phase I data. Results of the risk assessment will be used to propose the site for no further action (NFA) or to develop an appropriate corrective action.

The approach to Phase II sampling and analysis in the outfall area at PRS 21-024(i) is a tiered approach, which relies on a large amount of field survey data, a lesser amount of field screening data, and a limited amount of analytical laboratory data for site characterization decisions. This approach, which is described in detail in Section 3, has been applied at other TA-21 drainage areas (LANL 1995, 01-018). The lateral extent of contamination will be evaluated from the outlet of the vitrified-clay pipe, into Los Alamos Canyon, and to the bottom of the slope. The vertical extent of contamination will be evaluated from each 6-in. interval of sediment. The initial 6-in. interval of tuff will also be evaluated. If contamination is found in tuff samples, the conceptual model for contaminant transport will be reconsidered. Results from all surveying, screening, and laboratory analysis will be used to bound the lateral and vertical extent of contamination and to support a recreational risk assessment of the drainage area.

2.2 Septic Tank

The objective of the sampling at the septic tank is to identify contaminants present in the septic tank and to determine if any releases have occurred from the septic tank. The resulting data will be used to propose the site for NFA or corrective action or to determine if further sampling is required. The data may also be used to address waste management issues in the event that the septic system or its contents are removed as part of a corrective action. The conceptual model for contaminant transport associated with the septic tank assumes that historical release of contaminants would be associated with releases from the septic tank either from leaks (through cracks) or overflow.

The sampling and analysis approach at the septic tank focuses on investigating the contents of the tank and the material (soil or tuff) surrounding the base of the tank.

3.0 SAMPLING AND ANALYSIS PLAN

3.1 Geodetic Survey

Licensed surveyors will mark a survey grid 20 ft on either side of the outfall pipe's outlet and at 20-ft intervals downslope to the southern edge of the bench. After samples have been collected for laboratory analyses, surveyors will provide New Mexico state planar coordinates for these sample locations. Surveys will be conducted in accordance with LANL-ER-SOP-03.01, R1, ICN, Land Surveying Procedures (LANL 1993, 0875).

3.2 Field Survey

A field survey for radiation will be conducted using an alpha probe, a field instrument for detection of low-energy radiation (FIDLER), and a Geiger-Mueller (beta/gamma) probe. These radiological survey data will be collected at a minimum of 100 locations, including geodetic survey grid points, sediment accumulation areas, and locations that will assist in bounding the lateral extent of contamination. At these locations, the radiation instrument readings and distance from the geodetic survey stakes will be recorded.

Radiological surveys will be conducted, in part, 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).

3.3 Field Screening

To achieve greater resolution of field radiological survey results, field screening data will be obtained on samples collected at 6-in. depth intervals (0-to-6 in., 6-to-12 in., etc., of soil; when tuff is reached, 0-to-6 in. of tuff). Samples will be screened for radioactivity using an alpha probe with increased count times. To confirm the conceptual model for contaminant transport, samples will also be screened for inorganic contaminants using X-ray fluoresence (XRF) analysis in a mobile laboratory. These samples will be collected at a minimum of 20 locations that include sediment accumulation areas, locations that bound contamination, locations where radioactivity is maximal, and locations where radioactivity is intermediate between

background and the maximum. XRF screening results will be used to make a preliminary determination of the extent of inorganic contamination. If the XRF results indicate that inorganic contaminants, primarily arsenic, are bounded by the area of radiological contamination, no additional XRF measurements will be made. If the XRF results indicate otherwise, additional XRF screening will be conducted to determine the extent of inorganic contamination.

3.4 Sample Locations and Methods

3.4.1 Outfall Area

The location of samples selected for laboratory analyses will be determined by results of the field radiological survey, radiological screening measurements, and XRF screening results (Table 1). Proposed sample locations are shown in Fig. 2. To characterize the area where contamination is present and to determine vertical extent of contamination, a minimum of 9 samples (three 6-in. intervals at three locations) will be collected at locations where field screening results are maximal, and locations where field screening results are intermediate between background and the maximum. To bound the lateral extent of contamination, a minimum of 9 samples (three 6-in. intervals at three locations) will be collected from the west, east, and south boundaries of the drainage channels. These sample locations will be determined by field screening to represent background for the site. Additionally, to specifically address the vertical extent of arsenic contamination, samples will be collected at depth in the area known to have elevated arsenic levels and immediately downslope of Phase I sample location 21-1397, the location with the highest arsenic concentration (Fig. 2). Soil samples will be collected from 6-in. intervals until tuff is reached according to LANL-ER-SOP-6.09, R0, ICN2, Spade and Scoop Method for Collection of Soil Samples. When tuff is reached, a tuff sample will be collected in the first 6 in. using LANL-ER-SOP-6.10, R0, Hand Auger and Thin-Wall Tube Sampler.

TABLE 1

PHASE II SAMPLE ANALYSES FOR PRS 21-024(i)

		FIELD SURVEY		FIELD SCREENING			FIELD LABORATORY ANALYSIS				FIXED LABORATORY ANALYSIS								
Sample number	Sample depth	Geodetic survey	Radiological survey	Alpha radiation	Beta/gamma radiation	Volatile organic compounds	Gross alpha radiation	Gross beta radiation	Gross gamma radiation	X-ray fluorescence	Gamma spectroscopy	Gross beta radiation	Isotopic plutonium	Isotopic uranium	Isotopic thorium	Tritium	Metals	Volatile organic compounds	Semivolatile organic compounds
Outfall area																			
West boundary of drainage channels																			
1	0-6 in.	X[a]	X	X			X	X	X	C[b]	X	X	X	X	X	X	X		
2	6-12 in.			X			X	X	X	C	X	X	X	X	X	X	X		
3	0-6 in. (tuff)			X			X	X	X	C	X	X	X	X	X	X	X		
East boundary of drainage channels																			
1	0-6 in.	X	X	X			X	X	X	C	X	X	X	X	X	X	X		
2	6-12 in.			X			X	X	X	C	X	X	X	X	X	X	X		
3	0-6 in. (tuff)			X			X	X	X	C	X	X	X	X	X	X	X		
South boundary of drainage channels																			
1	0-6 in.	X	X	X			X	X	X	C	X	X	X	X	X	X	X		
2	6-12 in.			X			X	X	X	C	X	X	X	X	X	X	X		
3	0-6 in. (tuff)			X			X	X	X	C	X	X	X	X	X	X	X		
Below sample location 21-1397																			
1	0-6 in.	X	X	X			X	X	X	C	X	X	X	X	X	X	X		
2	6-12 in.			X			X	X	X	C	X	X	X	X	X	X	X		
3	0-6 in. (tuff)			X			X	X	X	C	X	X	X	X	X	X	X		
Additional locations, within drainage channels																			
1	0-6 in.	X	X	X			X	X	X	C	X	X	X	X	X	X	X		
2	6-12 in.			X			X	X	X	C	X	X	X	X	X	X	X		
3	0-6 in. (tuff)			X			X	X	X	C	X	X	X	X	X	X	X		
4	0-6 in.	X	X	X			X	X	X	C	X	X	X	X	X	X	X		
5	6-12 in.			X			X	X	X	C	X	X	X	X	X	X	X		
6	0-6 in. (tuff)			X			X	X	X	C	X	X	X	X	X	X	X		
7	0-6 in.	X	X	X			X	X	X	C	X	X	X	X	X	X	X		
8	6-12 in.			X			X	X	X	C	X	X	X	X	X	X	X		
9	0-6 in. (tuff)			X			X	X	X	C	X	X	X	X	X	X	X		

TABLE 1 (CONTINUED)

PHASE II SAMPLE ANALYSES FOR PRS 21-024(i)

		FIELD SURVEY		FIELD SCREENING			FIELD LABORATORY ANALYSIS				FIXED LABORATORY ANALYSIS								
Sample number	Sample depth	Geodetic survey	Radiological survey	Alpha radiation	Beta/gamma radiation	Volatile organic compounds	Gross alpha radiation	Gross beta radiation	Gross gamma radiation	X-ray fluorescence	Gamma spectroscopy	Gross beta radiation	Isotopic plutonium	Isotopic uranium	Isotopic thorium	Tritium	Metals	Volatile organic compounds	Semivolatile organic compounds
Septic Tank Interior[c]																			
Bottom of borehole																			
1	7-8 ft	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
2	7-8 ft			X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Additional locations in borehole, as necessary																			
1	0-7 ft			C	C	C	C	C	C		C	C	C	C	C	C	C	C	C
2	0-7 ft			C	C	C	C	C	C		C	C	C	C	C	C	C	C	C
Septic Tank Exterior[c]																			
East of tank																			
1	8-9 ft	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
2	0-8 ft			C	C	C	C	C	C		C	C	C	C	C	C	C	C	C
West of tank																			
1	8-9 ft	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
2	0-8 ft			C	C	C	C	C	C		C	C	C	C	C	C	C	C	C
South of tank																			
1	8-9 ft	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
2	0-8 ft			C	C	C	C	C	C		C	C	C	C	C	C	C	C	C

[a] X = Planned sample.
[b] C = Contingency sample.
[c] Septic tank is assumed to be 8 ft deep and septic tank base assumed to be 1 ft below ground surface.

3.4.2 Septic Tank

3.4.2.1 Tank Interior

The location of the septic tank will be determined using either geophysical techniques or excavation with hand tools or a backhoe.

Based on common septic tank abandonment practices at TA-21, the septic tank is likely to contain fill material and sludge. The septic tank is expected to have a single baffle across the bottom and two access ports in the lid, one for each side of the tank. Soil overlying the tank will be removed with hand-held tools or with a backhoe to access the entry ports. Four samples will be collected from material found inside the septic tank using LANL-ER-SOP-6.10, R0, Hand Auger and Thin-Wall Tube Sampler. Figure 2 illustrates the proposed sampling locations. One sample will be collected in each auger hole from material (sludge) recovered from the bottom of the tank, and a second sample will be selected from each auger hole based on evidence of visual staining and VOC and radiation field-screening results. During this sampling, the depth of the tank will be determined.

3.4.2.2 Tank Exterior

During the Phase I RFI, a borehole was drilled adjacent to the suspected septic tank location and sampled. The proximity of the borehole to the tank will be assessed when the location of the septic tank is confirmed. In order to characterize any releases from the septic tank, four samples will be collected from materials (soil or tuff) near the base of the septic tank using LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler, or another appropriate method. Along each side of the septic tank, one borehole will be augered from the surface to approximately one foot below the base of the septic tank. Figure 2 illustrates the proposed sampling locations. From each borehole, one sample will be collected from material (soil or tuff) recovered from the one-foot interval at the bottom of the auger hole. Additional samples (above the bottom of the borehole) may be selected based on visual inspection or VOC and radiological field-screening results indicating the presence of contamination.

3.5 Laboratory Analyses

Based on results of the Phase I investigation in the outfall area presented in the RFI reports for TA-21, the analytical suites for the Phase II investigation at PRS 21-024(i) have been modified as follows (LANL 1994, 1260; LANL 1995, 1261). Samples chosen for fixed laboratory analysis from the outfall area will be analyzed for metals, isotopic uranium, isotopic plutonium, isotopic thorium, tritium, gamma-emitting radionuclides using gamma spectrometry, and gross

alpha radiation. Samples collected from the interior and exterior of the tank will be analyzed for VOCs, SVOCs, metals, isotopic uranium, isotopic plutonium, isotopic thorium, tritium, gamma-emitting radionuclides using gamma spectrometry and gross alpha. To assess the expected presence of actinium-227 progeny, the following radionuclides will be explicitly quantified in the gamma spectrometry analysis: radium-223, radon-219, lead-211, bismuth-211, and polonium-211. In addition, a specific request will be made for quantitation of thorium-227 by radiochemical separation and alpha spectrometry. Table 1 details the analytical suites.

All samples will be screened in the field with hand-held alpha and beta/gamma radiation detectors to ensure worker health and safety. Quality control samples, including one blank, one replicate, and one rinsate for every 20 or fewer soil samples sent for laboratory analysis will be collected to assess the quality of the data resulting from the Phase II field sampling program. Samples will be sent to a mobile laboratory and screened for gross alpha, beta, and gamma radiation to meet transportation and fixed laboratory sample-screening requirements. Samples will then be sent to a fixed laboratory for analysis, and where appropriate, analyzed using EPA SW-846 or equivalent methods. All sample preparation will follow LANL-ER-SOP-01.02, Sample Containers and Preservation, and LANL-ER-SOP-01.03, Handling, Packaging, and Shipping of Samples (LANL 1993, 0875).

4.0 REFERENCES

EPA (Environmental Protection Agency), March 6, 1995. "Notice of Deficiency, RFI Reports 1B, 1C and Addendum 1B-1C, Operable Unit 1106, Los Alamos National Laboratory," EPA Region 6 memorandum from William K. Honker (RCRA Permits Branch) to Joseph C. Vozella (Department of Energy), Dallas, Texas. **(EPA 1995, 01-0016)**

LANL (Los Alamos National Laboratory), May 1991. "TA-21 Operable Unit RFI Work Plan for Environmental Restoration," Volumes I-III, Los Alamos National Laboratory Report LA-UR-91-962, Los Alamos, New Mexico. **(LANL 1991, 0689)**

LANL (Los Alamos National Laboratory). "Los Alamos National Laboratory Environmental Restoration Program Standard Operating Procedures," Los Alamos National Laboratory report, Los Alamos, New Mexico. **(LANL 1993, 0875)**

LANL (Los Alamos National Laboratory), November 1993. "Installation Work Plan for Environmental Restoration," Revision 3, Los Alamos National Laboratory Report LA-UR-93-3987, Los Alamos, New Mexico. **(LANL 1993, 1017)**

LANL (Los Alamos National Laboratory), February 28, 1994. "Phase Report 1C, TA-21 Operable Unit RCRA Facility Investigation, Outfalls Investigation," Los Alamos National Laboratory Report LA-UR-94-228, Los Alamos, New Mexico. **(LANL 1994, 1260)**

LANL (Los Alamos National Laboratory), January 1995. "Phase Report Addendum 1B and 1C Operable Unit 1106 RCRA Facility Investigation," Los Alamos National Laboratory Report LA-UR-94-4360, Los Alamos, New Mexico. **(LANL 1995, 1261)**

LANL (Los Alamos National Laboratory), September 28, 1995. Voluntary Corrective Action Completion Report: Potential Release Site 21-024(e) Septic Tank, Los Alamos, New Mexico. **(LANL 1995, 01-018)**

Sampling and Analysis Plan for

Potential Release Site
21-024(c)
Septic Tank System and
Associated Outfall

Field Unit 1

Environmental
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January 1996

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CONTENTS

EXECUTIVE SUMMARY iii

1.0 INTRODUCTION 1

1.1 Description and History 1

1.2 Physical Setting 4

2.0 OBJECTIVES AND APPROACH 5

2.1 Outfall Area 5

2.2 Septic Tank 6

3.0 SAMPLING AND ANALYSIS PLAN 6

3.1 Geodetic Survey 6

3.2 Field Survey 6

3.3 Field Screening 7

3.4 Sample Locations and Methods 7

3.4.1 Outfall Area 7

3.4.2 Septic Tank 8

3.4.2.1 Tank Interior 8

3.4.2.2 Tank Exterior 8

3.5 Laboratory Analyses 9

4.0 REFERENCES 12

LIST OF TABLES

Table 1 Phase II Sample Analyses for PRS 21-024(c) 10

LIST OF FIGURES

Fig. 1. Location of PRS 21-024(c). 2

Fig. 2. Locations of Phase I samples, Phase II survey grid, and proposed Phase II sample locations for PRS 21-024(c). 3

EXECUTIVE SUMMARY

This sampling and analysis plan describes the Phase II Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) at potential release site (PRS) 21-024(c), a septic system and its associated outfall at Technical Area (TA) 21. The septic system routed sanitary waste from buildings TA-21-54 and TA-21-61, through a concrete septic tank, and to the surface near the southern edge of DP Mesa. Phase I RFI results indicate elevated levels of metals, total uranium, americium-241, plutonium-239, and strontium-90 at the outfall area. (Although radionuclides are not regulated under RCRA, they will be addressed in this sampling and analysis plan.) The objectives of Phase II sampling at PRS 21-024(c) are to 1) characterize the outfall area by collecting data necessary to determine the lateral and vertical extent of contamination in the outfall area, 2) collect data necessary to identify potential contamination inside and at the base of the septic tank and determine the extent of contamination, if any and, 3) collect data to support a risk assessment. The results of the risk assessment at the outfall area will be used to propose the site for no further action or to develop an appropriate corrective action.

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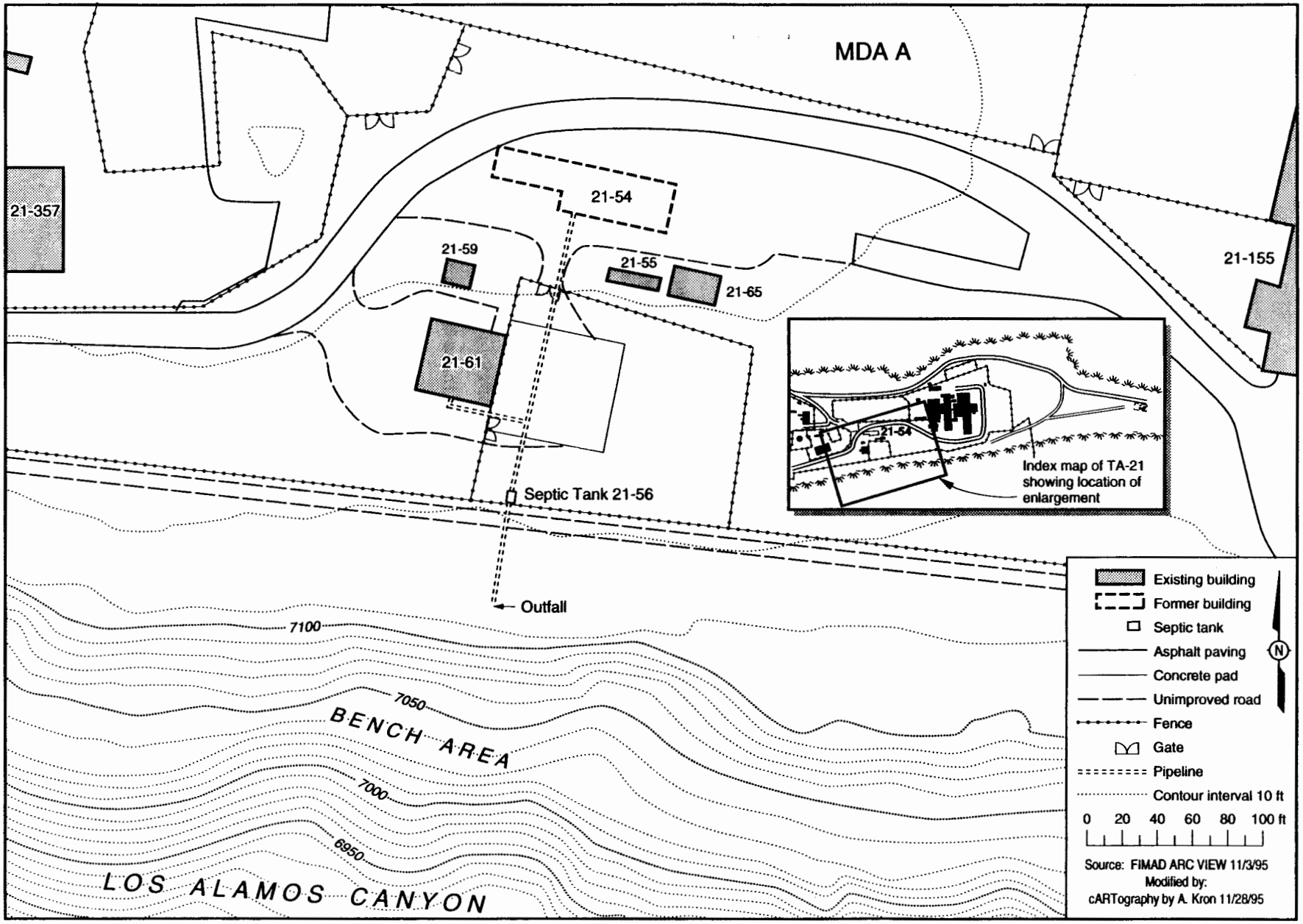

Fig. 1. Location of PRS 21-024(c).

1.0 INTRODUCTION

This sampling and analysis plan describes the proposed Phase II Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) sampling at potential release site (PRS) 21-024(c), a septic system and its associated outfall at Technical Area (TA) 21. This plan will be used with other documents that outline activities (such as waste management and health and safety) associated with this Phase II RFI sampling.

1.1 Description and History

PRS 21-024(c) is a solid waste management unit (SWMU) listed in the Hazardous and Solid Waste Amendments (HSWA) Module of Los Alamos National Laboratory's (LANL's) Part B operating permit. The PRS 21-024(c) septic system consists of a 4-ft wide x 8-ft long x 5-ft deep reinforced concrete septic tank (TA-21-56), 4-in. diameter vitrified-clay pipe (VCP) inlet and outlet lines, and the associated outfall area. Septic tank TA-21-56 was reportedly abandoned in place in 1966. According to engineering drawings, the septic system served buildings TA-21-54 and TA-21-61 (Fig. 1). One inlet line routed sanitary waste from building TA-21-54 approximately 150 ft southwest to the septic tank. A second inlet line routed sanitary waste from building TA-21-61 approximately 30 ft east to a connection with the inlet line that extended from building TA-21-54. The sole outlet line from the septic tank extended approximately 80 ft and discharged 20 ft from the south edge of DP Mesa.

Previous field activities at PRS 21-024(c) were conducted during 1988 Department of Energy (DOE) reconnaissance sampling and during the 1992 and 1993 Phase I RFI sampling. These sampling activities were limited to the upper, mesa-top component of PRS 21-024(c). During the 1988 sampling effort, one sample was collected in the outfall drainage pathway and analyzed for radionuclides, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and metals. Results indicated elevated levels of americium-241, plutonium-238, plutonium-239, tritium, uranium, zinc, copper, lead, and mercury. Isotopic analysis of uranium indicated that enriched uranium was present. Additional information regarding the 1988 sampling effort and results are available in the RFI Work Plan for Operable Unit 1106 (LANL 1991, 0689).

Phase I RFI activities conducted in 1992 and 1993 included radiation surveys, surface and near-surface sampling in the upper outfall area, and subsurface borehole sampling adjacent to the suspected septic tank location (Fig. 2). All samples were analyzed for radionuclides, VOCs, SVOCs, and metals; however, mercury and PCBs were inadvertently omitted from the analyte suite. Additional information regarding the Phase I RFI sampling activities and results are presented in two RFI reports for TA-21 (LANL 1994, 1260; LANL 1995, 1261).

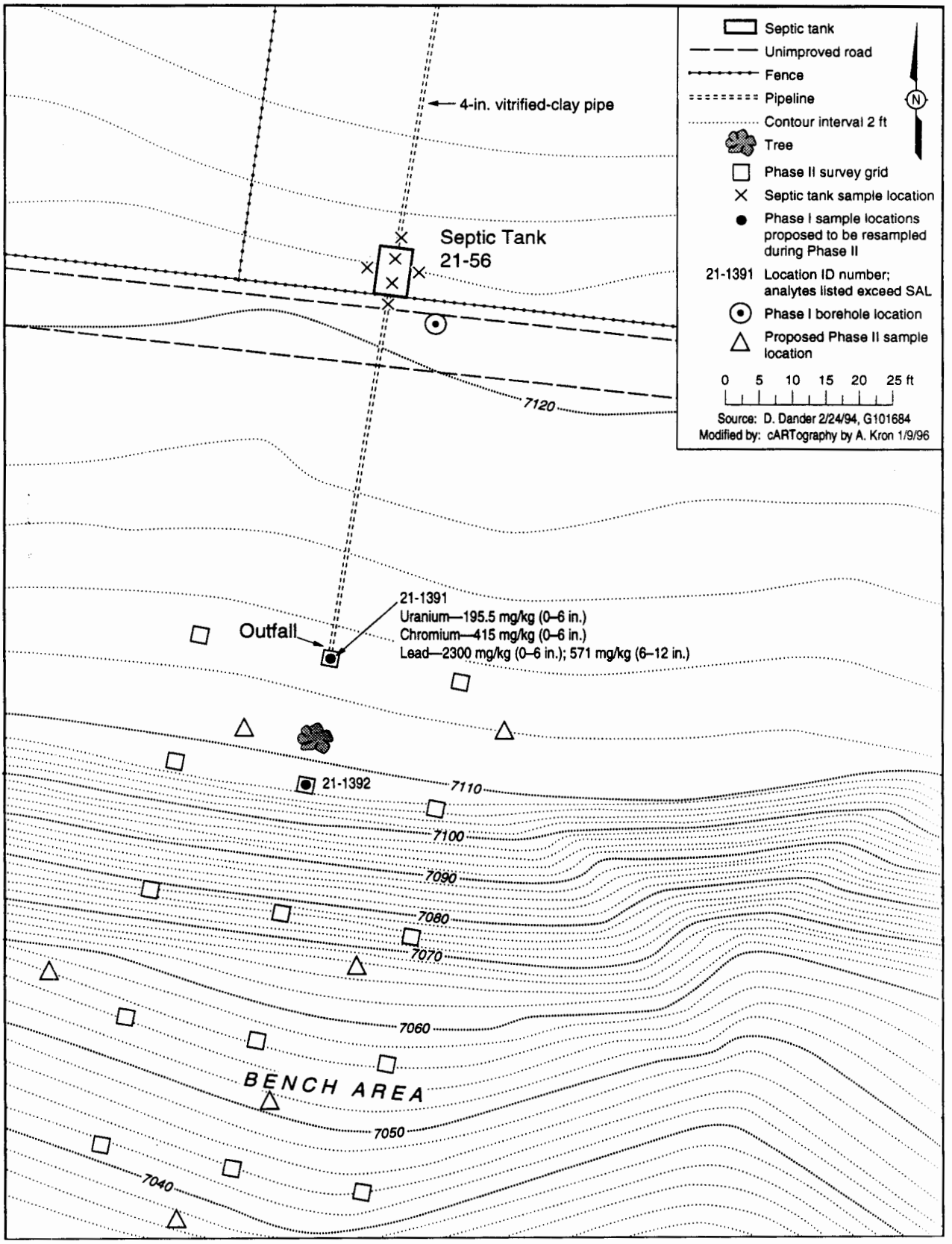

Fig. 2. Locations of Phase I samples, Phase II survey grid, and proposed Phase II sample locations for PRS 21-024(c).

The chemicals of potential concern (COPCs) at the outfall area are based on the analytical results from the Phase I RFI sampling activities. Analytical results indicate that chromium, lead, and total uranium concentrations exceed screening action levels (SALs) and, therefore, are COPCs for the Phase II investigation. Figure 2 shows the locations and concentrations of chromium, lead, and total uranium at levels exceeding SALs. Cadmium, chromium, copper, nickel, lead, silver, and vanadium are also considered COPCs for the outfall area based on the result of a multiple constituent evaluation (LANL 1995, 1261). Analytical results also indicate the presence of elevated levels of americium-241, plutonium-239, and strontium-90; however, limited Phase I sampling prevents a confident conclusion regarding the presence of radiological contamination at the site. As a result, americium-241, plutonium-239, and strontium-90 are COPCs. The RFI Report Addendum initially reported elevated levels of tritium, but these tritium levels were compared with an incorrect comparison value (LANL 1995, 1261). PCBs and mercury remain COPCs at the outfall area because they were inadvertently omitted from the Phase I sampling suite.

COPCs at the septic tank have yet to be identified. Analytical results indicate that no inorganic analytes were elevated and no radionuclides were reported above SALs. Carbon disulfide was reported slightly above the detection limit, but is thought to be a laboratory contaminant (LANL 1995, 01-0014). It is not known if borehole sampling associated with the septic tank was appropriate to identify contamination or a release because the structure was not physically located during the 1993 Phase I RFI sampling. As a result, the analyte suite at the septic tank still includes radionuclides, VOCs, SVOCs, metals, and PCBs.

1.2 Physical Setting

The entire septic system is believed to be abandoned in place. Although the exact location of the septic tank has not been confirmed, based on engineering drawings, it is suspected to be located on the mesa top approximately 80 ft upgradient from the discharge point (Fig. 2).

At present, the end of the outlet line (outfall pipe) is visible at the outfall area, which is located above a 20-ft long gentle slope extending to the mesa edge. Sediments accumulated within the outfall area vaguely define the drainage pathway. Sediment depth at the outfall pipe is estimated to be 6 to 12 in. Tuff is exposed approximately 6 ft from the outfall pipe and extends to the mesa edge. Approximately 8 ft from the outfall pipe, the drainage pathway splits around a juniper tree. The drainage pathway is approximately 2 ft wide at the outfall pipe and broadens to approximately 6 ft at the juniper tree. The exact flow pattern below the juniper tree to the

mesa edge is unclear. Approximately 50 ft below the edge of the mesa, a large, shallow, sloping bench extends approximately 60 ft and then ends at a steep cliff dropping 250 ft into Los Alamos Canyon.

2.0 OBJECTIVES AND APPROACH

2.1 Outfall Area

The Phase II sampling objective at the outfall area of PRS 21-024(c) is to characterize the drainage by collecting data necessary to bound the extent of inorganic and radiological contamination and support a risk assessment (Although radionuclides are not regulated under RCRA, they will be addressed in this sampling and analysis plan.). Risk assessment will use a recreational scenario for mesa edges, benches, and cliff faces. The conceptual exposure model upon which this risk assessment will be based is discussed in detail in Appendix K of the Installation Work Plan (LANL 1993, 1017). The conceptual model for contaminant transport in the outfall area of PRS 21-024(c) is that historical and present migration of contaminants, both radioactive and inorganic chemicals, is dominated by physical redistribution of sediment on the slope rather than dissolution and precipitation of contaminants. Sediment (and contaminant) transport may also result in burial of contaminants and may require evaluating contamination at depth.

The approach to Phase II sampling and analysis in the outfall area at PRS 21-024(i) is a tiered approach, which relies on a large amount of field survey data, a lesser amount of field screening data, and a limited amount of analytical laboratory data for site characterization decisions. This approach, which is described in detail in Section 3, has been applied at other TA-21 drainage areas (LANL 1995, 01-018). The lateral extent of contamination will be evaluated from the mouth of the outfall pipe into Los Alamos Canyon to the bottom of the slope or as far as field survey and field screening results indicate contamination at levels greater than background. The vertical extent of contamination will be evaluated from each 6-in. interval of sediment. The initial 6-in. interval of tuff will also be evaluated. If contamination is found in tuff samples, the conceptual model for contaminant transport will be reconsidered. Results from all surveying, screening, and laboratory analysis will be used to bound the lateral and vertical extent of contamination and to support a recreational risk assessment of the drainage area.

2.2 Septic Tank

The sampling objective at the septic tank is to identify contaminants present in the septic tank and to determine if any releases have occurred. If releases have occurred, the objective will be to define the vertical and lateral extent of contamination. The resulting data will be used to propose the site for no further action (NFA), corrective action, or to determine if further sampling is required. The data will also be used to address waste management issues in the event that the septic system or its contents are removed as part of a corrective action. The conceptual model for contaminant transport associated with the septic tank is that historical release of contaminants is associated with releases from leaks (through cracks) or overflow.

The sampling and analysis approach at the septic tank focuses on investigating the contents of the tank and the material (soil or tuff) surrounding the base of the tank.

3.0 SAMPLING AND ANALYSIS PLAN

3.1 Geodetic Survey

Licensed surveyors will establish and mark a survey grid 20 ft on either side of the outfall pipe and at 20-ft intervals from the outfall pipe to the mesa edge and onto the lower bench (Fig. 2). After samples have been collected for laboratory analyses, surveyors will provide New Mexico state planar coordinates for these sample locations. Surveys will be conducted in accordance with LANL-ER-SOP-03.01, R1, ICN, Land Surveying Procedures (LANL 1993, 0875).

3.2 Field Survey

A field survey for radiation will be conducted using an alpha probe, a field instrument for detection of low-energy radiation (FIDLER), and a Geiger-Mueller (beta/gamma) probe. These radiological survey data will be collected at a minimum of 100 locations, including geodetic survey grid points, sediment accumulation areas, and locations that will assist in bounding the lateral extent of contamination. At these locations, the radiation instrument readings and the distance from the geodetic survey stake will be recorded. Radiological surveys will be conducted, in part, 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).

3.3 Field Screening

To achieve greater resolution of field radiological survey results, field screening data will be obtained on samples collected at 6-in. depth intervals (0-to-6 in., 6-to-12 in., etc., of soil; when tuff is reached, 0-to-6 in. of tuff). Samples will be screened for radioactivity using an alpha probe with increased count times. To confirm the conceptual model for contaminant transport, samples will also be screened for inorganic contaminants using XRF in a mobile laboratory. These samples will be collected at a minimum of 20 locations that include sedimentation areas, locations that bound contamination, locations where radioactivity is maximal, and locations where radioactivity is intermediate between background and the maximum. XRF screening results will be used to make a preliminary determination of the extent of inorganic contamination. If the XRF results indicate that inorganic contaminants, primarily chromium and lead, are bounded by the area of radiological contamination, no additional XRF measurements will be made. If the XRF results indicate otherwise, additional XRF screening will be conducted to determine the extent of inorganic contamination.

3.4 Sample Locations and Methods

3.4.1 Outfall Area

The location of samples selected for fixed laboratory analyses will be determined by results of the radiological screening measurements and XRF screening (Table 1). Proposed sample locations are shown in Fig. 2. To characterize the area where contamination is present and to determine vertical extent of contamination, a minimum of 9 samples (three 6-in. intervals at three locations) will be collected at locations where field screening results are maximal and locations where field screening results are intermediate between background and the maximum. To bound the lateral extent of contamination, a minimum of 9 samples (three 6-in. intervals at three locations) will be collected from the west, east, and south boundaries of the drainage channels. These sample locations will be determined by field screening to represent background for the site. Because several analytes were inadvertently omitted from the Phase I analytical suite, samples will also be collected from the initial 6-in. soil/sediment interval and the initial 6-in. tuff interval at sample locations 21-1391 and 21-1392 and submitted for fixed laboratory analysis (Fig. 2). Soil samples will be collected in 6-in. depth intervals until tuff is encountered according to LANL-ER-SOP-06.09, R1, ICN2, Spade and Scoop Method for Collection of Soil Samples (LANL 1993, 0875). Once tuff is encountered, a tuff sample will be collected from the initial 6-in. depth interval using LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler (LANL 1993, 0875).

3.4.2 Septic Tank

3.4.2.1 Tank Interior

The location of the septic tank will be determined using either geophysical techniques or excavation with hand tools or a backhoe. Based on common septic tank abandonment practices at TA-21, the septic tank is likely to contain fill material and sludge. The septic tank is expected to have a single baffle with two access ports located on top of the tank (one for each side of the baffle). Soil overlying the tank will be excavated with hand-held tools or a backhoe to expose the access ports and delineate the lateral dimensions of the tank. In order to characterize the contents of the septic tank, four samples will be collected from material found inside the tank using LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler (LANL 1993, 0875). Cuttings will be collected through the material(s) in the tank at locations accessible through each access port. From each borehole, one sample will be collected from material (sludge) recovered from the bottom of the tank and a second sample will be collected from fill materials. The specific four sample intervals will be selected based on visual inspection or VOC and radiological field-screening results that indicate the presence of contamination.

3.4.2.2 Tank Exterior

In order to determine if any releases occurred from the septic tank, four samples will be collected from materials (soil or tuff) near the base of the septic tank using LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler, or other appropriate method. Along each side of the septic tank, one borehole will be augered from the surface to approximately one foot below the base of the septic tank. From each borehole, one sample will be collected from material (soil or tuff) recovered from the one-foot interval at the bottom of the auger hole. Additional samples may be selected based on visual inspection or VOC and radiological field-screening results indicating the presence of contamination.

3.5 Laboratory Analyses

Based on survey and screening results, outfall area samples collected will be submitted for analysis of TAL metals, PCBs, americium-241, strontium-90, isotopic plutonium, isotopic uranium, and for gamma-emitting radionuclides using gamma spectrometry. Samples collected from sample locations 21-1391 and 21-1392 will be submitted for analysis of TAL metals, PCBs, and isotopic uranium. Samples collected from within and adjacent to the septic tank will be submitted for laboratory analysis of TAL metals, PCBs, SVOCs, VOCs, americium-241, strontium-90, isotopic plutonium, isotopic uranium, and gamma-emitting radionuclides using gamma spectrometry. The sample analyses planned for PRS 21-024(c) are summarized in Table 1.

All samples will be field-screened using hand-held alpha and beta/gamma radiation detectors to ensure worker health and safety. Quality control samples, one field blank, one field duplicate, and one rinsate blank for every 20 or fewer soil samples submitted for laboratory analysis will be collected to assess the quality of the data resulting from the Phase II sampling. All samples will be submitted to a mobile laboratory for gross alpha, beta, and gamma radiation screening to meet transportation and fixed laboratory requirements; then samples will be submitted to a fixed laboratory for analysis. Samples will be prepared for shipping in accordance with LANL-ER-SOP-01.02, R0, Sample Container and Preservation and LANL-ER-SOP-01.03, R1, Handling, Packaging, and Shipping of Samples (LANL 1993, 0875). Samples will be analyzed in a fixed laboratory using appropriate EPA SW-846 methods or equivalent methods.

TABLE 1

PHASE II SAMPLE ANALYSES FOR PRS 21-024(c)

		FIELD SURVEY		FIELD SCREENING			FIELD LABORATORY ANALYSIS				FIXED LABORATORY ANALYSIS								
Sample number	Sample depth	Geodetic survey	Radiological survey	Alpha radiation	Beta/gamma radiation	Volatile organic compounds	Gross alpha radiation	Gross beta radiation	Gross gamma radiation	X-ray fluorescence	Gamma spectroscopy	Isotopic plutonium	Isotopic uranium	Americium-241	Strontium-90	Polychlorinated biphenyls	Metals	Volatile organic compounds	Semivolatile organic compounds
Outfall area																			
West boundary of drainage channels																			
1	0-6 in.	X[a]	X	X			X	X	X	X	X	X	X	X	X	X	X		
2	6-12 in.			X			X	X	X	X	X	X	X	X	X	X	X		
3	0-6 in. (tuff)			X			X	X	X	X	X	X	X	X	X	X	X		
East boundary of drainage channels																			
1	0-6 in.	X	X	X			X	X	X	X	X	X	X	X	X	X	X		
2	6-12 in.			X			X	X	X	X	X	X	X	X	X	X	X		
3	0-6 in. (tuff)			X			X	X	X	X	X	X	X	X	X	X	X		
South boundary of drainage channels																			
1	0-6 in.	X	X	X			X	X	X	X	X	X	X	X	X	X	X		
2	6-12 in.			X			X	X	X	X	X	X	X	X	X	X	X		
3	0-6 in. (tuff)			X			X	X	X	X	X	X	X	X	X	X	X		
Sample location 21-1391																			
1	0-6 in.	X	X	X			X	X	X	X			X			X	X		
2	0-6 in. (tuff)			X			X	X	X	X			X			X	X		
Sample location 21-1392																			
1	0-6 in.	X	X	X			X	X	X	X			X			X	X		
2	0-6 in. (tuff)			X			X	X	X	X			X			X	X		
Additional locations within drainage channels																			
1	0-6 in.	X	X	X			X	X	X	X	X	X	X	X	X	X	X		
2	6-12 in.			X			X	X	X	X	X	X	X	X	X	X	X		
3	0-6 in. (tuff)			X			X	X	X	X	X	X	X	X	X	X	X		

TABLE 1 (CONTINUED)

PHASE II SAMPLE ANALYSES FOR PRS 21-024(c)

		FIELD SURVEY		FIELD SCREENING			FIELD LABORATORY ANALYSIS				FIXED LABORATORY ANALYSIS								
Sample number	Sample depth	Geodetic survey	Radiological survey	Alpha radiation	Beta/gamma radiation	Volatile organic compounds	Gross alpha radiation	Gross beta radiation	Gross gamma radiation	X-ray fluorescence	Gamma spectroscopy	Isotopic plutonium	Isotopic uranium	Americium-241	Strontium-90	Polychlorinated biphenyls	Metals	Volatile organic compounds	Semivolatile organic compounds
Additional locations within drainage channels (continued)																			
4	0-6 in.	X	X	X			X	X	X	X	X	X	X	X	X	X	X		
5	6-12 in.			X			X	X	X	X	X	X	X	X	X	X	X		
6	0-6 in. (tuff)			X			X	X	X	X	X	X	X	X	X	X	X		
7	0-6 in.	X	X	X			X	X	X	X	X	X	X	X	X	X	X		
8	6-12 in.			X			X	X	X	X	X	X	X	X	X	X	X		
9	0-6 in. (tuff)			X			X	X	X	X	X	X	X	X	X	X	X		
Septic tank interior																			
North end of tank																			
1	5-6 ft	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
2	0-5 ft[b]			X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
South end of tank																			
1	5-6 ft			X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
2	0-5 ft[b]			X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Septic tank exterior																			
East of tank																			
1	7-8 ft	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
2	0-7 ft[b]			X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
West of tank																			
1	7-8 ft	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
2	0-7 ft[b]			X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
South of tank																			
1	7-8 ft	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
2	0-7 ft[b]			X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
North of tank																			
1	7-8 ft	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
2	0-7 ft[b]			X	X	X	X	X	X		X	X	X	X	X	X	X	X	X

[a] X = Planned sample

[b] Septic tank is assumed to be 8 ft deep and base of septic tank is assumed to be 9 ft below ground surface.

4.0 REFERENCES

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Sampling and Analysis Plan for

Potential Release Site
21-027(a)
Surface Drainage South of TA-21-3

Field Unit 1

Environmental Restoration Project

January 1996

A Department of Energy
Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

LA-UR-95-4257

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CONTENTS

EXECUTIVE SUMMARY iii

1.0 INTRODUCTION 1

1.1 Description and History 1

1.2 Physical Setting 3

2.0 OBJECTIVES AND APPROACH 5

3.0 SAMPLING AND ANALYSIS PLAN 7

3.1 Geodetic Survey 7

3.2 Field Survey 7

3.3 Field Screening 8

3.4 Sample Locations and Methods 8

3.5 Laboratory Analyses 9

4.0 REFERENCES 11

LIST OF TABLES

Table 1 Phase II Sample Analyses for PRS 21-027(a) 10

LIST OF FIGURES

Fig. 1. Locations of Phase I samples, Phase II survey grid, and proposed Phase II sample locations for PRS 21-027(a). 2

Fig. 2. Chromium results greater than screening action levels for Phase I samples at PRS 21-027(a). 4

Fig. 3. Correlation between Phase I RFI total chromium and total uranium at PRS 21-027(a). 6

EXECUTIVE SUMMARY

This sampling and analysis plan describes the Phase II Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) at potential release site (PRS) 21-027(a), a surface drainage system at Technical Area (TA) 21 between a former equipment room and the south rim of DP Mesa. A Phase I RFI conducted during 1992 and 1993 identified chromium, americium-241, plutonium-238, plutonium-239, and uranium at levels greater than screening action levels and indicated the need for additional investigations in the PRS 21-027(a) drainage area. (Although radionuclides are not regulated under RCRA, they will be considered in Phase II sampling.) The objective of Phase II sampling at PRS 21-027(a) is to collect data necessary to determine the extent of chromium and radiological contamination in the drainage area, to confirm previous mercury analyses, and to support a recreational risk assessment of the site. The results of the risk assessment will be used to propose the site for no further action or to develop an appropriate corrective action. The approach to Phase II sampling and analysis at PRS 21-027(a) is to obtain a large amount of field survey data, a lesser amount of field screening data, and a limited amount of analytical laboratory data. The location of Phase II samples will be determined by radiological and chromium screening. Soil samples will be collected at 6-in. intervals until tuff is reached; when tuff is reached, a tuff sample will be collected in the first 6 in. Samples chosen from the drainage area for fixed laboratory analysis will be analyzed for gamma-emitting radionuclides using gamma spectroscopy, and for isotopic plutonium, isotopic uranium, americium-241, metals (including total chromium and mercury), and chromium(VI) using an appropriate method to be identified. The results from all surveying, screening, and analyses will be used to bound the lateral and vertical extent of contamination and to support a recreational risk assessment of the drainage area at PRS 21-027(a).

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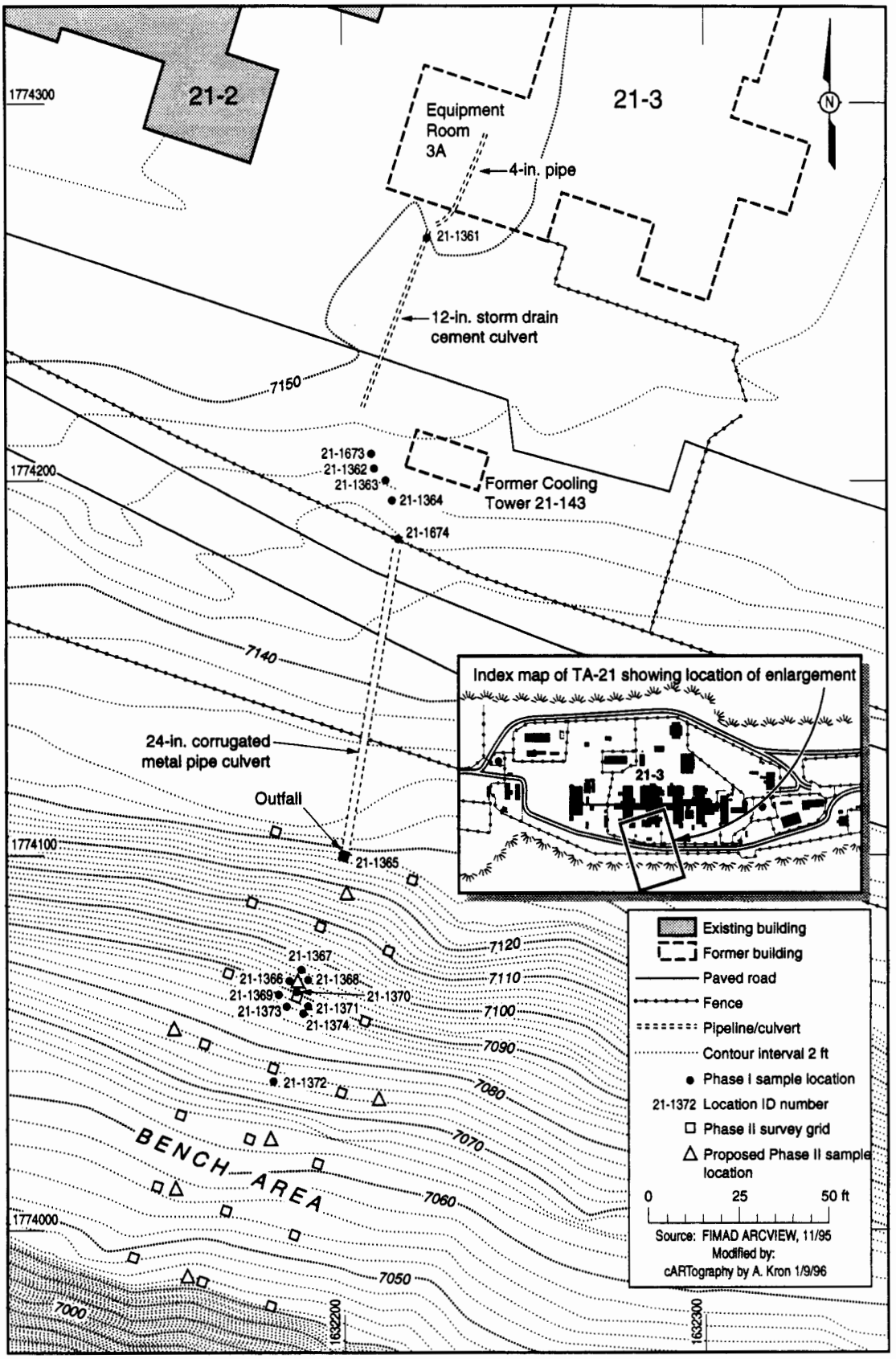

Fig. 1. Locations of Phase I samples, Phase II survey grid, and proposed Phase II sample locations for PRS 21-027(a).

1.0 INTRODUCTION

This sampling and analysis plan describes the Phase II Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) for potential release site (PRS) 21-027(a), a surface drainage at Technical Area (TA) 21. This plan will be used with other documents that outline activities (such as waste management and health and safety) associated with the Phase II RFI.

1.1 Description and History

PRS 21-027(a) is a solid waste management unit (SWMU) listed in the Hazardous and Solid Waste Amendments (HSWA) Module of Los Alamos National Laboratory's (LANL's) RCRA Part B operating permit. PRS 21-027(a) is a surface drainage system between a former equipment room and the south rim of DP Mesa (Fig. 1). The PRS 21-027(a) drainage system originated in the floor drains of Equipment Room 3A at the southwest corner of building TA-21-3. TA-21-3, its drains, and the pipes beneath it have all been removed. The floor drains were connected to 3-in. pipes, which connected to a 4-in. pipe. The 4-in. pipe ran beneath Equipment Room 3A and a paved area south of TA-21-3 for approximately 30 ft and then into a storm drain. The pipes beneath the paved area are in place. The storm drain, also in place, collects storm water runoff from nearby parking lots. A 12-in. cement culvert, which is in place, runs from the storm drain underground for approximately 50 ft. The cement culvert empties onto the ground at the southwest corner of the footprint of a former cooling tower (structure TA-21-143, designated area of concern C-21-027). From the southwest corner of the cooling tower footprint where the cement culvert empties, runoff flows across the ground in an unlined ditch to a 24-in. corrugated metal pipe culvert that is still in place, which carries runoff beneath the south perimeter road to the mesa edge. Runoff flows over the mesa edge, across a large, shallow, sloping bench, and into Los Alamos Canyon.

The southern portion of TA-21-3 (including Equipment Room 3A and the pipes beneath it) and the cooling tower were removed during decontamination and decommissioning (D&D) activities in 1994 and 1995. After D&D, LANL conducted a voluntary corrective action (VCA) at the footprint of the cooling tower, which is not a HSWA solid waste management unit (SWMU). No samples collected from the footprint of the cooling tower contained contaminants at levels greater than screening action levels (SALs). LANL submitted a VCA report to the Department of Energy (DOE) in September 1995 and requested that DOE approve no further action (NFA) at the cooling tower footprint (LANL 1995, 01-0015).

A Phase I RFI was conducted during 1992 and 1993 at PRS 21-027(a), and LANL submitted a report on the results of this investigation to the Environmental Protection Agency (EPA) in 1994 (LANL 1994, 1261). Figure 1 identifies Phase I sample locations. The chemicals of potential concern (COPCs) identified in this report include one inorganic analyte (chromium) and several radionuclides (americium-241, plutonium-238, plutonium-239, and uranium) that were found at levels exceeding SALs. These chemicals were found at the following maximum levels: total chromium, 1 000.4 mg/kg; americium-241, 37.1 pCi/g; plutonium-238, 52 pCi/g; plutonium-239, 193 pCi/g; and total uranium, 231.5 mg/kg. Figure 2 identifies sampling locations with chromium at levels exceeding SALs.*

Although mercury analyses were planned, they were omitted from the analytical suite during the Phase I RFI. Results from previous investigations, however, indicate that mercury levels at PRS 21-027(a) do not exceed the SAL (23 mg/kg) and would not be a concern in a multiple constituent evaluation. In 1988 a sample collected from the area near the cooling tower where the storm drain empties onto the ground had 0.29 mg/kg of mercury (LANL 1994, 1260). In October 1995 preliminary results from a sample collected farther downslope, where the corrugated metal pipe empties over the mesa edge (and where Phase I RFI chromium results were elevated), confirmed the 1988 mercury results. Although these analyses indicate that mercury is not a COPC at this site, mercury analyses (as part of the metals analyses) will be performed in the Phase II investigation to confirm this.

1.2 Physical Setting

In the drainage area of PRS 21-027(a), the end of the corrugated metal pipe is visible and extends approximately 3 ft over the mesa edge. Runoff from PRS 21-027(a) leaves the pipe and travels down cliff-face boulders approximately 50 ft to a boulder-strewn bench. The bench extends approximately 50 ft before another cliff drops off steeply, approximately 250 ft, into Los Alamos Canyon. The drainage channel on the bench and the point at which runoff falls into Los Alamos Canyon are poorly defined. Sediment on the bench is expected to be up to 12 in. deep.

*Chromium found during the Phase I investigation was assumed to be chromium(VI), the chromium species that poses the greatest risk, from chromates added to the cooling tower. Samples were analyzed for total chromium, not chromium(VI), so this assumption was not verified. If samples had been analyzed for chromium species and found to contain chromium (III), which poses little risk, instead of chromium(VI), a less stringent SAL would apply.

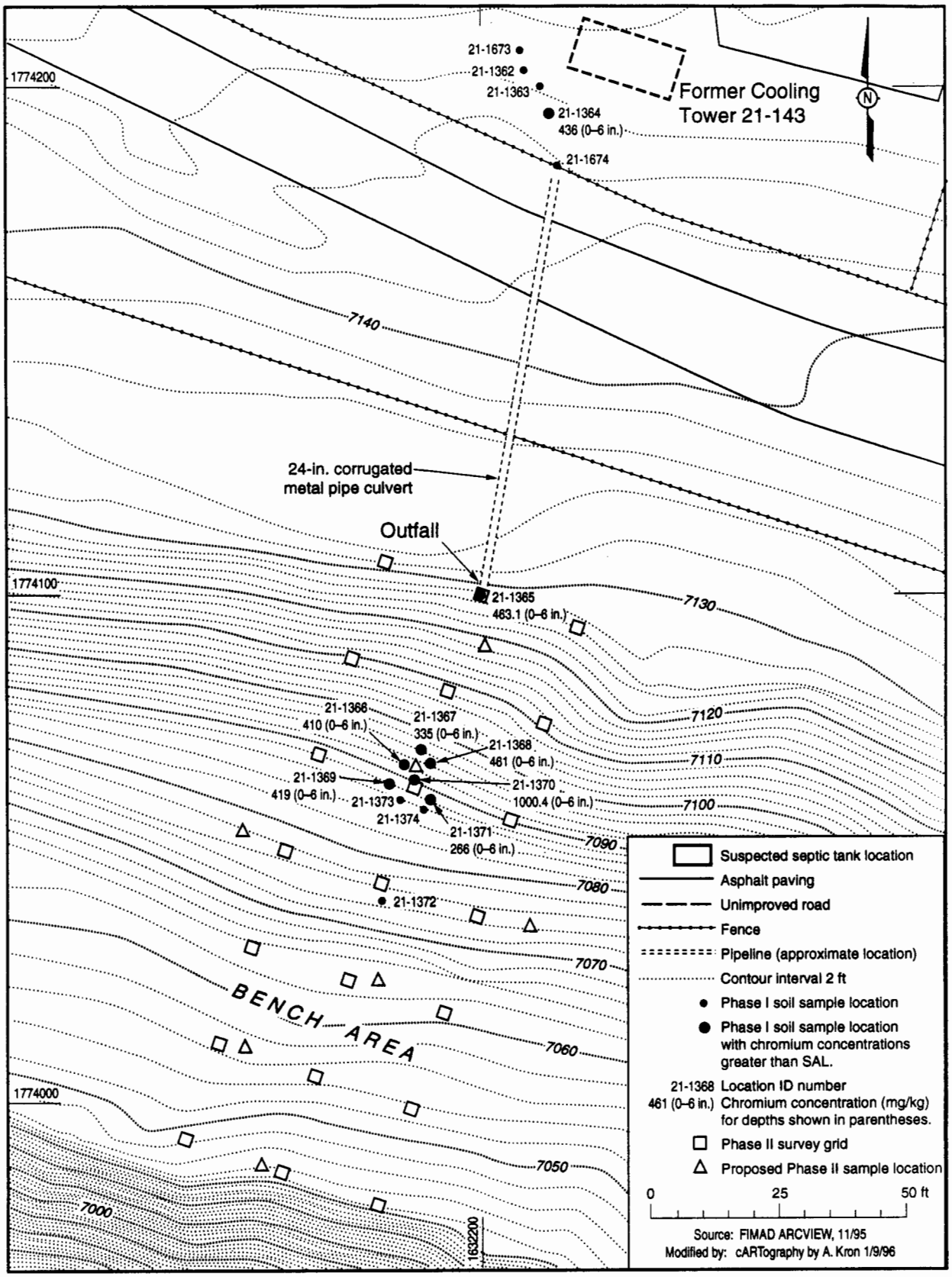

Fig. 2. Chromium results greater than screening action levels for Phase I samples at PRS 21-027(a).

2.0 OBJECTIVES AND APPROACH

The Phase II sampling objective at PRS 21-027(a) is to collect data necessary to bound the lateral and vertical extent of chromium and radiological contamination in the drainage area and to support a recreational risk assessment of the drainage area. (Although radionuclides are not regulated under RCRA, they will be considered in Phase II sampling.) The results of the risk assessment will be used to propose the site for NFA or to develop an appropriate corrective action. Another objective is to confirm the previous analytical results for mercury which were below SAL.

Risk assessment will use a recreational scenario for mesa edges, benches, and cliff faces. The conceptual exposure model upon which risk assessment will be based is discussed in detail in Appendix K of the Installation Work Plan (LANL 1993, 1017).

The conceptual model for contaminant transport in the drainage area of PRS 21-027(a) is that historical and present migration of contaminants, both radioactive and inorganic chemicals, is dominated by physical redistribution of sediment on the slope rather than dissolution and precipitation of contaminants. Sediment (and contaminant) transport may also result in burial of contaminants and may require evaluation of contamination at depth.

This model is supported by the approximate correlation between total uranium and chromium levels obtained during Phase I sampling at PRS 21-027(a) (Fig. 3). Radioactivity measurements obtained in the field on surface and subsurface samples will be used to help identify sample locations for fixed laboratory analysis. The model will be confirmed by these laboratory results.

This model and the following issues raised by Phase I sampling results drive the Phase II sampling and analysis approach.

- Phase I sampling stopped short of the topographic bench above Los Alamos Canyon (Fig. 1).
- Phase I sampling identified chromium at concentrations greater than the chromium(VI) SAL at six locations starting south of the cooling tower footprint and continuing down the drainage area. However, these samples were analyzed for total chromium, not chromium(VI).

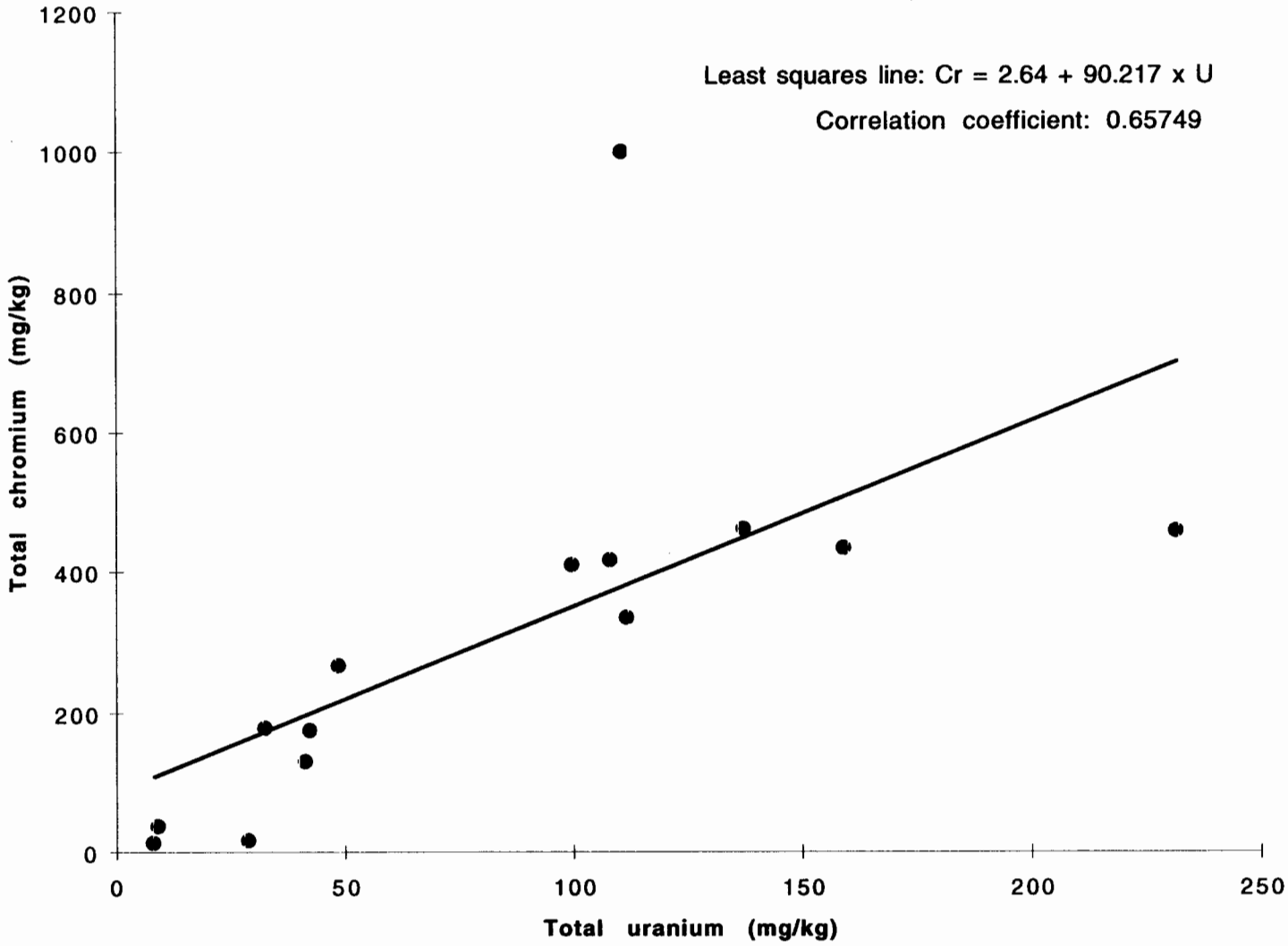

Fig. 3. Correlation between Phase I RFI total chromium and total uranium at PRS 21-027(a).

The approach to Phase II sampling and analysis at PRS 21-027(a) is a tiered approach, which relies on a large amount of field survey data, a lesser amount of field screening data, and a limited amount of analytical laboratory data for site characterization decisions. This approach, which is described in detail in Section 3, has been applied at other TA-21 drainage areas (LANL 1995, 01-018). The lateral extent of contamination will be evaluated from the outlet of the corrugated metal pipe, into Los Alamos Canyon, and to the bottom of the slope. The vertical extent of contamination will be evaluated from each 6-in. interval of sediment. The initial 6-in. interval of tuff will also be evaluated. If contamination is found in tuff samples, the conceptual model for contaminant transport will be reconsidered. Results from all surveying, screening, and analysis will be used to bound the lateral and vertical extent of contamination and to support a recreational risk assessment of the drainage area at PRS 21-027(a).

3.0 SAMPLING AND ANALYSIS PLAN

3.1 Geodetic Survey

Licensed surveyors will mark a survey grid 20 ft on either side of the outlet of the corrugated metal pipe and at 20-ft intervals downslope to the southern edge of the bench (Fig. 1). After samples have been collected for laboratory analyses, surveyors will provide state planar coordinates for these sample locations. Surveys will be conducted in accordance with LANL-ER-SOP-03.01,R1, ICN, Land Surveying Procedures.

3.2 Field Survey

A field survey for radiation (radiological survey) will be conducted using an alpha probe, a field instrument for detection of low-energy radiation (FIDLER), and a Geiger-Mueller (beta/gamma) probe. Radiological survey data will be collected at a minimum of 100 locations, including geodetic survey grid points, sediment accumulation areas, and locations that will assist in bounding the lateral extent of contamination. At these locations, the radiation instrument readings and the distance from the geodetic survey stake will be recorded. Because chromium levels approximately correlate to uranium levels at PRS 21-027(a), sample locations for chromium initially can be identified by the radiological survey and confirmed by field screening for chromium and by laboratory analysis. Radiological surveys will be conducted, in part, 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).

3.3 Field Screening

To achieve greater resolution of field radiological results, field screening data will be obtained on samples collected at 6-in. depth intervals (0-to-6 in., 6-to-12 in., etc., of soil; when tuff is reached, 0-to-6 in. of tuff). Samples will be screened for radioactivity using an alpha probe with increased count times. To confirm the conceptual model for contaminant transport, samples will be screened for chromium using mobile laboratory analysis or field kits. These samples will be collected at a minimum of 20 locations that include sediment accumulation areas, locations that bound contamination, locations where radioactivity is maximal, and locations where radioactivity is intermediate between background and the maximum (to correlate field survey data with field screening data).

3.4 Sample Locations and Methods

The location of samples selected for laboratory analyses will be determined by radiological survey and radiological and chromium screening results. Proposed sample locations are shown in Fig. 1. To determine the vertical extent of contamination, a minimum of nine samples (three 6-in. intervals at three locations) will be collected at locations where field screening results are maximal and where field screening results are intermediate between background and maximum. To bound the lateral extent of contamination, a minimum of nine samples (three 6-in. intervals at three locations) will be collected from the west, east, and south boundaries of the drainage channels. These sample locations will be determined by field screening to represent background for the site. In addition, three samples (three 6-in. intervals) will be collected from one location where chromium levels were elevated during the Phase I RFI (Fig. 2). Soil samples will be collected at 6-in. intervals (0- to 6-in., 6- to 12-in., etc.) until tuff is reached according to LANL-ER-SOP-6.09, R0, ICN2, Spade and Scoop Method for Collection of Soil Samples. When tuff is reached, a tuff sample will be collected in the first 6 in. using the hand-auger method, LANL-ER-SOP-6.10, R0, Hand Auger and Thin-Wall Tube Sampler (LANL 1993, 0875). The soil and tuff will be submitted for laboratory analysis.

TABLE 1

PHASE II SAMPLE ANALYSES FOR PRS 21-027(a)

		FIELD SURVEY		FIELD SCREENING		FIELD LABORATORY ANALYSIS				FIXED LABORATORY ANALYSIS					
Sample number	Sample depth	Geodetic survey	Radiological survey	Alpha radiation	Chromium	Gross alpha radiation	Gross beta radiation	Gross gamma radiation	Chromium	Gamma spectroscopy	Isotopic plutonium	Isotopic uranium	Americium-241	Metals	Chromium(VI)
West boundary of drainage channels															
1	0-6 in.	X[a]	X	X	X	X	X	X	C[b]	X	X	X	X	X	X
2	6-12 in.			X	X	X	X	X	C	X	X	X	X	X	X
3	0-6 in. (tuff)			X	X	X	X	X	C	X	X	X	X	X	X
East boundary of drainage channels															
1	0-6 in.	X	X	X	X	X	X	X	C	X	X	X	X	X	X
2	6-12 in.			X	X	X	X	X	C	X	X	X	X	X	X
3	0-6 in. (tuff)			X	X	X	X	X	C	X	X	X	X	X	X
South boundary of drainage channels															
1	0-6 in.	X	X	X	X	X	X	X	C	X	X	X	X	X	X
2	6-12 in.			X	X	X	X	X	C	X	X	X	X	X	X
3	0-6 in. (tuff)			X	X	X	X	X	C	X	X	X	X	X	X
Location of Phase I elevated chromium results															
1	0-6 in.	X	X	X	X	X	X	X	C	X	X	X	X	X	X
2	6-12 in.			X	X	X	X	X	C	X	X	X	X	X	X
3	0-6 in. (tuff)			X	X	X	X	X	C	X	X	X	X	X	X
Additional locations within drainage channels															
1	0-6 in.	X	X	X	X	X	X	X	C	X	X	X	X	X	X
2	6-12 in.			X	X	X	X	X	C	X	X	X	X	X	X
3	0-6 in. (tuff)			X	X	X	X	X	C	X	X	X	X	X	X
4	0-6 in.		X	X	X	X	X	X	C	X	X	X	X	X	X
5	6-12 in.			X	X	X	X	X	C	X	X	X	X	X	X
6	0-6 in. (tuff)			X	X	X	X	X	C	X	X	X	X	X	X
7	0-6 in.		X	X	X	X	X	X	C	X	X	X	X	X	X
8	6-12 in.			X	X	X	X	X	C	X	X	X	X	X	X
9	0-6 in. (tuff)			X	X	X	X	X	C	X	X	X	X	X	X

[a] X = Planned sample.
[b] C = Contingency sample.

3.5 Laboratory Analyses

Based on the results of the Phase I investigation presented in the RFI report, the analytical suites for the Phase II investigation at PRS 21-027(a) will be as follows (LANL 1994, 1261). Samples chosen for fixed laboratory analysis from the drainage area will be analyzed for gamma-emitting radionuclides using gamma spectroscopy, and for isotopic plutonium, isotopic uranium, americium-241, TAL metals (including total chromium and mercury), and chromium(VI) using an appropriate method. Proposed samples and analytical suites are summarized in Table I.

All samples will be screened in the field with hand-held alpha and beta/gamma radiation detectors to ensure worker health and safety. Quality control samples, one field blank, one field duplicate, and one rinsate blank for every 20 or fewer soil samples sent for laboratory analysis will be collected to provide the means to assess the quality of the data resulting from the Phase II field sampling program. Samples will be sent to a mobile laboratory and screened for gross alpha, beta, and gamma radiation to meet transportation and fixed laboratory requirements. Samples will then be sent to a fixed laboratory for analysis. Where appropriate, samples will be analyzed using EPA SW-846 or equivalent methods. All sample preparation will follow standard operating procedures LANL-ER-SOP-01.02, R0, Sample Container and Preservation, and LANL-ER-SOP-01.03, R1, Handling, Packaging, and Shipping of Samples.

4.0 REFERENCES

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LANL (Los Alamos National Laboratory), December 1994. "Phase Report Addendum 1B and 1C, Operable Unit 1106 RCRA Facility Investigation," Los Alamos National Laboratory Report LA-UR-94-4360, Los Alamos, New Mexico. **(LANL 1994, 1261)**

LANL (Los Alamos National Laboratory), September 28, 1995. "Voluntary Corrective Action Completion Report: Potential Release Site C21-027 TA-21 Cooling Tower," Los Alamos, New Mexico. **(LANL 1995, 01-0015)**

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