HSWA LANL 1/1106/21/21-024(c+i), 21-027(a)

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Date: December 15, 1997
Refer to: EM/ER:97-536

DEC 1997
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Dr. Robert Dinwiddie
NMED-HRMB
P.O. Box 26110
Santa Fe, NM 87502

SUBJECT: ADDITIONAL INFORMATION TO RESPONSE TO REQUEST FOR SUPPLEMENTAL INFORMATION FOR PHASE II SAPS FOR PRSs 21-024(c) and 21-027(a) (FORMER OU 1106)

Dear Dr. Dinwiddie:

Enclosed is the Los Alamos National Laboratory's Supplemental Information for Phase II Sampling and Analysis Plans for Potential Release Sites 21-024(c) and 21-027(a) in Technical Area 21. On November 15, 1997, reference EM/ER:97-482, we stated that we would submit additional information within 30 days of that submittal.

If you have any questions, please contact Gary McMath at (505) 665-4969 or Bonnie Koch at (505) 665-7202.

Sincerely,

Julie A. Canepa, Program Manager
LANL/ER Project

Sincerely,

Theodore J. Taylor, Program Manager
DOE/LAAO

JC/TT/ss

Enclosures (1) Supplemental Information for Phase II SAPS for PRSs 21-024(c) and 21-027(a) in TA-21 (former OU 1106)

TV

10324

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Sampling and Analysis Plan for

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

Revision 1

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Field Unit 1

Environmental
Restoration
Project

December 1997

A Department of Energy
Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

LA-UR-95-4258

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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. 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, (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. Although radionuclides are not regulated under RCRA, they will be addressed in this sampling and analysis plan. 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(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) 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). The sole outlet line from the septic tank extended approximately 80 ft and discharged 20 ft from the south edge of DP Mesa.

One inlet line to septic tank TA-21-56 routed sanitary waste from building TA-21-54 approximately 150 ft southwest to the septic tank. Building TA-21-54 was built in 1945 and served as a warehouse and machine shop. The building was demolished in 1967. Little is known about what was stored in the warehouse or what type of machine work was conducted in the building. However, documents describing the work required for demolition of the building indicate that the building was contaminated with radioactive materials including plutonium.

A second inlet line to septic tank TA-21-56 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. Building TA-21-61 was built in 1950 and is still in place. This building was built to support classified work, and no information has been found to document work that was performed in the building from 1950 to 1956. In 1956 the building was remodeled to support work on the Rover Program, an experimental project related to the development of nuclear-powered space vehicles. A 1961 request for furnace work notes that a small amount of uranium contamination was present in the building, and that coveralls and shoe covers were required to perform the work. It is unclear from the available information whether the noted uranium contamination came from activities between 1950 and 1956 or from Rover Program work. The Rover Program was complete sometime during the

mid- to late-1960's; however, the exact date that operations ceased at building TA-21-61 is unknown. The building was used again from 1970 to 1972 as an iron fabrication shop in support of a facility upgrade at TA-21. Finally, the building was used for the storage and management of equipment containing oil contaminated with polychlorinated biphenyls (PCBs). Building TA-21-61 and the surrounding area are listed in the TA-21 Operable Unit Work Plan as PRS 21-003.

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, 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).

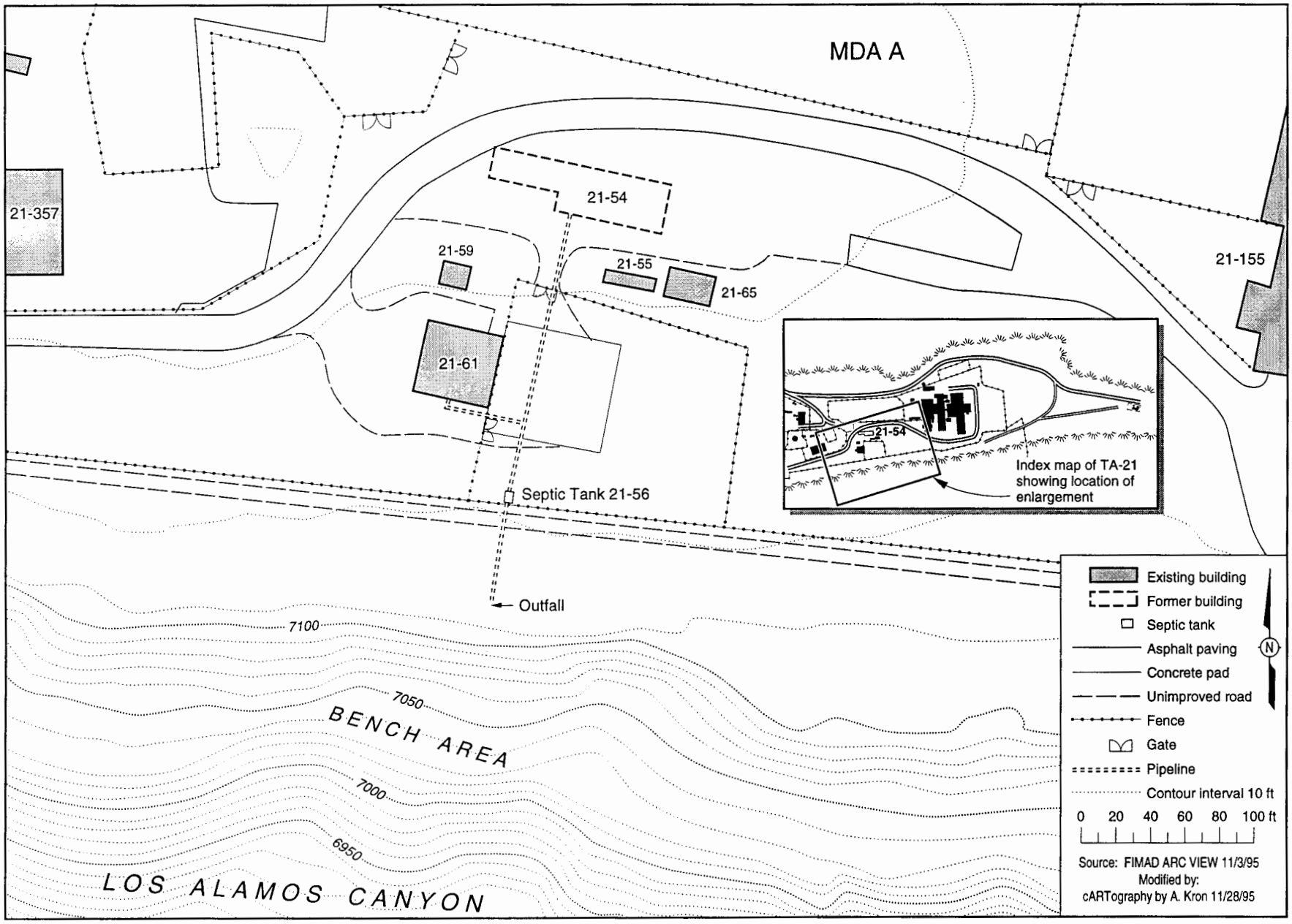

Fig. 1. Location of PRS 21-024(c).

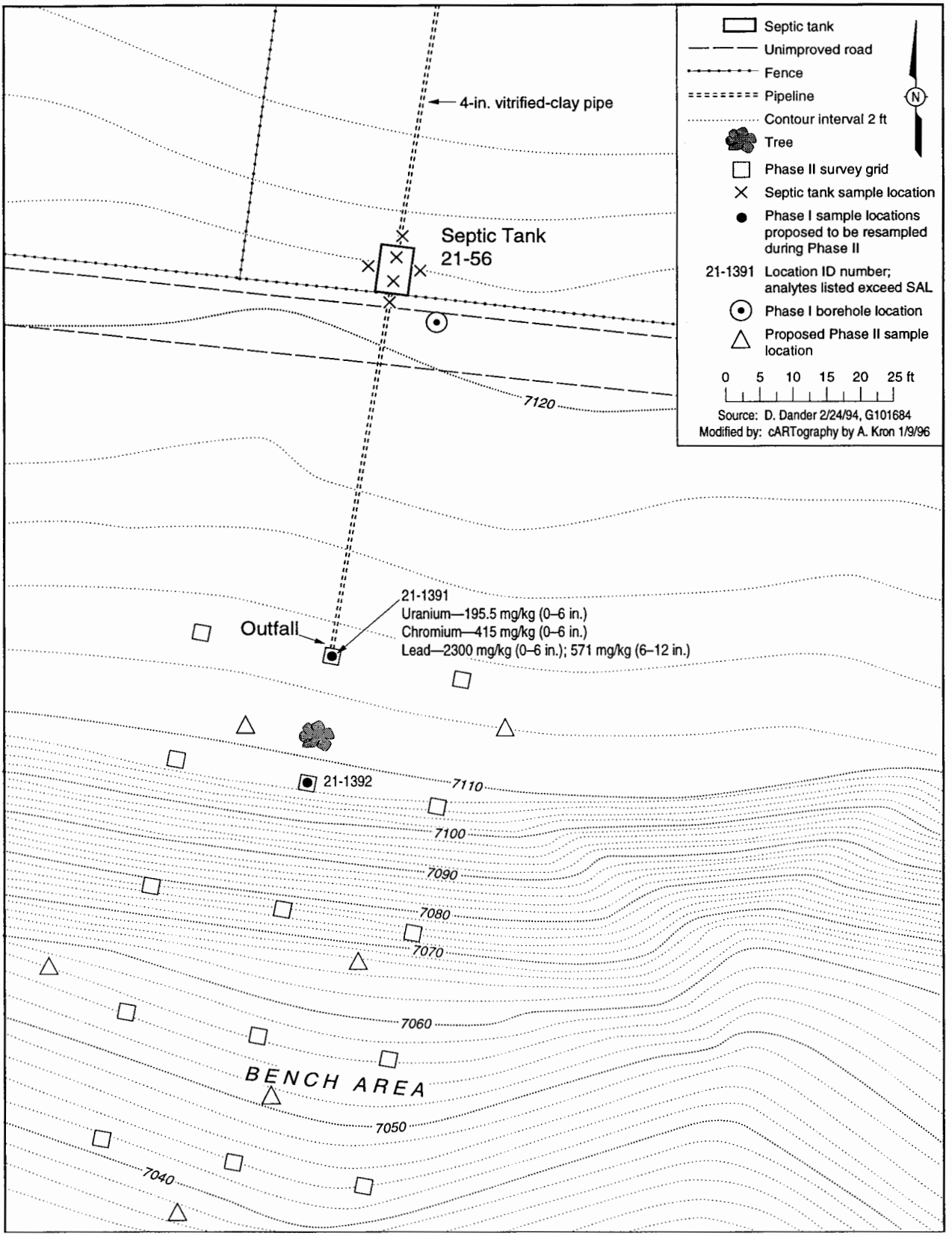

Fig. 2. Locations of Phase I samples, Phase II survey grid, and proposed Phase II sample locations for PRS 21-024(c).

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 ***total uranium***, 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, ***isotopes of uranium***, 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 and inlet and outlet lines have not been confirmed, based on engineering drawings, the tank is suspected to be located on the mesa top approximately 80 ft upgradient from the discharge point (Fig. 2). The inlet and outlet lines run north and south from the septic tank. At present, the end of the outlet line (outfall pipe) is visible approximately 20 ft from 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, ***PCB***, 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. The 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 described below and 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 migration of radioactive, ***PCB***, and inorganic chemicals is dominated by physical redistribution of sediment on the slope rather than dissolution and precipitation of contaminants. ***Based on this model, it is assumed that radionuclide, PCB, and inorganic contamination will be collocated in sediment deposits within the drainage. 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(c) is a tiered approach that 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, and it has proven to be effective in identifying areas where radioactivity is elevated relative to background. If the conceptual model for containment transport is confirmed (see Section 3.3), then radionuclides can be used as tracers for other COPCs, and radiological field survey results can be used to identify areas of contamination and likely bounding areas***. 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 objective of sampling at the septic tank is to identify contaminants present in the septic tank and determine whether 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) or corrective action, or to determine whether 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 (which is described in Section 2.1), samples will also be screened for inorganic contaminants using x-ray fluorescence (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 locations of samples selected for fixed laboratory analyses will be determined by the 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 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 locations where field screening results are intermediate between background and the 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. 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

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 target analysis list (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

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), 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), 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)**

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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)**

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Sampling and Analysis Plan for

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

Revision 1

Field Unit 1

Environmental Restoration Project

December 1997

A Department of Energy
Environmental Cleanup Program

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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. 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. Although radionuclides are not regulated under RCRA, they will be considered in Phase II sampling. 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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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 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 SWMU. No samples collected from the footprint of the cooling tower contained contaminants at levels greater than screening action levels (SALs). LANL submitted a voluntary corrective action (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) ***(See Attachment A)***.

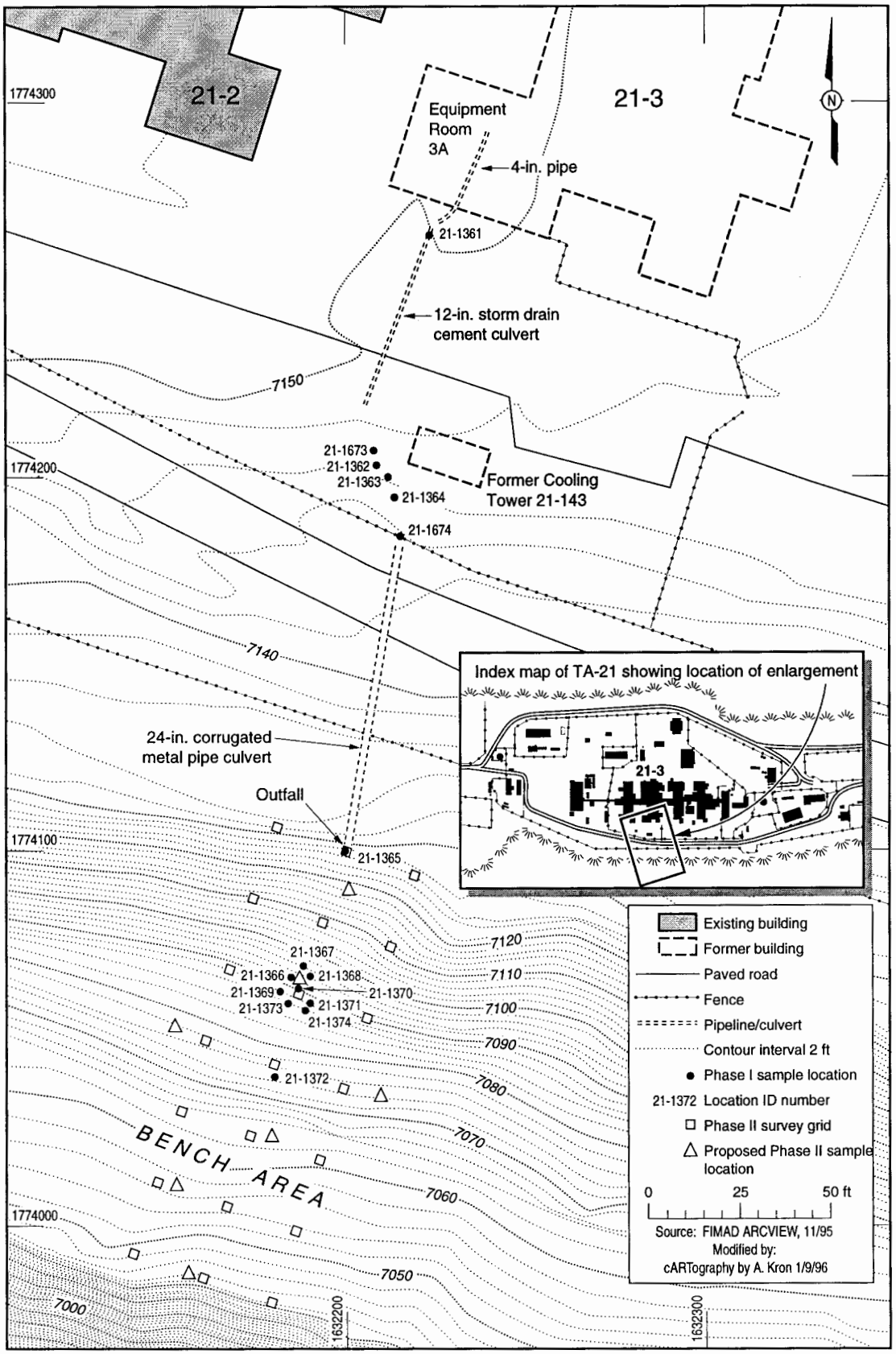

Fig. 1. Locations of Phase I samples, Phase II survey grid, and proposed Phase II sample locations for PRS 21-027(a).

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) ***(see Attachment B)***. 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, 1261) ***(see Attachment B)***. 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 for 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.

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*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.

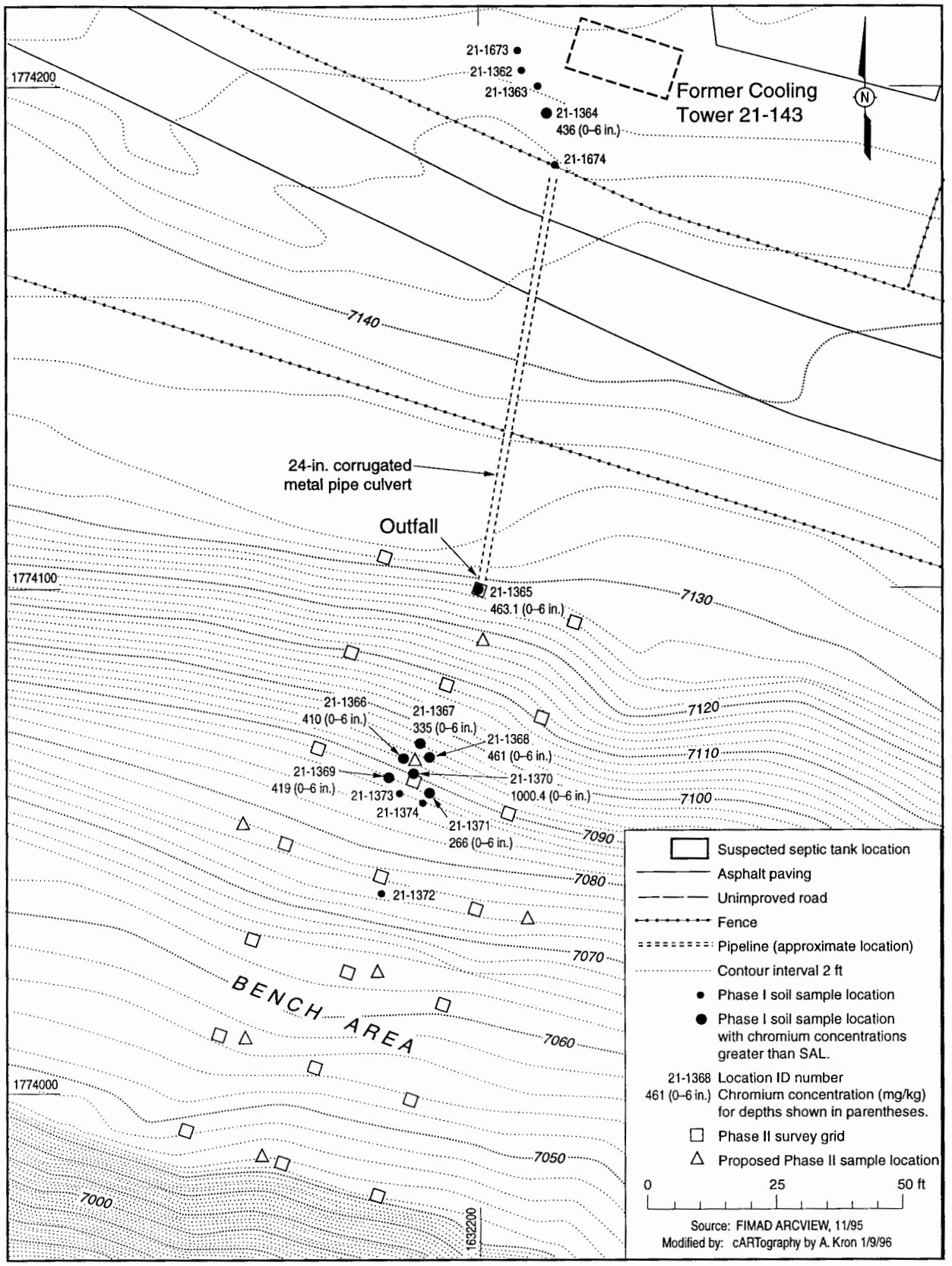

Fig. 2. Chromium results greater than screening action levels for Phase I samples at PRS 21-027(a).

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.

The 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. ***Based on this model, it is assumed that radioactive and inorganic contamination will be collocated in sediment deposits within the drainage.*** 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).

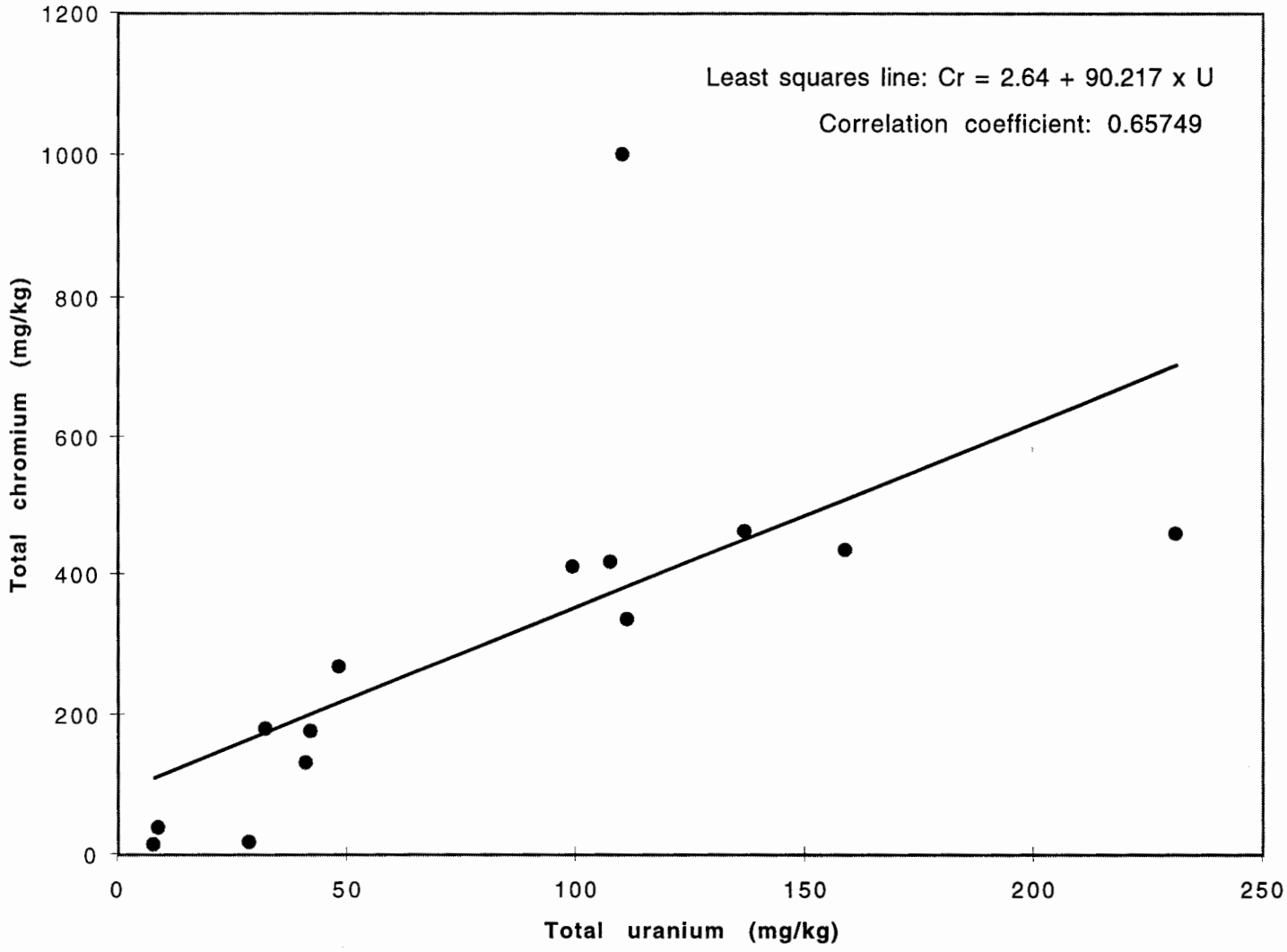

Fig. 3. Correlation between Phase I RFI total chromium and total uranium at PRS 21-027(a).

The approach to Phase II sampling and analysis at PRS 21-027(a) is a tiered approach that 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, ***and it has proven to be effective in identifying areas where radioactivity is elevated relative to background. If the conceptual model for contaminant transport is confirmed (see Section 3.3), then radionuclides can be used as tracers for other COPCs, and radiological field survey results can be used to identify areas of contamination and likely bounding areas.*** 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 locations 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.

3.5 Laboratory Analyses

Based on the results of the Phase I investigation presented in the RFI report ***(see Attachment B)***, the analytical suites for the Phase II investigation at PRS 21-027(a) will be as follows. 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, target analyte list (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."

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.

4.0 REFERENCES

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), 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)**

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)**

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ATTACHMENT A Voluntary Corrective Action Completion Report, PRS 21-027

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Voluntary Corrective Action Completion Report
Potential Release Site C21-027
TA-21 Cooling Tower

DESCRIPTION

The potential release site (PRS) C21-027 is the site of structure TA-21-143, a cooling tower (chilled water recirculator) that received water from Building TA-21-3, circulated it, and returned it to the building in a closed loop. PRS C21-027 is not listed in the Hazardous and Solid Waste Amendments (HSWA) module of Los Alamos National Laboratory's (LANL's) Resource Conservation and Recovery Act (RCRA) permit but was listed in Chapter 19.2 of the Technical Area 21 (TA-21) RFI work plan[1] as an area of concern (AOC).

The cooling tower occupied an area approximately 10 ft by 20 ft. The above-ground section of the cooling tower was removed (along with the south portion of Building TA-21-3) in 1994 by the Decontamination and Decommissioning Program, and the below-ground section was removed in April 1995. No information was available from previous investigations to determine whether hazardous or radioactive contamination remained at this site. It was expected that any contamination was removed during decontamination and decommissioning.

CORRECTIVE ACTION

PRS C21-027 at Field Unit 1, TA-21 at LANL was selected for voluntary corrective action (VCA). A VCA plan was prepared, and the plan was approved by the Department of Energy (DOE).[2,3] The VCA was conducted according to the plan with minor deviations (noted below). This report provides the results of the VCA.

Action on this PRS was begun in 1994 when decontamination and decommissioning operations removed the contaminated structures that stood above ground on this site and continued in April 1995 when the below-ground sections were removed. Documentation that the remedy was completed is provided by confirmatory sampling discussed in this report.

In compliance with the approved VCA plan, we collected three confirmatory samples from one location in the center of the footprint of the former cooling tower (Fig. 1). Samples were collected at 0-to-6 in., 6-to-12 in., and 12-to-18 in. intervals using a hand auger.

To ensure worker health and safety and to meet the requirements of the fixed analytical laboratory, samples were screened for radiation using hand-held field instruments and mobile laboratory techniques. To confirm the absence of contaminants following corrective action, samples were sent to a fixed laboratory and analyzed for gamma-emitting radionuclides, tritium, isotopic uranium, isotopic plutonium, isotopic thorium, strontium-90, americium-241, semivolatile and volatile organic compounds, and metals, as stated in the approved VCA plan.

All wastes were disposed of through the TA-21 decontamination and decommissioning process.

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[1] *TA-21 Operable Unit RFI Work Plan for Environmental Restoration*, May 1991
[2] *Voluntary Corrective Action Plan for TA-21 Sump and Cooling Tower Sites*, August 9, 1995.
[3] Memo LAAO:EP:TJT:VCA:1.4.2.5.3.3.17, from Theodore J. Taylor to J. Jansen, August 1995.

The remedy was completed with the following deviations from the approved VCA plan.

- Sample locations were surveyed to provide exact coordinates, which was not required explicitly in the plan.
- Samples were not screened for volatile organic compounds in the field as planned because experience from decontamination and decommissioning operations indicated that such contaminants were not present at this site.
- Samples were analyzed for isotopic uranium rather than total uranium (as planned) to provide a more complete characterization.

RESULTS

The results of confirmatory sampling are presented in Tables 1 and 2. Copies of all data reports are available and will be provided upon request.

No volatile or semivolatile organic compounds were present at levels greater than the minimum level the analytical method could detect. All detected metals and radionuclides were present at levels less than the screening action level,[4] and all but chromium, plutonium-239, and uranium-235 were present at levels less than the upper tolerance limit[5] and the process area baseline.[6] (Note that for strontium-90, the upper tolerance limit and the process area baseline are less than the minimum amount the analytical method could detect.)

CONCLUSIONS

No samples were found to contain contaminants at levels greater than screening action levels. We conclude that the decontamination and decommissioning activities have accomplished all necessary remediation at PRS C21-027. This PRS, which is associated with cooling tower structure TA-21-143, should be removed from the list of Environmental Restoration Project PRSs. This report serves as the formal request for DOE concurrence to approve no further action at PRS C21-027.

[4] Action level developed for Environmental Restoration Project screening assessments, documented in *Installation Work Plan for Environmental Restoration*, Appendix J, September 1994.

[5] Limit at the 99th percentile with a 95% confidence level of a range of regional background concentrations, documented in *Statistical Comparisons to Background, Part I*, LA-UR-95-1217, March 28, 1995.

[6] A comparison value developed from the 95.5% confidence level of ambient analyte concentrations in soil from TA-21 process areas, documented in *Phase Report 1C, TA-21 Operable Unit RCRA Facility Investigation*, LA-UR-94-228, February 28, 1994.

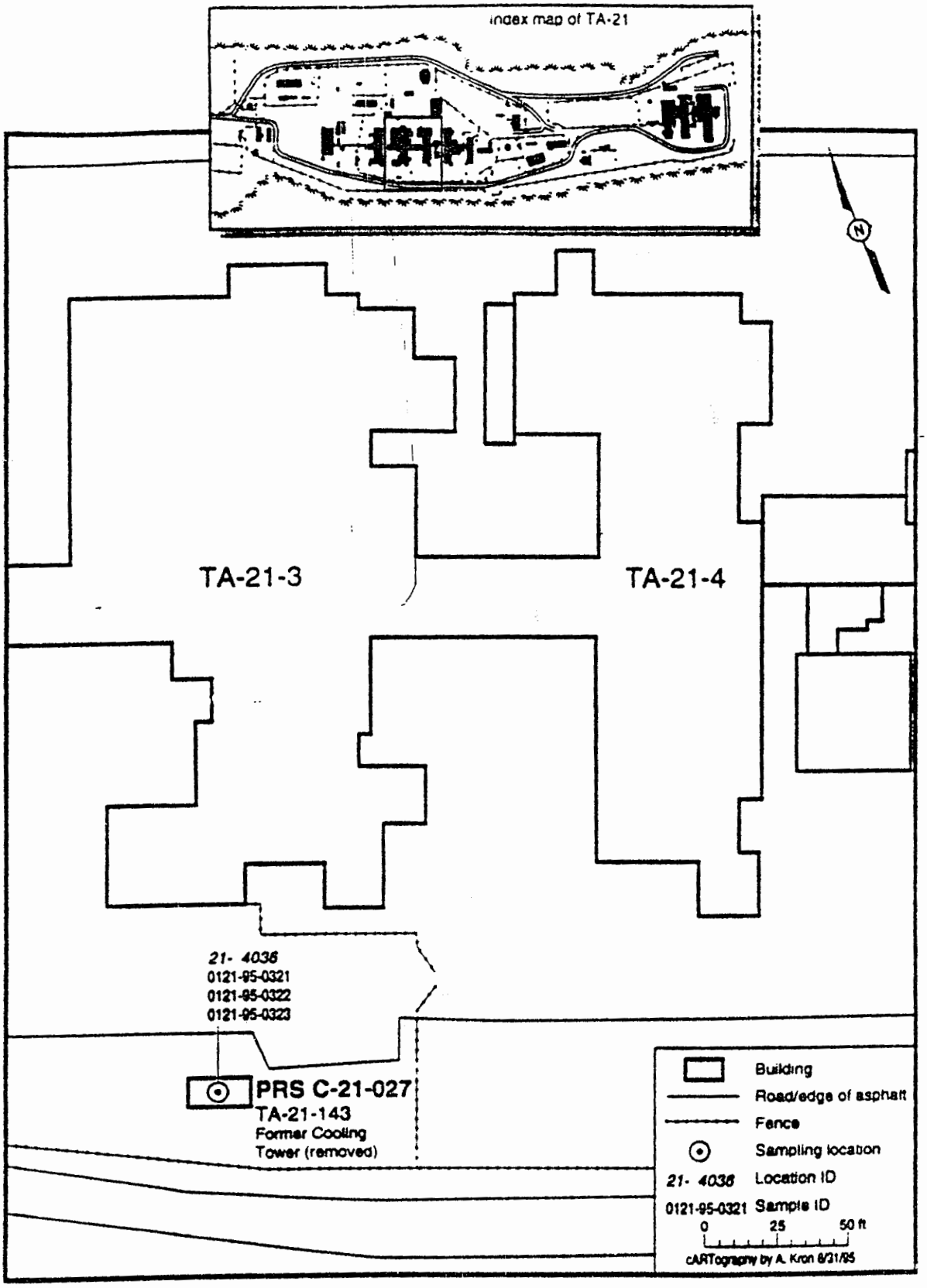

Fig. 1. Location of Confirmatory Samples Collected at PRS C21-027

Table 1. Results of Analyses for Metals at PRS C21-027

Comparison Value	Al (mg/kg)	As (mg/kg)	Ba (mg/kg)	Be (mg/kg)	Ca (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	K (mg/kg)	Mg (mg/kg)	Mn (mg/kg)	Na (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	V (mg/kg)	Zn (mg/kg)
Upper tolerance limit[a]	58,900	11.6	1,140	3.31	54,400	51.1	34.2	15.7	35,600	6,180	16,100	1,030	1,880	26.7	39.0	66	101
Process area baseline[b]	74,900	3.67	513	4.23	13,880	8.50	21	50.8	23,200	NA[c]	4,760	592	29,600	13.6	56.5	43.4	210
Screening action level[d]	NA[c]	NA[c]	5,600	NA[c]	NA[c]	NA[c]	400[e]	3,000	NA[c]	NA[c]	NA[c]	11,000	NA[c]	1,600	400	560	24,000

Loc. ID	Sample ID	Depth (in.)	Al (mg/kg)	As (mg/kg)	Ba (mg/kg)	Be (mg/kg)	Ca (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	K (mg/kg)	Mg (mg/kg)	Mn (mg/kg)	Na (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	V (mg/kg)	Zn (mg/kg)
21-4036	121-95-0321	0-6	12,000	2.4	159	1.0	11,600	5.6	17	7	12,400	1,830	2,710	257	360	9.5	14.6	19.5	32.3
21-4036	121-95-0322	6-12	9,540	2.6	112	0.83	8,360	4.5	16.5	6.3	10,600	1,420	2,010	228	282	7.1	9.5	17.0	31.8
21-4036	121-95-0323	12-18	13,800	2.8	115	0.93	4,560	4.3	104[1]	5.8	13,100	1,800	2,220	182	260	9.2	10.5	19.0	33.3

a Limit at the 99th percentile with a 95% confidence level of a range of regional background concentrations
b Comparison value developed for the 95.5% confidence level of ambient analyte concentrations in soil in TA-21 process areas
c Not available
d Action level developed for Environmental Restoration Project screening assessments
e Level is for chromium(VI)

Table 2. Results of Analyses for Moisture and Radionuclides at PRS C21-027

Comparison Value	^{241}Am (pCi/g)	^{137}Cs (pCi/g)	^{3}H (pCi/L)	^{40}K (pCi/g)	^{238}Pu (pCi/g)	^{239}Pu (pCi/g)	^{90}Sr (pCi/g)	^{228}Th (pCi/g)	^{230}Th (pCi/g)	^{232}Th (pCi/g)	^{234}U (pCi/g)	^{235}U (pCi/g)	^{238}U (pCi/g)
Upper tolerance limit[a]	NA[b]	1.4	NA[b]	36.1	0.014	0.052	1	2.68	1.90	2.68	2.03	0.088	1.90
Process area baseline[c]	0.53	NA[b]	7850	NA[b]	6.21	9.41	0.73	2.05	1.82	1.98	2.03	0.15	2.19
Screening action level[d]	17	4	2,300,000[e]	NA[b]	20	18	5.9	NA[b]	5	5	86	18	59

Location ID	Sample ID	Depth (in.)	Moisture (%)	^{241}Am (pCi/g)	^{137}Cs (pCi/g)	^{3}H (pCi/L)	^{40}K (pCi/g)	^{238}Pu (pCi/g)	^{239}Pu (pCi/g)	^{90}Sr (pCi/g)	^{228}Th (pCi/g)	^{230}Th (pCi/g)	^{232}Th (pCi/g)	^{234}U (pCi/g)	^{235}U (pCi/g)	^{238}U (pCi/g)
21-4036	121-95-0321	0-6	23.0	0.07	0.009	< 2,500	24.2	0.01	0.08	< 2.00	1.2	1.1	0.9	1.41	0.100	0.880
21-4036	121-95-0322	6-12	24.1	0.07	-0.010	< 2,500	24.3	0.0	0.02	<2.00	0.6	0.8	0.9	1.04	0.060	0.840
21-4036	121-95-0323	12-18	25.3	0.2	-0.014	< 2,500	28.6	0.0	0.05	<2.00	1.3	0.5	1.0	1.10	0.080	0.870

a Limit at the 99th percentile with a 95% confidence level of a range of regional background concentrations
b Not available
c Comparison value developed from the 95.5% confidence level of ambient analyte concentrations in soil from TA-21 process areas
d Action level developed for Environmental Restoration Project screening assessments
e Calculated assuming a screening action level of 810 pCi/g of dry soil and 26% soil moisture

ATTACHMENT B Sections of the TA-21 OU RFI Phase Report IC Regarding SWMU 21-027(a)

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10.0 SURFACE DISCHARGE

10.1 SWMU 21-027(a)

Outfall SWMU 21-027(a) is addressed in Section 15.5 of the RFI work plan and is located within the process baseline area. The outfall and sampling locations at SWMU 21-027(a) are shown on Figure 10.1-1. Assessment of the available RFI data for SWMU 21-027(a) suggests that further radiological surveys and field sampling may be necessary. However, a decision on the disposition of this SWMU will be deferred until 1993 borehole data are received and assessed.

10.1.1 Site Process and Sampling History

SWMU 21-027(a) receives liquid wastes from Building TA-21-3. The drain line extends from the southwest corner of Building TA-21-3 to the southwest corner of the cooling tower TA-21-143, where the line discharges into a ponding area. This ponding area also received NPDES-permitted discharges of treated cooling water from the cooling tower. Discharges collected in the ponding area enter a 24 in. corrugated metal pipe that releases at the mesa edge.

Two samples were collected from SWMU 21-027(a) during 1988 reconnaissance sampling. The samples were analyzed according to CLP SOW protocol for target compound list volatile organics, semi-volatile organics and pesticides/PCBs, and target analyte list metals. Standard analyses were performed for americium-241, cesium-137, plutonium-238, plutonium-239/240, radium-226, strontium-90, thorium-232, uranium-234, uranium-235, uranium-238, and tritium. Three samples were also collected from this SWMU as part of a DOE Headquarters Environmental Survey.

Cadmium, chromium, copper, lead, zinc, and mercury were detected well above regional background but generally below SALs. Americium-241, plutonium-238, plutonium-239/240, uranium-234, uranium-235, uranium-238, thorium-232, strontium-90, and cesium-137 were detected in some samples above regional background. Toluene and trichloroethane also were reported at very low levels for these samples. Polynuclear aromatics were identified in samples collected at this SWMU, but the drainage pathway leading to the outfall is lined with asphalt. Analytical results of the 1988 reconnaissance sampling are shown in Table 10.1-1. Analytical results of the DOE Environmental Survey samples are shown in Table 10.1-2. The approximate location of the 1988 reconnaissance samples and the DOE Headquarters Environmental Survey samples are shown in Figure 10.1-1.

10.1.2 RFI Activities and Data Presentation

Characterization at SWMU 21-027(a) was performed in 1992 as prescribed in the RFI work plan, with the exception of the sample locations on the bench below the mesa edge and the analyses that were performed. Bedrock at the proposed sampling locations required sampling locations to be move slightly to allow the required sample volumes to be retrieved. Americium-241 was added to the analyte list and the shallow borehole samples were analyzed for isotopic uranium rather than total uranium.

The investigation included a radiological field survey and collection of samples from five locations on the mesa top and nine locations on the bench below the mesa edge. One surface (0-6 in.) sample was collected at each location.

Table 10.1-3 presents a summary of analyte concentrations detected above the applicable baseline 95.5 percentile.

Two 20-ft boreholes were completed in the ponding area to the south of the cooling tower during 1993. One sample was collected at each five-ft interval in the boreholes. Analytical results were not available for the inclusion in Phase Report 1C, but will be assessed in a phase report addendum. In addition to the locations specifically selected for characterization of 21-027(a), one grid location (21-1289) sampled in the 1992 surface soil investigation was approximately 30 ft east of the outfall channel on the bench. The analytical results for 12-1289 were included in the data assessment for this SWMU.

10.1.3 Data Assessment

The inorganic analytes arsenic, cadmium, chromium, copper nickel, lead, and zinc were detected above their applicable baseline 95.5 percentiles. Chromium exceeded the chromium (VI) SAL at several sampling locations, while other inorganic analytes (except arsenic) were less than 10% of their SALs.

Radionuclide analytes americium-241, tritium, plutonium-238, plutonium-239/240, and uranium were detected above applicable baseline 95.5 percentiles. With the exception of tritium, each radionuclide concentration exceeded its SAL at two or more locations. Tritium was found in concentrations substantially above the process area baseline, on the bench below the mesa edge. The tritium SAL was not exceeded in any of these samples. Field radiological surveys were not prescribed in the RFI work plan and were not carried out.

No near-surface data is currently available to determine vertical migration of contaminants. Neighboring grid location 21-1289 sample data show no analytes above the applicable 95.5 percentile baseline. This would indicate that lateral contamination from this outfall has not occurred.

Previous process knowledge and sample results indicate that enriched uranium (higher uranium-234 and uranium-235 concentrations) might be present in the soil at this SWMU. Because the 1992 RFI samples were analyzed for total uranium, a direct comparison of RFI data to previous isotopic data is not possible.

10.1.4 Conclusions and Recommendations

A recommendation on the disposition of SWMU 21-027(a) will be deferred until outstanding borehole analytical data are received and assessed. However, a follow-on radiological survey and additional near-surface and shallow borehole samples may be needed. Isotopic uranium analyses will be included in the analytical suites for these samples. In addition, isotopic uranium analyses on samples archived from the 1992 investigation have been requested. The results of these analyses will be summarized in a phase report addendum.

10.1.5 QA/QC Sample Summary

The field rinsate blank associated with this SWMU indicated no radionuclide contamination. No detectable inorganics or semi-volatile organics were detected in this blank. Analytical results for this sample were given for only three volatile organics. No detectable concentrations were reported.

No detectable concentrations were reported for 23 of the 25 inorganics in the field reagent blank associated with this SWMU. No detectable volatile or semi-volatile organic concentrations were reported in this blank.

No detectable concentrations were reported in the field trip blank associated with this SWMU.

A radionuclide laboratory duplicate was performed on the sample collected at location 21-1367. Only selected members of the radionuclide suite were chosen in the laboratory for duplicate analysis. Five of the seven sets of results met the precision criteria specified in section 2.1.4 of this report.

A volatile organic MS/MSD analysis was performed on the 0-6 in. sample collected from location 21-1370. Because recoveries were listed in FIMAD in ug/kg, organic precision and accuracy criteria, as specified in the QAPjP, could not be evaluated at this time.

Because inorganic laboratory duplicates or MS/MSD analyses were not performed, inorganic precision and accuracy criteria, as specified in the QAPjP, could not be evaluated.

Table 10.1-4 lists the radionuclides that did not meet the precision criteria specified in the QAPjP.

Table 10.1-5 lists inorganics and volatile organics that were detected in blanks collected at SWMU 21-027(a).

Table 10.1-1 1988 outfall reconnaissance sampling – SWMU 21-027(a).

ANALYTE	CONCENTRATION	DETECTION LIMIT	UNITS
SAMPLE #1			
Volatiles			
Methylene chloride	75	65	ug/g
Semi-Volatiles			
Fluoranthene	3000	2200	ug/g
Phenanthrene	2400	2200	ug/g
Pyrene	2300	2200	ug/g
Metals			
Aluminum	1490	39.1	ug/g
Arsenic	3.3	2.0	ug/g
Cadmium	1.1	0.98	ug/g
Calcium	1790	978	ug/g
Chromium	48.9	2.0	ug/g
Copper	35.4	4.9	ug/g
Iron	10200	19.6	ug/g
Lead	46.6	19.6	ug/g
Manganese	87.7	2.9	ug/g
Mercury	0.29	0.12	ug/g
Nickel	12.8	7.8	ug/g
Oil & Grease	4630	58.2	ug/g
Vanadium	13.5	9.8	ug/g
Zinc	226	3.9	ug/g
Radionuclides			
Americium	4.6	0.6	ug/g
Cesium-137	0.5	0.1	pCi/g
Plutonium-238	1.9	0.2	pCi/g
Plutonium-239/240	28	1.0	pCi/g
Radium-226	0.7	0.1	pCi/g
Strontium-90	0.4	0.2	pCi/g
Thorium-232	0.9	0.1	pCi/g
Tritium	1,600	100	nCi/l
Uranium-234	290	20	pCi/g
Uranium-235	10	1	pCi/g
Uranium-238	1.9	0.4	pCi/g

ANALYTE	CONCENTRATION	DETECTION LIMIT	UNITS
SAMPLE #2			
Radionuclides			
Americium	7.6	0.5	pCi/g
Cesium-137	0.3	0.1	pCi/g
Plutonium-238	8.5	0.5	pCi/g
Plutonium-239/240	6.8	2.0	pCi/g
Radium-226	1.2	0.1	pCi/g
Thorium-232	0.4	0.2	pCi/g
Tritium	68	3.0	nCi/l
Uranium-234	4.0	0.4	pCi/g
Uranium-235	0.2	0.1	pCi/g
Uranium-238	0.7	0.2	pCi/g
Metals			
Aluminum	1290	31.7	ug/g

Note: Sample #1 was from CEARP Outfall 3d; Sample #2 from 3ae.

Table 10.1-2 Environmental Problem 19 analytical data.

ANALYTE	LA30201	LA30202	LA30303
Inorganics (ug/g)			
Antimony	--	--	--
Arsenic	--	--	--
Barium	195	103	131
Beryllium	--	0.53B	0.39B
Cadmium	--	--	4.9
Chromium	16.5	38.1	90.6
Copper	50.1	110	103
Lead	63.5	52.4	77.2
Mercury	NR	NR	NR
Nickel	12.4	7.3B	10.6
Selenium	--	--	--
Silver	--	--	--
Thallium	--	--	--
Zinc	296	286	379
Radionuclides (pCi/g)[a]			
Alpha emitters			
Thorium-232[b]	<4.4	<9.22	<8.28
Uranium-234	--	--	267
Uranium-235	0.469	0.29	14.8
Uranium-238[b]	<6.51	<10	<7.79
Total uranium	2.0	5.0	6.0
Plutonium-238	4.0	86	14.4
Plutonium-239/240	22.3	216	84.5
Americium-241	4.2	27.4	9.3
Beta emitters			
Strontium-90	<0.55	<0.76	<0.84
Gamma emitters			
Potassium-40	12.3	17.8	17.7
Cesium-137	0.21	0.642	1.37
Beryllium-7	0.34	--	0.6

ANALYTE	LA30201	LA30202	LA30303
Tentatively Identified Compounds (ug/kg)			
Butyl Phenol	41J	--	--
Terpene	56J	1600J	--
Terpene	110J	110J	--
Terpene	--	2000J	--
Target Compound (ug/kg)			
Acetone	100B	260B	--
1,1,1-Trichloroethane	--	--	--
Trichloroethene	--	--	73
Toluene	--	--	44
Ethylbenzene	--	--	20J
Xylene (total)	--	--	18J
alpha-BHC	--	--	--
Endosulfan I	--	--	--
Endosulfan II	--	--	--
4,4'DDD	--	--	--
4,4'-DDT	--	--	--
Gamma-chlordane	--	--	--
Aroclor-1221	--	--	--
Aroclor-1248	--	--	--
Aroclor-1254	2600J	3200J	7700J

[a] - Total uranium is reported in ug/g.
[b] - Total unbroken chain activity in equilibrium.
B - Detected in associated blank.
J - Estimated value.
Note - Thorium-230, total uranium, plutonium-238, plutonium-239/240, and strontium-90 are reported on a dry weight basis.

Table 10.1-3 Analytes detected above the 95.5 percentile of applicable baseline categories at SWMU 21-027(a).

Analyte	Location ID	Applicable Category	95.5 Percentile*	SAL*	Surface (0-6 in.)*
Am-241	21-1361	P	0.526	22	14.5
	21-1362	P	0.526	22	34
	21-1363	P	0.526	22	0.784
	21-1364	P	0.526	22	8.77
	21-1365	P	0.526	22	11.2
	21-1366	P	0.526	22	12.11
	21-1367	P	0.526	22	9.96
	21-1369	P	0.526	22	15.82
	21-1370	P	0.526	22	37.1
	21-1371	P	0.526	22	13.22
	21-1372	P	0.526	22	9.79
	21-1373	P	0.526	22	8.15
	21-1374	P	0.526	22	10.59
H-3	21-1365	P	7.85	15000	9.5
	21-1366	P	7.85	15000	127.4
	21-1367	P	7.85	15000	284.7
	21-1368	P	7.85	15000	45.9
	21-1369	P	7.85	15000	304.9
	21-1370	P	7.85	15000	25.3
	21-1371	P	7.85	15000	56.8
	21-1372	P	7.85	15000	263.7
	21-1373	P	7.85	15000	2300
	21-1374	P	7.85	15000	69
Pu-238	21-1362	P	6.21	27	12.1
	21-1364	P	6.21	27	7.89
	21-1366	P	6.21	27	10.7
	21-1367	P	6.21	27	8.79
	21-1368	P	6.21	27	14.8
	21-1369	P	6.21	27	14.16
	21-1370	P	6.21	27	52
	21-1371	P	6.21	27	25.23
	21-1372	P	6.21	27	6.47
	21-1373	P	6.21	27	21.9
	21-1374	P	6.21	27	20.34
Pu-239/240	21-1361	P	9.41	24	30.4
	21-1362	P	9.41	24	193
	21-1363	P	9.41	24	16.8

Analyte	Location ID	Applicable Category	95.5 Percentile*	SAL*	Surface (0-6 in.)*
Pu-239/240	21-1364	P	9.41	24	43.6
	21-1365	P	9.41	24	50
	21-1366	P	9.41	24	73.29
	21-1367	P	9.41	24	67.26
	21-1368	P	9.41	24	67.08
	21-1369	P	9.41	24	75.03
	21-1370	P	9.41	24	165
	21-1371	P	9.41	24	89.6
	21-1372	P	9.41	24	59.63
	21-1373	P	9.41	24	96.23
	21-1374	P	9.41	24	64.81
U Total	21-1361	P	7.51	66.3	28.8
	21-1362	P	7.51	66.3	8.6
	21-1363	P	7.51	66.3	7.6
	21-1364	P	7.51	66.3	158.6
	21-1365	P	7.51	66.3	137
	21-1366	P	7.51	66.3	99.3
	21-1367	P	7.51	66.3	111.4
	21-1368	P	7.51	66.3	231.5
	21-1369	P	7.51	66.3	108
	21-1370	P	7.51	66.3	110.2
	21-1371	P	7.51	66.3	48.5
	21-1372	P	7.51	66.3	42
	21-1373	P	7.51	66.3	41
	21-1374	P	7.51	66.3	32.2
As	21-1364	NP	3.67	0.4	5
	21-1365	NP	3.67	0.4	4.7
	21-1366	NP	3.67	0.4	4.4
	21-1367	NP	3.67	0.4	4.2
	21-1368	NP	3.67	0.4	3.7
	21-1369	NP	3.67	0.4	4.9
	21-1370	NP	3.67	0.4	6.9
Cd	21-1362	P	2.14	80	2.2
	21-1364	P	2.14	80	4.2
	21-1366	P	2.14	80	3.9
	21-1367	P	2.14	80	3.2
	21-1368	P	2.14	80	3.3
	21-1369	P	2.14	80	3.6
	21-1371	P	2.14	80	4
	21-1373	P	2.14	80	2.3

Analyte	Location ID	Applicable Category	95.5 Percentile*	SAL*	Surface (0-6 in.)*
Cr	21-1374	P	2.14	80	3
	21-1362	NP	20.95	400	36.6
	21-1364	NP	20.95	400	436
	21-1365	NP	20.95	400	463.1
	21-1366	NP	20.95	400	410
	21-1367	NP	20.95	400	335
	21-1368	NP	20.95	400	461
	21-1369	NP	20.95	400	419
	21-1370	NP	20.95	400	1000.4
	21-1371	NP	20.95	400	266
	21-1372	NP	20.95	400	174
	21-1373	NP	20.95	400	131
	21-1374	NP	20.95	400	178
Cu	21-1362	P	50.8	3000	79.2
	21-1364	P	50.8	3000	198
	21-1366	P	50.8	3000	179
	21-1367	P	50.8	3000	98.3
	21-1368	P	50.8	3000	86.7
	21-1369	P	50.8	3000	136
	21-1372	P	50.8	3000	86.5
Ni	21-1364	P	13.62	1600	42.3
	21-1365	P	13.62	1600	34.7
	21-1370	P	13.62	1600	21.8
Pb	21-1364	P	56.5	500	73
	21-1366	P	56.5	500	57.8
	21-1369	P	56.5	500	62.3
Zn	21-1361	P	210.4	24000	442
	21-1362	P	210.4	24000	316
	21-1364	P	210.4	24000	512
	21-1365	P	210.4	24000	826.3
	21-1366	P	210.4	24000	497
	21-1367	P	210.4	24000	469
	21-1368	P	210.4	24000	345
	21-1369	P	210.4	24000	463
	21-1370	P	210.4	24000	240.9

Analyte	Location ID	Applicable Category	95.5 Percentile*	SAL*	Surface (0-6 in.)*
Zn	21-1371	P	210.4	24000	232
	21-1372	P	210.4	24000	216

* - Units for radiological analyte values are in pCi/g, except for H3 which are in nCi/l soil moisture and U which are in ppm.
- Units for inorganic analyte values are in ug/g
P - Process Area Baseline
NP - Non-Process Area Baseline

Table 10.1-4 QA/QC Sample Summary - Radionuclide data precision - SWMU 21-027(a).

Analyte	Location ID	Sample Depth	Sample Concentration	Laboratory Duplicate Location	Relative Percent Difference
Americium-241	21-1367	0 to 6"	9.96 pCi/g	16.7 pCi/g	60
Plutonium-239 /240	21-1367	0 to 6"	67.3 pCi/g	112 pCi/g	60

Table 10.1-5 QA/QC sample summary – blanks – SWMU 21-027(a).

Analyte	Location ID	Sample Concentration	Blank Type
Acetone	21-1361	41 ug/l	FB
Cobalt	21-1374	9.5 ug/l	FR
Sodium	21-1374	42.8 ug/l	FR

FR-Field reagent blank; FB-Field trip blank.

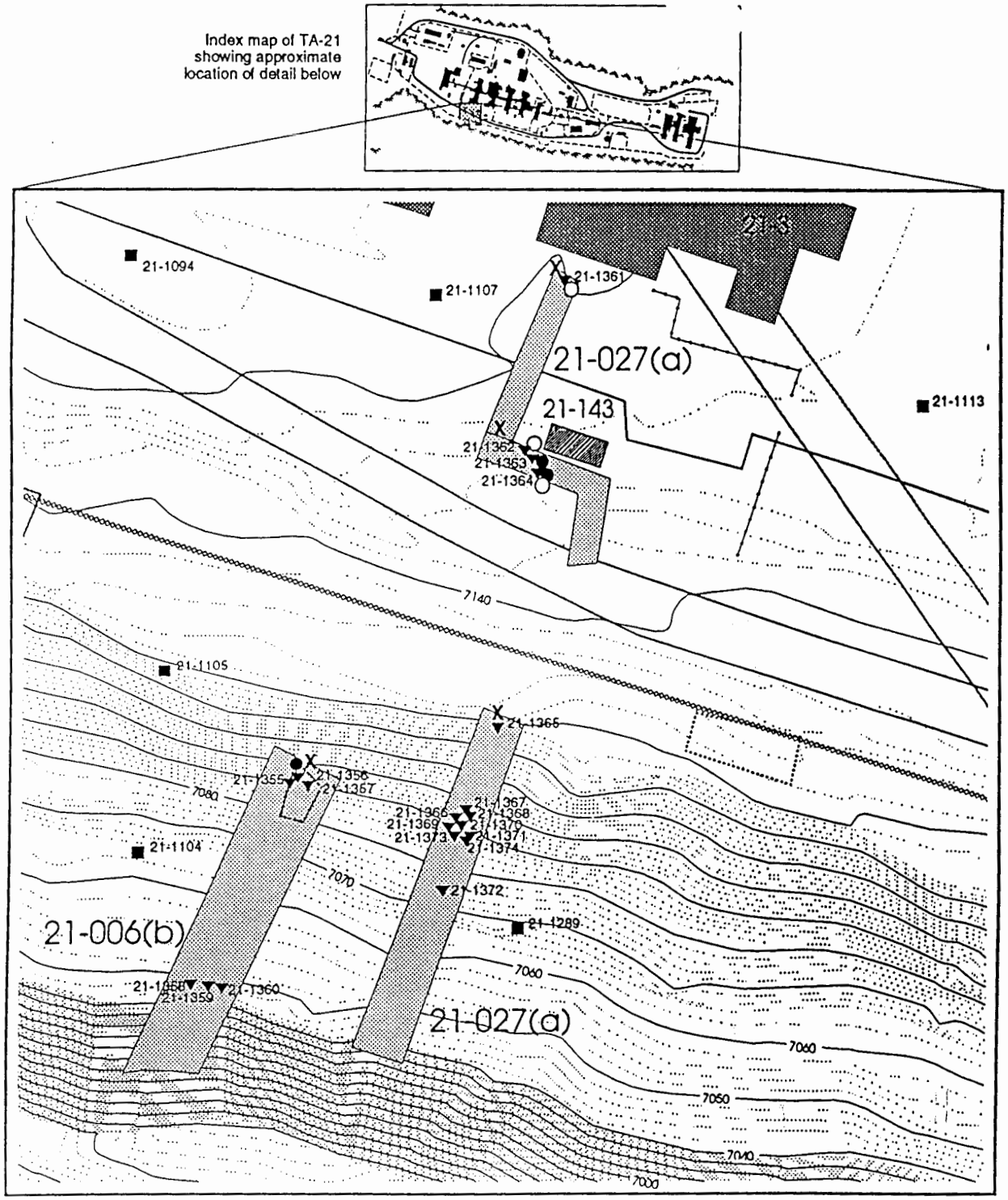

Figure 10.1-1
SWMU 21-027(a)

- Contours, 2 foot
- Contours, 10 foot
- Fence, Industrial
- Fence, Security
- Rad Survey Area
- Roads, Dirt
- Roads, Paved
- Permanent Structure
- Solid waste Management Unit
- Temporary Structure
- Grid Sample Locations
- 1992 Outfall Sample Locations
- 1988 Reconnaissance Sample Locations
- Environmental Survey Problem #19 Sample Locations
- Discharge Point

Underground drain lines associated with the outfall are not shown

Potential release site locations are estimated

Samples were collected in or near most probable flow path

0 33.3 100
FEET

N

Based on FIMAD Map: G101780

Modified by: David Dander 2/22/94