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Date: APR 28 1995

Refer to: EM/ER:95-172

MAY 3 1995

Mr. William Honker
RCRA Permits Branch
Hazardous Waste Management Division
US Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

SUBJECT: SUBMITTAL OF THE RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION (RFI) REPORT FOR A POTENTIAL RELEASE SITE (PRS) IN TECHNICAL AREA (TA) 31

Dear Mr. Honker:

Enclosed are two copies of the Los Alamos National Laboratory's RFI Report concerning PRS 31-001 in TA-31. The report documents the fieldwork performed as detailed in the approved RFI Work Plan for Operable Unit 1079 and the sampling results. This RFI Report was due to your office on March 29, 1995.

Please ask your office to contact Garry Allen at (505) 667-6080 or Bonnie Koch at (505) 665-7202 if you have any questions.

Sincerely,

Tracy Slatton
for Jorg Jansen, Project Manager
Environmental Restoration

Sincerely,

T. J. Taylor
Theodore J. Taylor, Program Manager
Los Alamos Area Office

Environmental Restoration

2161

TL

JJ/TT/bp

Enclosure: RFI Report for PRS 31-001 (2 copies)

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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:

Submittal of the Resource Conservation and Recovery Act Facility Investigation (RFI) Report for A Potential Release Site (PRS) in Technical Area (TA) 31

Name: _____ Date: 4-27-95

Tom Baca, Program Director
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or

Jorg Jansen, Project Manager
Environmental Restoration Project
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Name: _____ Date: 4/28/95

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

RFI Report for PRSs

31-001

LANL
XIII

Field Unit 1

Environmental Restoration Project

Los Alamos National Laboratory

May 5, 1995

A Department of Energy

Environmental Cleanup Program

LANL
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LA-UR-95-XXX

[redacted]

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EXECUTIVE SUMMARY

This Resource Conservation and Recovery Act (RCRA) Facility Investigation Report describes the Phase I investigation performed at former Technical Area (TA) 31, also known as the east receiving yard. Former TA-31 was located on East Mesa north of East Road and west of the Los Alamos Airport. The site served as the main receiving area for Los Alamos Scientific Laboratory supplies, including everything from office supplies to technical apparatus, from 1945 until it was decommissioned in 1954. During this time period, no radioactive materials were stored at TA-31, and it is unlikely that large amounts of bulk chemicals were stored at the site. The Hazardous and Solid Waste Amendments Module VIII of Los Alamos National Laboratory's RCRA Facility Permit identifies one solid waste management unit (SWMU) at TA-31, SWMU 31-001, a former septic tank system.

The objectives of the Phase I investigation at TA-31 were: 1) to determine if there was residual soil contamination associated with the septic tank system and the related outfall area; and 2) to determine if the septic line connecting the former main warehouse to the former septic tank remained and, if found, to remove it.

Results of the SWMU 31-001 investigation indicate that no septic line remains, and that there is no residual contamination in the area of the former septic line. However, at the mouth of the septic tank outfall pipe the polychlorinated biphenyl Aroclor 1254™ was detected at a concentration above its screening action level and above the regulatory cleanup level. Therefore, a voluntary corrective action is recommended to remediate the site to eliminate any potential health or ecological risks associated with this chemical of potential concern.

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1.0 INTRODUCTION

This report presents the results of the Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Technical Area (TA) 31 at Los Alamos National Laboratory (LANL). Included in this report are the data assessment and analysis approach used in this investigation, and the site-specific results, conclusions, and recommendations for SWMU 31-001.

1.1 Facility Background

Former TA-31, known as the east receiving yard, was located on East Mesa north of East Road and west of the Los Alamos Airport (Fig. 1). The site was the main receiving area for supplies at Los Alamos Scientific Laboratory from 1945 to 1954. TA-31 was operated by Group A-4, which was responsible for procuring everything from office supplies to technical apparatus.

The TA-31 facilities originally consisted of five warehouses, a roofed receiving dock, and an oil drum storage area. A transformer station and a paved parking area that could accommodate up to 50 trucks and other vehicles were added sometime prior to 1950. In 1949 a new main warehouse, TA-31-7, was constructed to replace one of the original warehouses. This new warehouse included a sanitary septic system consisting of two manholes, an aboveground septic tank, and a septic line (Fig. 2). The sewer line ran north from the main warehouse to the concrete septic tank, which was located on a small topographic bench above the mesa rim of Pueblo Canyon (DOE 1987, 0264). The septic tank drained through a four-inch-diameter vitrified clay outfall pipe directly into a natural drainage on the southern slope of Pueblo Canyon. This septic tank system is designated as solid waste management unit (SWMU) 31-001, the only SWMU identified at TA-31 (LANL 1992, 0783).

It is not documented which chemicals were received and stored at TA-31, but operational history indicates that no radioactive materials were stored there. It is also unlikely that large quantities of bulk chemicals were stored at TA-31 because Group A-4 maintained a chemical storage area at TA-21 (LASL 1947, 0461). No documented spills occurred at TA-31, but an undocumented spill may have released chemicals into the septic system.

The RFI Work Plan for Operable Unit (OU) 1079 identifies the chemicals of potential concern (COPCs) at TA-31 as semivolatile organic compounds (SVOCs) and target analyte list (TAL) metals (LANL 1992, 0783). If field screening results indicated concentrations of volatile organic compounds (VOCs) and radionuclides above their background levels, the work plan also recommended fixed laboratory analysis for these analytes.

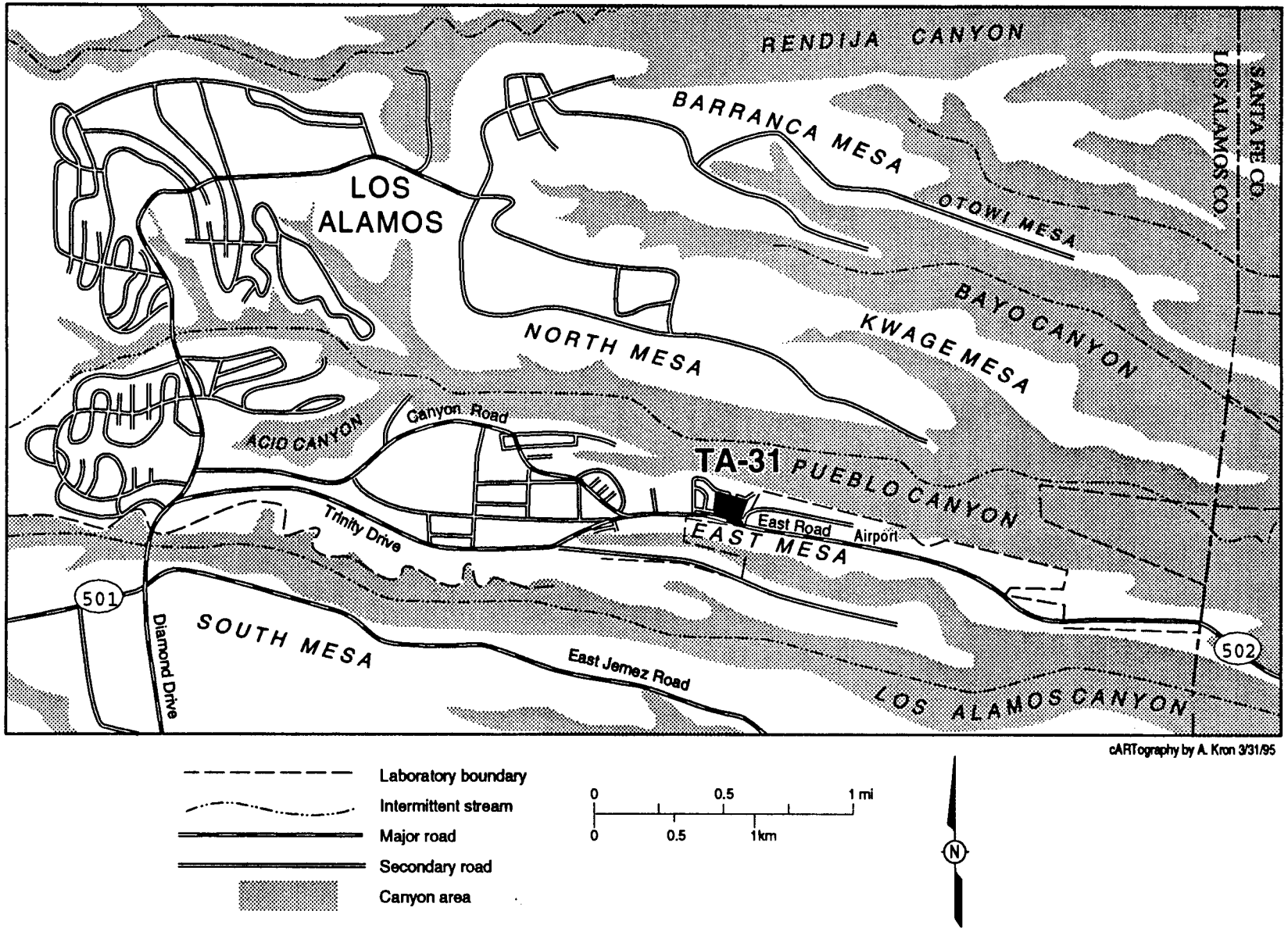


Fig. 1. General location of TA-31.

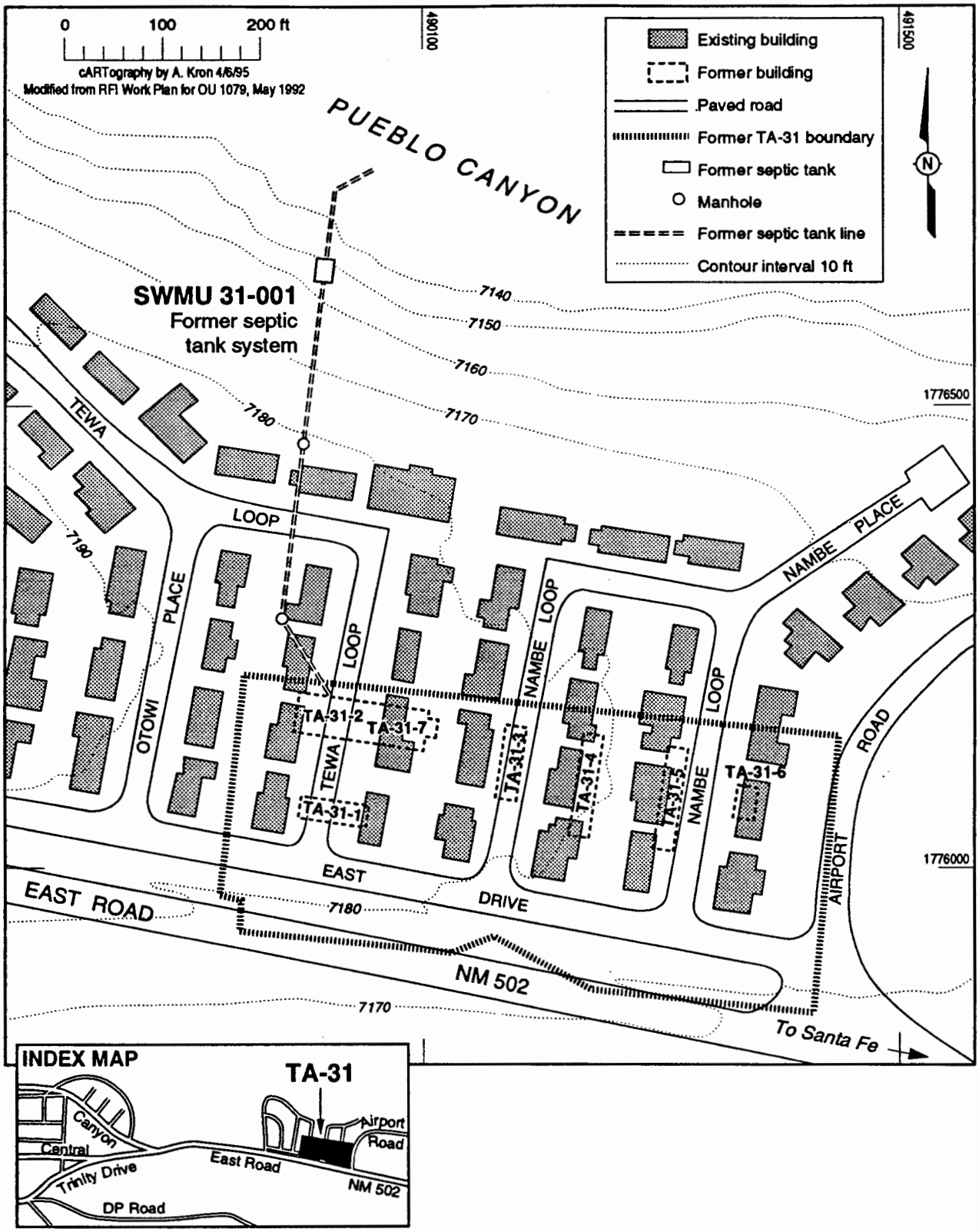


Fig. 2. Locations of former and existing structures at TA-31.

In 1954, TA-31 was abandoned, and the buildings were removed. However, there is no record of site decontamination and decommissioning. Homes have since been built over this area (Fig. 2). The septic tank was removed and sampled in 1988. There were no detectable concentrations of hazardous constituents in any of the samples; however, the documentation for these analyses is unavailable. No septic line was encountered when the septic tank was removed.

1.2 Phase I Work Plan Overview

The Phase I investigation at TA-31 had two objectives. The first objective was to determine if there was residual soil contamination associated with the septic tank system and its related outfall area to corroborate the undocumented verbal reports that there was no chemical or radioactive contamination in the septic tank at the time of its removal. The second objective was to determine if the septic line from the former main warehouse (TA-31-7) to the former septic tank remained and, if found, to remove it.

No sampling in the residential area was warranted during the Phase I investigation. However, if residual contamination had been found in the former septic tank location, the septic line location, or the outfall area, sampling in the residential area was to be considered.

1.3 Field Activities

Field activities at TA-31 consisted of collecting surface and subsurface soil samples from the former septic tank location, the former septic line location, and the related outfall area. Surface and subsurface soil samples were collected using the following standard operating procedures (SOPs): LANL-ER-SOP-6.09,R0, Spade and Scoop Method for Collection of Soil Samples and LANL-ER-SOP-6.10,R0, Hand Auger and Thin-Wall Tube Sampler. Two trenches were dug to locate the former septic system line, and soil samples were taken from each trench (ICF Kaiser 1993, 06-0104) (Fig. 3).

One field duplicate sample, one field water blank sample, and one equipment rinsate sample were collected for quality assurance. Two soil samples, AAA4688 and AAA4689, were collected to serve as a matrix spike and a matrix spike duplicate to meet the Quality Assurance Project Plan requirements (LANL 1991, 0553). These soil samples, collected at the same location as AAA4680, were not spiked, and they served in this investigation as field duplicates of AAA4680 (Fig. 3).

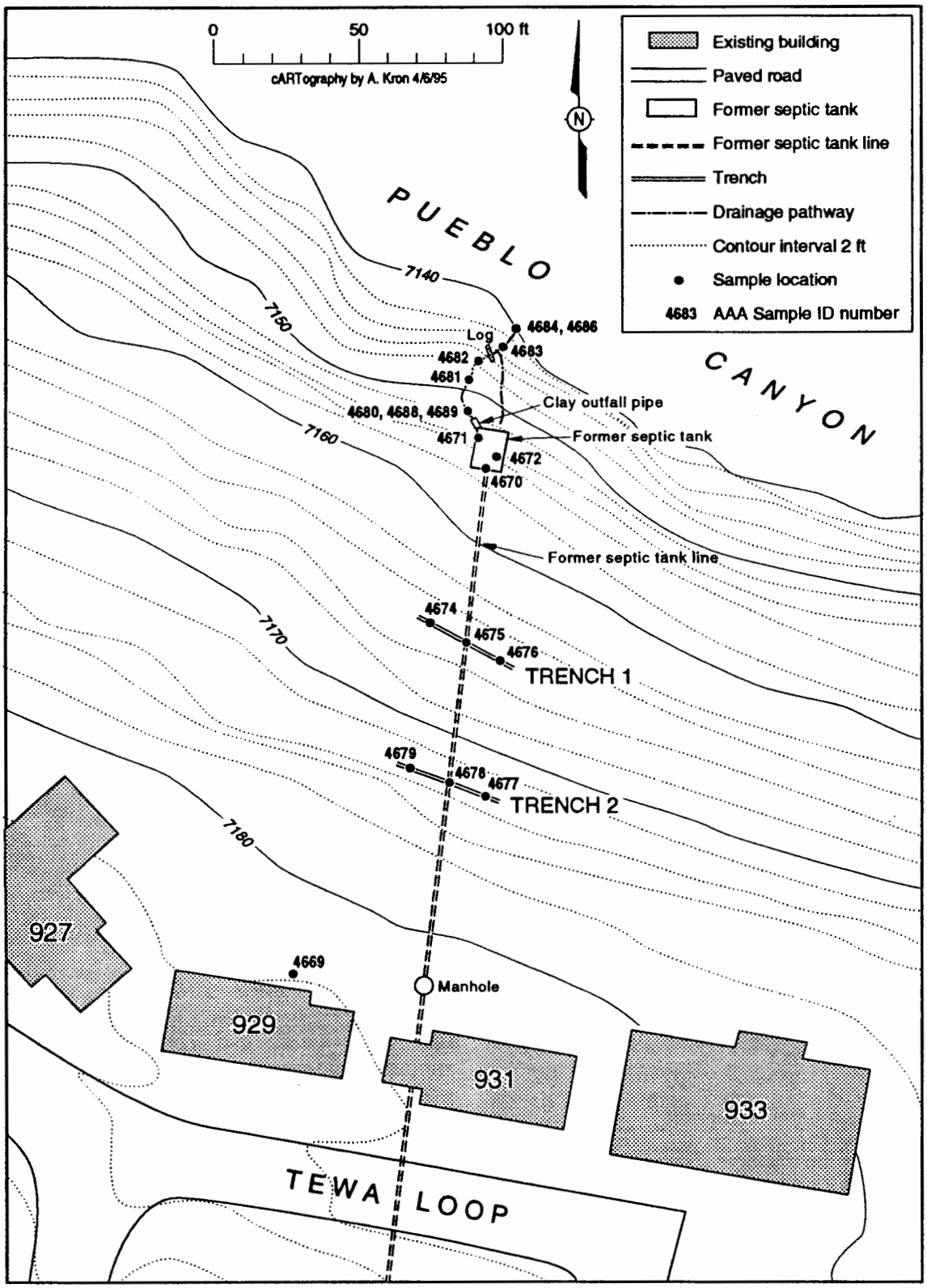


Fig. 3. Locations of Phase I Sample IDs at SWMU 31-001, the former septic tank system at TA-31.

All samples were field screened for radioactivity using a Ludlum Model 2221 with a Ludlum probe 44-9 (Standard Geiger-Müller), and for volatile organic vapors using a photoionization detector (HNu), then they were submitted with chain-of-custody documentation to the sample coordination facility (SCF) for analysis. If radioactivity was detected at levels above background in any sample during field screening, that sample was to be analyzed using gamma spectrometry to identify individual radionuclides. Although the work plan states that fixed laboratory analysis for VOCs would be performed only if field screening results indicated VOC concentrations above background levels, all samples were analyzed for VOCs.

At the SCF, all samples were analyzed for TAL metals by flame atomic absorption, electrothermal vaporization atomic absorption, cold vaporization atomic absorption, inductively coupled plasma emission spectroscopy (EPA SW-846 Method 6010), inductively coupled plasma/mass spectrometry, and colorimetry. The TAL metals list includes aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc. All samples were analyzed for VOCs using purge and trap gas chromatography/mass spectrometry (EPA SW-846 Method 8240); for SVOCs using packed column gas chromatography/mass spectrometry (EPA SW-846 Method 8250); and for polychlorinated biphenyls (PCBs) using gas chromatography/electron capture detector (EPA SW-846 Method 8080). In addition, one field blank was analyzed for the following radionuclides: tritium using liquid scintillation; cesium-137 and americium-241 using gamma spectroscopy; and uranium-234, -235, and -238, plutonium-238 and -239, and americium-241 using alpha spectrometry.

2.0 ENVIRONMENTAL SETTING

2.1 Climate

The Los Alamos area of north-central New Mexico has a semiarid, temperate mountain climate. Annual precipitation in the area normally reaches about 18 in., 40% of which occurs as brief, intense thunderstorms during July and August. Winter snowfall averages about 51 in. annually. In summer months, maximum daily temperatures are usually below 90°F, dropping into the 50s at night. Winter temperatures typically range from 30°F to 50°F during the day, and from 15°F to 25°F at night, occasionally dropping to 0°F or below (LANL 1993, 1017). Winds in Los Alamos vary greatly with the time of day and location, due in large part to the complex terrain. Prevailing winds at TA-31 are generally from the west-southwest to south-southwest, averaging about 12 mph (LANL 1992, 0783).

2.2 Geology

TA-31 is situated on the Pajarito Plateau. The plateau has a relatively flat, eastward-sloping surface dissected by numerous steep-sided canyons. TA-31 is located on the north side of East Mesa at an elevation of 7 270 ft. The ground at the site slopes gently toward the rim of Pueblo Canyon, and the canyon wall adjacent to the mesa top consists of alternating steep slopes and cliffs. The surface soils at TA-31 are made up of alluvial deposits and well-drained, sandy loams with a maximum depth of only a few feet. Bandelier Tuff, composed of volcanic air-fall and ash-flow deposits, forms the bedrock at the site. Areas of exposed bedrock exist near the edges of the mesa (LANL 1992, 0783).

2.3 Hydrology

There is no surface water body present at TA-31, but surface water runoff can occur in response to rain or melting snow. The prevalence of short, intense summer thunderstorms suggests that water-driven erosion of surface soils may be an important mechanism in transporting surface contaminants at TA-31.

The Pueblo Canyon watershed stretches west on US Forest Service land from above the townsite all the way to the Rio Grande. West of TA-31, the Acid Canyon-Pueblo Canyon confluence contains a perennial stream. The portion of this stream in middle Pueblo Canyon at the Acid Canyon-Bayo Canyon confluence near TA-31 is an intermittently flowing stream. East of TA-31, the Los Alamos Municipal Sewage Treatment Plant at the east end of Kwage Mesa adds sufficient effluent to provide artificial perennial stream flow to the Rio Grande.

The main aquifer beneath the Pajarito Plateau is at an elevation of nearly 6 000 ft and lies chiefly within the sediments of the Puye and Tesuque geologic formations. At mesa-top sites such as TA-31, between 1 000 and 1 200 ft of unsaturated tuff and sediments separate the surface from the main aquifer.

2.4 Wildlife Habitats

TA-31 is readily discernible as two wildlife habitats: the mesa-top habitat and the canyon habitat below the outfall. The mesa-top habitat is characterized by urban disturbance from the Los Alamos townsite. Comprehensive plant and animal inventories were not performed for the TA-31 mesa top because of the high level of disturbance. Because the wildlife habitat on the mesa top can be characterized as urban plant and animal communities, it is not necessary to assess the affects of any COPCs found at the site to the mesa-top habitat.

However, the canyon habitat below the TA-31 outfall, including the north-facing cliffside at TA-31 and continuing into middle and lower Pueblo Canyon, is not highly disturbed and contains sensitive habitats (Biggs 1993, 06-0101). East of TA-31, the Los Alamos Municipal Sewage Treatment Plant adds sufficient effluent to the intermittent stream that flows in the middle canyon to provide artificial perennial stream flow to the Rio Grande. The treated effluent has had a positive ecological impact on lower Pueblo Canyon, creating a sensitive streamside riparian habitat that supports a wide variety of hydrophilic plants and animals. The peregrine falcon (Falco peregrinis), federally endangered and protected as an endangered species in New Mexico, nests in lower Pueblo Canyon.

Because of the sensitive nature of the middle and lower Pueblo Canyon habitats, an ecological screening assessment will be performed to assess the potential impact of any COPCs found at the site to the biota within the canyon.

3.0 DATA ASSESSMENT AND ANALYSIS APPROACH

3.1 Summary of Quality Assurance/Quality Control Activities

Seventeen soil samples, including three duplicates, were collected at TA-31. In addition, two liquid samples, a field water blank sample and an equipment rinsate sample, were submitted for analyses. Radiation screening results (gross alpha, gross beta, and gross gamma) for all samples indicated no radioactive contamination, as shown in Table 1.

All 19 samples were analyzed for TAL metals under request numbers 15672, 15690, and 15691 (Table 2). All of the quality control (QC) results for TAL metals in these requests were within allowable limits; therefore, all of the data associated with TAL metals in these requests are rated as valid.

All 19 samples were analyzed for VOCs under request numbers 15674, 15686, and 15689 (Table 2). In requests 15686 and 15689 all of the QC results for VOCs were within allowable limits; therefore, all of the data associated with VOCs in these requests are rated as valid. In request 15674, 1,2-dibromo-3-chloropropanol was found in the method blank at 12 ug/kg, affecting samples AAA4669, AAA4680, AAA4671, AAA4672, AAA4681, AAA4682, AAA4683, AAA4684, AAA4686, AAA4688, and AAA4689. However, 1,2-dibromo-3-chloropropanol was not detected in any of the samples. Therefore, the data associated with VOCs in this request are rated as valid.

TABLE 1

RADIATION SCREENING RESULTS FOR SAMPLES COLLECTED AT TA-31

SAMPLE ID	ANALYTE	ANALYSIS RESULTS	UNCERTAINTY	UNITS
AAA4669	Alpha	14.60	± 63.1	pCi/g
	Beta	-1.20	± 23.8	pCi/g
	Gamma	2.70	± 4.4	pCi/g
AAA4670	Alpha	7.30	± 63.1	pCi/g
	Beta	-0.80	± 23.8	pCi/g
	Gamma	1.30	± 4.4	pCi/g
AAA4671	Alpha	3.60	± 63.1	pCi/g
	Beta	11.10	± 23.8	pCi/g
	Gamma	4.10	± 4.4	pCi/g
AAA4672	Alpha	3.60	± 63.1	pCi/g
	Beta	10.40	± 23.8	pCi/g
	Gamma	-0.20	± 4.4	pCi/g
AAA4674	Alpha	0.00	± 63.1	pCi/g
	Beta	-7.60	± 23.8	pCi/g
	Gamma	2.00	± 4.4	pCi/g
AAA4675	Alpha	0.00	± 63.1	pCi/g
	Beta	1.90	± 23.8	pCi/g
	Gamma	7.30	± 4.4	pCi/g
AAA4676	Alpha	7.30	± 63.1	pCi/g
	Beta	3.40	± 23.8	pCi/g
	Gamma	5.80	± 4.4	pCi/g
AAA4680	Alpha	25.50	± 63.1	pCi/g
	Beta	-5.20	± 23.8	pCi/g
	Gamma	2.30	± 4.4	pCi/g
AAA4681	Alpha	29.20	± 63.1	pCi/g
	Beta	-3.90	± 23.8	pCi/g
	Gamma	2.00	± 4.4	pCi/g
AAA4682	Alpha	3.60	± 63.1	pCi/g
	Beta	-4.70	± 23.6	pCi/g
	Gamma	-0.70	± 4.4	pCi/g
AAA4683	Alpha	10.90	± 63.1	pCi/g
	Beta	-3.60	± 23.8	pCi/g
	Gamma	-1.80	± 4.4	pCi/g
AAA4684	Alpha	7.30	± 63.1	pCi/g
	Beta	8.40	± 23.8	pCi/g
	Gamma	-1.50	± 4.4	pCi/g
AAA4686	Alpha	40.10	± 63.1	pCi/g
	Beta	-5.70	± 23.8	pCi/g
	Gamma	-0.80	± 4.4	pCi/g
AAA4688	Alpha	3.60	± 63.1	pCi/g
	Beta	-1.00	± 23.8	pCi/g
	Gamma	-1.50	± 4.4	pCi/g
AAA4689	Alpha	3.60	± 63.1	pCi/g
	Beta	9.30	± 23.8	pCi/g
	Gamma	-1.90	± 4.4	pCi/g
AAA4720	Alpha	0.00	± 63.1	pCi/swipe
	Beta	-0.60	± 23.8	pCi/swipe
	Gamma	-11.10	± 4.4	pCi/swipe
AAA4721	Alpha	0.00	± 63.1	pCi/swipe
	Beta	-0.30	± 23.8	pCi/swipe
	Gamma	-10.90	± 4.4	pCi/swipe
AAA4722	Alpha	-0.50	± 63.1	pCi/swipe
	Beta	-1.50	± 23.8	pCi/swipe
	Gamma	-12.00	± 4.4	pCi/swipe
AAA4677	Alpha	-3.60	± 63.1	pCi/swipe
	Beta	2.60	± 23.8	pCi/swipe
	Gamma	0.60	± 4.4	pCi/swipe
AAA4678	Alpha	3.60	± 63.1	pCi/swipe
	Beta	0.60	± 23.8	pCi/swipe
	Gamma	-1.10	± 4.4	pCi/swipe

SAMPLE ID	ANALYTE	ANALYSIS RESULTS	UNCERTAINTY	UNITS
AAA4679	Alpha	0.00	± 63.1	pCi/swipe
	Beta	-1.89	± 23.8	pCi/swipe
	Gamma	-5.40	± 4.4	pCi/swipe
AAA4723	Alpha	1.00	± 63.1	pCi/swipe
	Beta	0.30	± 23.8	pCi/swipe
	Gamma	-10.30	± 4.4	pCi/swipe
AAA4724	Alpha	-0.50	± 63.1	pCi/swipe
	Beta	-0.60	± 23.8	pCi/swipe
	Gamma	-6.70	± 4.4	pCi/swipe
AAA4725	Alpha	-0.50	± 63.1	pCi/swipe
	Beta	-1.50	± 23.8	pCi/swipe
	Gamma	-8.90	± 4.4	pCi/swipe
AAA4726	Alpha	-0.50	± 63.1	pCi/swipe
	Beta	-1.80	± 23.8	pCi/swipe
	Gamma	-5.20	± 4.4	pCi/swipe
AAA4727	Alpha	-0.50	± 63.1	pCi/swipe
	Beta	-0.90	± 23.8	pCi/swipe
	Gamma	-1.50	± 4.4	pCi/swipe
AAA4728	Alpha	0.00	± 63.1	pCi/swipe
	Beta	-0.60	± 23.8	pCi/swipe
	Gamma	-5.10	± 4.4	pCi/swipe
AAA4729	Alpha	-0.50	± 63.1	pCi/swipe
	Beta	1.50	± 23.8	pCi/swipe
	Gamma	-6.20	± 4.4	pCi/swipe
AAA4730	Alpha	-0.50	± 63.1	pCi/swipe
	Beta	0.90	± 23.8	pCi/swipe
	Gamma	-8.20	± 4.4	pCi/swipe
AAA4731	Alpha	7.30	± 63.1	pCi/g
	Beta	4.10	± 23.8	pCi/g
	Gamma	0.60	± 4.4	pCi/g
AAA4732	Alpha	0.00	± 63.1	pCi/g
	Beta	-0.40	± 23.8	pCi/g
	Gamma	3.00	± 4.4	pCi/g
AAA4733	Alpha	-3.60	± 63.1	pCi/g
	Beta	-7.60	± 23.8	pCi/g
	Gamma	-0.10	± 4.4	pCi/g
AAA4734	Alpha	3.60	± 63.1	pCi/g
	Beta	-12.30	± 23.8	pCi/g
	Gamma	-0.50	± 4.4	pCi/g
AAA4735	Alpha	-3.60	± 63.1	pCi/g
	Beta	-8.70	± 23.8	pCi/g
	Gamma	0.60	± 4.4	pCi/g
AAA4736	Alpha	0.00	± 63.1	pCi/swipe
	Beta	-0.30	± 23.8	pCi/swipe
	Gamma	12.00	± 4.4	pCi/swipe
AAA4737	Alpha	-0.50	± 63.1	pCi/swipe
	Beta	-2.70	± 23.8	pCi/swipe
	Gamma	2.50	± 4.4	pCi/swipe
AAA4738	Alpha	-3.60	± 63.1	pCi/g
	Beta	-14.40	± 23.8	pCi/g
	Gamma	-1.10	± 4.4	pCi/g
AAA4739	Alpha	3.60	± 63.1	pCi/g
	Beta	-14.20	± 23.8	pCi/g
	Gamma	-1.80	± 4.4	pCi/g
AAA4740	Alpha	7.30	± 63.1	pCi/g
	Beta	4.50	± 23.8	pCi/g
	Gamma	0.10	± 4.4	pCi/g

All 19 samples were analyzed for SVOCs under request numbers 15674, 15686, and 15689 (Table 2). In request 15689, all of the QC results for SVOCs were within allowable limits; therefore, all of the data associated with SVOCs in this request are rated as valid. In request 15686, di-n-butyl phthalate was found in the method blanks at 800 ug/kg, and in the samples at lower concentrations. The samples associated with this request are AAA4670, AAA4674, AAA4675, AAA4676, AAA4679, and AAA4685. Because all of the values for di-n-butyl phthalate in the samples were low, and the method blank had the highest value, the presence of di-n-butyl phthalate is attributed to laboratory contamination. Therefore, all data for SVOCs other than di-n-butyl phthalate associated with request 15686 are rated as valid. In request 15674, there was one high surrogate recovery in sample AAA4684 at 137% to 207%. No analytes were detected in this sample, so this does not affect the usability of the data. Therefore, all of the data for SVOCs associated with request 15674 are rated as valid.

All 19 samples were analyzed for PCBs under requests numbers 15674, 15686, and 15689 (Table 2). In requests 15674 and 15689, all of the QC results for PCBs were within allowable limits; therefore, all of the data associated with PCBs in these requests are rated as valid. In request 15686, the PCB Aroclor™ was found at a concentration of 8.6 ug/L in the method blank and at a concentration of 8.9 ug/L in the rinsate sample (AAA4685). The PCB Aroclor™ was not detected in any of the other samples associated with this request (AAA4670, AAA4674, AAA4675, AAA4676, AAA4679, and AAA4685), and the values detected in the method blank and the rinsate sample can be attributed to laboratory contamination. Therefore, all of the data associated with PCBs under request 15686 are rated as valid.

Under request number 15697, one field blank was analyzed for tritium, cesium-137, americium-241, uranium-234, -235, and -238, and plutonium-238 and -239. All of the QC results for these analyses were within allowable limits; therefore, all of the data associated with this request are rated as valid.

3.2 Screening Assessment

Screening assessment of the data makes use of simple comparisons to determine which constituents require further evaluation and which do not. Constituents requiring further evaluation are retained as COPCs. Figure 4 shows the decision logic used in the data analysis and screening assessment process. Screening is conducted on all analytes that are detected at a site. Analytes that are not detected are eliminated from the screening process. A detailed discussion of the screening assessment is located in Appendix J of the LANL Installation Work Plan (LANL 1993, 1017). Subsection 4.2 of this document contains the screening assessment performed on the data from the TA-31 Phase I investigation.

TABLE 2

SUMMARY TABLE OF QUALITY CONTROL RESULTS FOR TA-31 SAMPLES

SAMPLE LOCATION NUMBER	SAMPLE ID NUMBER	SAMPLE TYPE	LOCATION	ANALYSIS	REQUEST NUMBER	QUALITY CONTROL COMMENTS
31-1000	AAA4669	Field blank	Not Applicable	TAL metals	15672	QC results within allowable limits; all data valid.
				VOCs	15674	1,2-dibromo-3-chloropropanol found in method blank at 12 ug/kg, but not in samples. All data valid.
				SVOCs	15674	QC results within allowable limits; all data valid.
				PCBs	15674	QC results within allowable limits; all data valid.
				Radionuclides	15697	QC results within allowable limits; all data valid.
31-1001	AAA4670	Soil	Septic tank location	TAL metals	15690	QC results within allowable limits; all data valid.
				VOCs	15686	QC results within allowable limits; all data valid.
				SVOCs	15686	Di-n-butyl phthalate found in method blanks at 800 ug/kg, and in samples at lower concentrations; attributed to lab contamination. All other data valid.
				PCBs	15686	Aroclor™ found in blank sample at 8.6 ug/L and rinsate sample at 8.9 ug/L due to lab contamination. No Aroclor™ found in soil samples. All data valid.
31-1002	AAA4671	Soil	Septic tank location	TAL metals	15672	QC results within allowable limits; all data valid.
				VOCs	15674	1,2-dibromo-3-chloropropanol found in method blank at 12 ug/kg, but not in samples. All data valid.
				SVOCs	15674	QC results within allowable limits; all data valid.
				PCBs	15674	QC results within allowable limits; all data valid.
31-1003	AAA4672	Soil	Septic tank location	TAL metals	15672	QC results within allowable limits; all data valid.
				VOCs	15674	1,2-dibromo-3-chloropropanol found in method blank at 12 ug/kg, but not in samples. All data valid.
				SVOCs	15674	QC results within allowable limits; all data valid.
				PCBs	15674	QC results within allowable limits; all data valid.
31-1004	AAA4674	Soil	Trench 1	TAL metals	15690	QC results within allowable limits; all data valid.
				VOCs	15686	QC results within allowable limits; all data valid.
				SVOCs	15686	Di-n-butyl phthalate found in method blanks at 800 ug/kg, and in samples at lower concentrations; attributed to lab contamination. All other data valid.
				PCBs	15686	Aroclor™ found in blank sample at 8.6 ug/L and rinsate sample at 8.9 ug/L due to lab contamination. No Aroclor™ found in soil samples. All data valid.
31-1005	AAA4675	Soil	Trench 1	TAL metals	15690	QC results within allowable limits; all data valid.
				VOCs	15686	QC results within allowable limits; all data valid.
				SVOCs	15686	Di-n-butyl phthalate found in method blanks at 800 ug/kg, and in samples at lower concentrations; attributed to lab contamination. All other data valid.
				PCBs	15686	Aroclor™ found in blank sample at 8.6 ug/L and rinsate sample at 8.9 ug/L due to lab contamination. No Aroclor™ found in soil samples. All data valid.

TABLE 2 (CONTINUED)

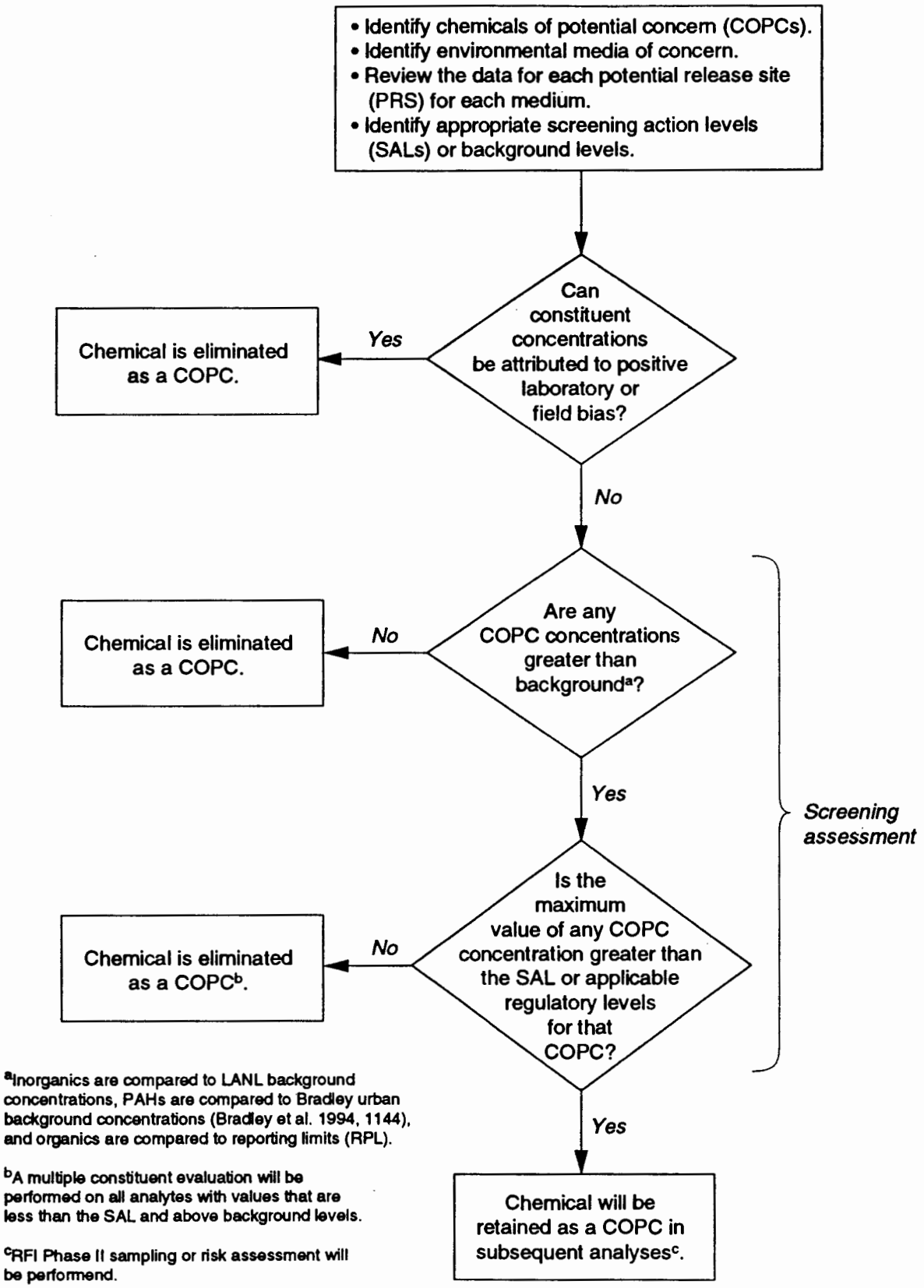
SUMMARY TABLE OF QUALITY CONTROL RESULTS FOR TA-31 SAMPLES

SAMPLE LOCATION NUMBER	SAMPLE ID NUMBER	SAMPLE TYPE	LOCATION	ANALYSIS	REQUEST NUMBER	QUALITY CONTROL COMMENTS
31-1006	AAA4676	Soil	Trench 1	TAL metals	15690	QC results within allowable limits; all data valid.
				VOCs	15686	QC results within allowable limits; all data valid.
				SVOCs	15686	Di-n-butyl phthalate found in method blanks at 800 ug/kg, and in samples at lower concentrations; attributed to lab contamination. All other data valid.
				PCBs	15686	Aroclor™ found in blank sample at 8.6 ug/L and rinsate sample at 8.9 ug/L due to lab contamination. No Aroclor™ found in soil samples. All data valid.
31-1007	AAA4677	Soil	Trench 2	TAL metals	15691	QC results within allowable limits; all data valid.
				VOCs	15689	QC results within allowable limits; all data valid.
				SVOCs	15689	QC results within allowable limits; all data valid.
				PCBs	15689	QC results within allowable limits; all data valid.
31-1008	AAA4678	Soil	Trench 2	TAL metals	15691	QC results within allowable limits; all data valid.
				VOCs	15689	QC results within allowable limits; all data valid.
				SVOCs	15689	QC results within allowable limits; all data valid.
				PCBs	15689	QC results within allowable limits; all data valid.
31-1009	AAA4679	Soil	Trench 2	TAL metals	15690	QC results within allowable limits; all data valid.
				VOCs	15686	QC results within allowable limits; all data valid.
				SVOCs	15686	Di-n-butyl phthalate found in method blanks at 800 ug/kg, and in samples at lower concentrations; attributed to lab contamination. All other data valid.
				PCBs	15686	Aroclor™ found in blank sample at 8.6 ug/L and rinsate sample at 8.9 ug/L due to lab contamination. No Aroclor™ found in soil samples. All data valid.
31-1010	AAA4680	Soil	Outfall area	TAL metals	15672	QC results within allowable limits; all data valid.
				VOCs	15674	1,2-dibromo-3-chloropropanol found in method blank at 12 ug/kg, but not in samples. All data valid.
				SVOCs	15674	QC results within allowable limits; all data valid.
				PCBs	15674	QC results within allowable limits; all data valid.
31-1011	AAA4681	Soil	Outfall area	TAL metals	15672	QC results within allowable limits; all data valid.
				VOCs	15674	1,2-dibromo-3-chloropropanol found in method blank at 12 ug/kg, but not in samples. All data valid.
				SVOCs	15674	QC results within allowable limits; all data valid.
				PCBs	15674	QC results within allowable limits; all data valid.
31-1012	AAA4682	Soil	Outfall area	TAL metals	15672	QC results within allowable limits; all data valid.
				VOCs	15674	1,2-dibromo-3-chloropropanol found in method blank at 12 ug/kg, but not in samples. All data valid.
				SVOCs	15674	QC results within allowable limits; all data valid.
				PCBs	15674	QC results within allowable limits; all data valid.

TABLE 2 (CONTINUED)

SUMMARY TABLE OF QUALITY CONTROL RESULTS FOR TA-31 SAMPLES

SAMPLE LOCATION NUMBER	SAMPLE ID NUMBER	SAMPLE TYPE	LOCATION	ANALYSIS	REQUEST NUMBER	QUALITY CONTROL COMMENTS
31-1013	AAA4683	Soil	Outfall area	TAL metals	15672	QC results within allowable limits; all data valid.
				VOCs	15674	1,2-dibromo-3-chloropropanol found in method blank at 12 ug/kg, but not in samples. All data valid.
				SVOCs	15674	QC results within allowable limits; all data valid.
				PCBs	15674	QC results within allowable limits; all data valid.
31-1014	AAA4684	Soil	Outfall area	TAL metals	15672	QC results within allowable limits; all data valid.
				VOCs	15674	1,2-dibromo-3-chloropropanol found in method blank at 12 ug/kg, but not in samples. All data valid.
				SVOCs	15674	One high surrogate recovery at 137% to 207%, but no analytes detected. All data valid.
				PCBs	15674	QC results within allowable limits; all data valid.
Not applicable	AAA4685	Rinsate	Not applicable	TAL metals	15690	QC results within allowable limits; all data valid.
				VOCs	15686	QC results within allowable limits; all data valid.
				SVOCs	15686	Di-n-butyl phthalate found in method blanks at 800 ug/kg, and in samples at lower concentrations; attributed to lab contamination. All other data valid.
				PCBs	15686	Aroclor™ found in blank sample at 8.6 ug/L and rinsate sample at 8.9 ug/L due to lab contamination. No Aroclor™ found in soil samples. All data valid.
31-1014	AAA4686	Duplicate of AAA4684	Outfall area	TAL metals	15672	QC results within allowable limits; all data valid.
				VOCs	15674	1,2-dibromo-3-chloropropanol found in method blank at 12 ug/kg, but not in samples. All data valid.
				SVOCs	15674	QC results within allowable limits; all data valid.
				PCBs	15674	QC results within allowable limits; all data valid.
31-1010	AAA4688	Duplicate of AAA4680	Outfall area	TAL metals	15672	QC results within allowable limits; all data valid.
				VOCs	15674	1,2-dibromo-3-chloropropanol found in method blank at 12 ug/kg, but not in samples. All data valid.
				SVOCs	15674	QC results within allowable limits; all data valid.
				PCBs	15674	QC results within allowable limits; all data valid.
31-1010	AAA4689	Duplicate of AAA4680	Outfall Area	TAL metals	15672	QC results within allowable limits; all data valid.
				VOCs	15674	1,2-dibromo-3-chloropropanol found in method blank at 12 ug/kg, but not in samples. All data valid.
				SVOCs	15674	QC results within allowable limits; all data valid.
				PCBs	15674	QC results within allowable limits; all data valid.



[a]Inorganics are compared to LANL background concentrations, PAHs are compared to Bradley urban background concentrations (Bradley et al. 1994, 1144), and organics are compared to reporting limits (RPL).

[b]A multiple constituent evaluation will be performed on all analytes with values that are less than the SAL and above background levels.

[c]RFI Phase II sampling or risk assessment will be performend.

Fig. 4. Data analysis and screening assessment decision logic flow chart.

3.2.1 Background Comparison

The first step in the screening assessment is a background comparison.

Inorganics. Analytes that occur naturally in soils, including most inorganics, are statistically compared to background concentrations in comparable uncontaminated soils. The TA-31 results represent either surface soil or sediment samples; therefore, LANL-wide surface soil samples were used to calculate the statistical background comparison values for inorganics for this report. The LANL-wide background data include soil samples from the A, B, and C soil horizons from a variety of locations across Los Alamos County (Longmire et al. in preparation, 1142). The statistical comparisons to background in this report follow the general guidance in the LANL Environmental Restoration (ER) Project policy paper on background comparisons (LANL 1995, 06-0105). This policy paper uses methods that are described in the Environmental Protection Agency (EPA) guidance document, Statistical Analysis of Ground-Water Monitoring Data (EPA 1989, 1141).

The hot measurement test was used as the statistically-based screening tool for background comparisons of TA-31 data. This test identifies the site data that exceed the highest background concentrations. It is based on the upper tolerance limits (UTLs) calculated for naturally-occurring metal constituents (Table 3). The UTL is the 95% upper confidence level of the 99th percentile. The 99th percentile is a value, estimated from the data distribution, so that only 1% of the data will exceed this value. For more information on UTLs, see the LANL ER Project policy paper on background comparisons (LANL 1995, 06-0105). UTLs were not calculated for rarely detected analytes (antimony, cadmium, mercury, selenium, and thallium), and the background maximum is used as their screening value.

Inorganic analytes with values less than their background UTLs are eliminated as COPCs. Inorganic analytes with values greater than their background UTLs are advanced in the screening process to the comparison to screening action levels (SALs).

PAHs. Polycyclic aromatic hydrocarbons (PAHs) are chemicals formed during the incomplete combustion of coal, oil, gas, wood, garbage, or other organic substances. PAHs are not manufactured except in small quantities for research purposes or for limited commercial applications (Clement International Corporation 1990, 0873). However, PAHs are widely distributed in urban environments such as the Los Alamos townsite due to human activities (Bradley et al. 1994, 1144). Therefore, it is appropriate to compare PAH concentrations at Los Alamos sites with urban background concentrations to determine if a release occurred. No LANL-specific background PAH concentration data are available, so background PAH data are derived from literature values reported for PAHs in other urban environments (Bradley et al. 1994, 1144). Background UTLs for these urban PAH data are discussed in Appendix B.

TABLE 3

LIST OF UPPER TOLERANCE LIMITS FOR LANL SOIL BACKGROUND DATA

ANALYTE	SAL[a] (mg/kg)	MEAN[b]	STANDARD DEVIATION[b]	UTL[c] 99%, 0.95	NUMBER OF SAMPLES	NUMBER OF SAMPLES > LOD[d]
Aluminum	NA[e]	19 000	13 800	123 000	47	47
Antimony	32	2.45	0.36	2.5[f]	46	2
Arsenic	NA[e]	4.4	2.5	11.6	46	46
Barium	5,600	161	129	1 140	47	47
Beryllium	NA[e]	1.15	0.75	3.31	47	47
Cadmium	80	0.39	0.54	2.7[f]	47	5
Calcium	NA[e]	5 790	12 500	54 400	47	47
Chromium (Total)	[g]	11.7	7.8	34.2	47	47
Cobalt	NA[e]	15.2	7.6	51.1	47	47
Copper	3 000	5.3	3.6	15.7	47	45
Iron	NA[e]	14 500	7 320	35 600	47	47
Lead	400[h]	15.0	8.3	39.0	47	44
Magnesium	NA[e]	2 920	2 150	16 100	47	47
Manganese	11 000	343	238	1 030	47	47
Mercury	24	0.05	0.01	0.1[f]	48	4
Nickel	1 600	9.7	5.9	26.7	47	45
Potassium	NA[e]	2 420	1 304	6 180	47	47
Selenium	400	0.43	0.41	1.7[f]	46	23
Sodium	NA[e]	577	453	3 320	47	47
Thallium	6.4	0.27	0.24	0.9[f]	45	21
Vanadium	560	25	14	66	47	47
Zinc	24 000	41	21	101	47	47

[a] SAL = Screening action level.
[b] Concentration values less than the limit of detection (LOD) were replaced by one-half the LOD.
[c] UTL = Upper tolerance limit.
[d] LOD = Limit of detection.
[e] NA = Not available.
[f] The maxiumun value is used as the screening value rather than the UTL.
[g] The SAL for chromium VI is 400 mg/kg; the SAL for chromium III is 80 000 mg/kg.
[h] EPA 1989, 06-0109.

If the maximum concentration for a given PAH is less than the urban background UTL, that PAH is eliminated as a COPC. If the maximum concentration for a given PAH is greater than the urban background UTL, that PAH will be included in subsequent screening assessment evaluations.

Non-PAH Organics. Background values are not calculated for organic analytes other than PAHs because background values for these analytes are expected to be undetectable. Therefore, if a non-PAH organic analyte is not detected, it is eliminated as a COPC. If a non-PAH organic analyte is detected, and there are no QC problems that indicate that the detected value is unreliable, it is carried forward in the screening process to the next step, comparison to SALs.

3.2.2 Screening Action Levels Comparison

The second step in performing the screening assessment is a comparison to SALs. SALs are conservative risk-based levels, primarily based on formulas presented in the proposed RCRA Subpart S, that are intended for use as a preliminary screening tool (EPA 1990, 0432). Appendix J of the Installation Work Plan explains how the SALs used in the screening assessment are derived (LANL 1993, 1017). All inorganic analytes and PAHs detected at concentrations greater than their background UTLs, and all detected non-PAH organic analytes are compared to their respective SALs. Based on this comparison, each analyte is placed into one of three categories: greater than or equal to SAL, no SAL, or below SAL.

Greater than or equal to SAL indicates that at least one analyte value is greater than or equal to the SAL for that analyte. Any analyte that is greater than or equal to its SAL remains a COPC unless an applicable regulatory guideline takes precedent.

No SAL indicates that there is currently no SAL available for comparison and that at least one analyte value is greater than the reporting limit (RPL). Regulatory guidelines are checked to determine if there are any appropriate criteria for comparison to determine if these analytes should be maintained as COPCs (Vocke 1993, 1073).

Below SAL indicates that the analyte values are all less than their respective SALs. Analytes with concentrations below their respective SALs in all samples generally pose no risk. However, these analytes are further evaluated to determine the potential for adverse health effects due to exposure to the analyte in combination with other analytes. This is called the multiple constituent evaluation.

It is possible that chemicals in combination, while near but not exceeding their SALs, could prove harmful to human health. In evaluating the effects of multiple analytes, a simplistic screening approach that assumes additive effects is used to normalize concentration data by comparing concentration data to SALs. If the sum of proportions between each analyte that is below SAL and its SAL is less than one, then the analytes are eliminated as COPCs. If the sum of proportions is greater than one, then the effect of the multiple constituents has the potential to be adverse. It should be noted that this evaluation is used for screening purposes only, and that the normalized sums or proportions do not indicate risk levels. The equation for calculating the appropriate normalized sum is

$$M = \max_{\text{samples}} \left\{ \sum_{\text{COPCs}} C_i / SAL_i \right\}$$

where:

M = maximum sum of proportions;

C_i = maximum concentration of the ith chemical for a given site; and

SAL_i = chemical-specific SAL for the ith chemical.

For more information regarding this equation, refer to Appendix J of the Installation Work Plan (LANL 1993, 1017).

3.2.3 Ecological Screening Assessment Methodology

In order to determine if further action at a site is warranted based on the ecological effects of analytes that may be present, the screening assessment includes a comparison to ecological screening action levels (ESALs) (Ebinger et al. 1994, 06-0102). The decision logic that follows this comparison is presented in Fig. 5 (Ferenbaugh 1995, 06-0106). If this preliminary ecological screening assessment identifies potentially adverse ecological effects, a baseline ecological risk assessment may be necessary. This may ultimately require risk management decisions based on human health risks, ecological risks, and other pertinent factors. A discussion of the requirements and generic approach for ecological risk assessments is presented in Appendix L of the LANL Installation Work Plan (LANL 1993, 1017).

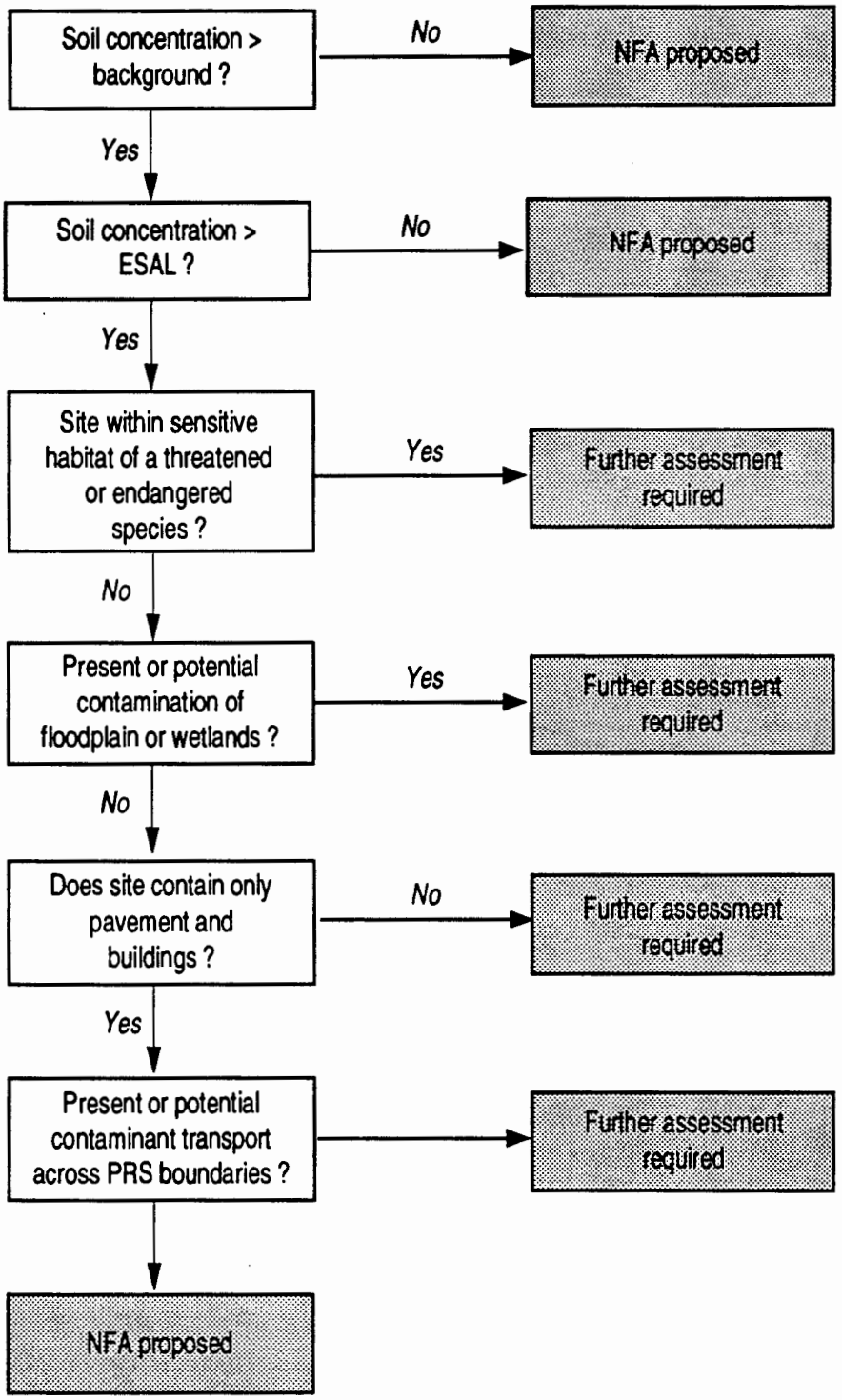


Fig. 5. Decision tree for ecological screening assessments.

3.3 Development of Conclusions and Recommendations

Conclusions are based on the results of the initial screening assessment performed on the analytical results of sampling at each potential release site (PRS). Recommendations are based on the potential for human health risk and ecological risk, and on applicable regulations.

4.0 SITE-SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

4.1 SWMU 31-001 Unit Description

The only SWMU identified at TA-31 is SWMU 31-001, the former septic tank system (Fig. 6). SWMU 31-001 consisted of two manholes, a reinforced concrete aboveground septic tank, and a septic line. The septic line ran north from the former main warehouse (TA-31-7) to the former septic tank, located on a small topographic bench above the mesa rim of Pueblo Canyon (DOE 1987, 0264). The septic tank drained through a four-inch-diameter vitrified clay outfall pipe directly into a natural drainage on the southern slope of Pueblo Canyon.

4.1.1 Field Investigation and Sampling Activities

Sampling activities were conducted at TA-31 on September 13, 14, and 15, 1993. Fieldwork was performed in accordance with the RFI Work Plan for OU 1079 (LANL 1992, 0783), approved subcontractor procedures, and the following LANL SOPs: LANL-ER-SOP-1.01,R0, General Instructions for Field Investigations; LANL-ER-SOP-1.02,R0, Sample Containers and Preservation; and LANL-ER-SOP-1.05,R0, Field Quality Control Samples. Surface and subsurface soil samples were collected using LANL-ER-SOP-6.09,R0, Spade and Scoop Method for Collection of Soil Samples, and LANL-ER-SOP-6.10,R0, Hand Auger and Thin-Wall Tube Sampler.

Septic Tank Location. The former septic tank location was surveyed according to information from a former Johnson Controls Incorporated employee who was in charge of the 1988 septic tank removal (ICF Kaiser 1993, 06-0104). The surveyed area was then divided in half, and three biased samples (AAA4670, AAA4671, and AAA4672) were collected (Fig. 7). One biased sample was collected from each half of the surveyed area at locations that appeared to be disturbed and to have thicker deposits of soil where potential contaminants might have been trapped (AAA4671 and AAA4672). The third biased sample (AAA4670) was collected from the influent tank line location (Fig. 7). These soil samples were collected from shallow boreholes at the soil/bedrock interface, 6 to 12 in. below ground surface, because this is the level at which contaminants are most likely to accumulate.

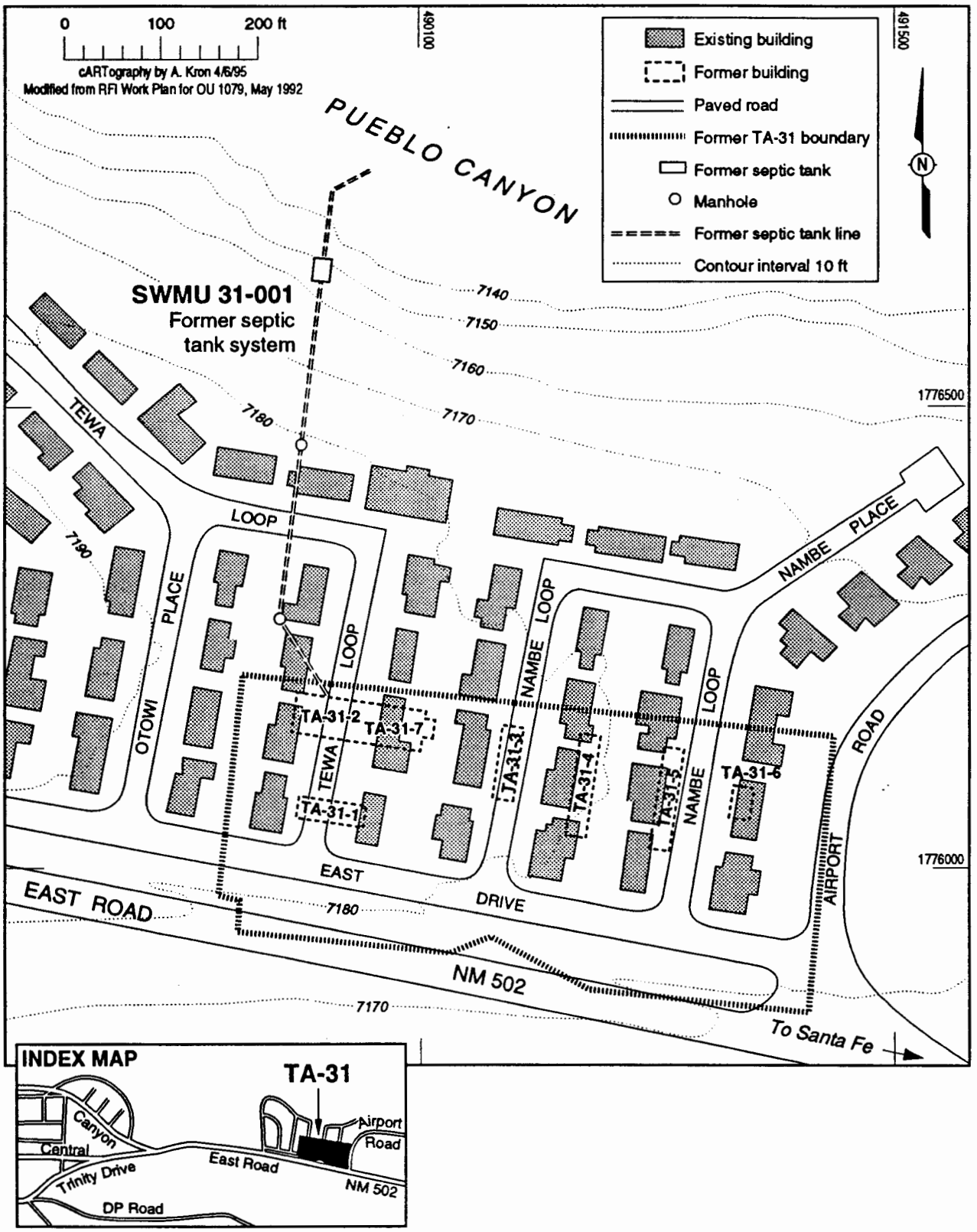


Fig. 6. Locations of former and existing structures at SWMU 31-001.

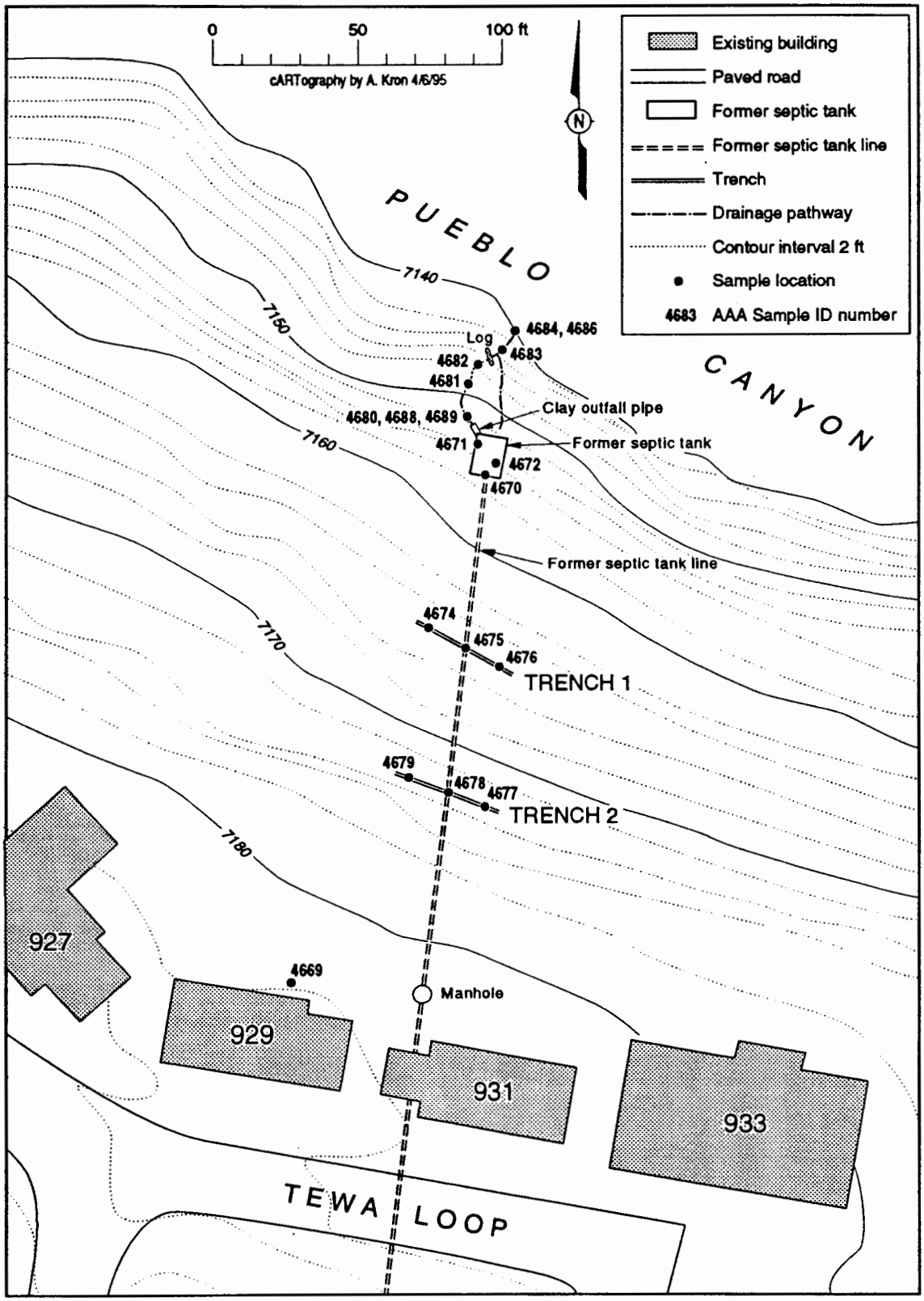


Fig. 7. Locations of Phase I Sample IDs at SWMU 31-001, the former septic tank system at TA-31.

Septic System Line Location. Two trenches were excavated perpendicular to the location of the former septic line (Fig. 7). Both trenches were excavated in an east-to-west direction using a backhoe. The length of each trench was determined in the field and was based on exposing enough area to locate any pipe that might be present. The width of each trench was dictated by the width of the backhoe bucket. The depth of each trench was dictated by the depth to bedrock or, if it existed, exposed pipe. Samples were collected from the trenches at levels just above the bedrock using stainless steel spoons.

Septic System Line Trench 1. Trench 1 was excavated approximately 60 ft south of the former septic tank location, and was approximately 31 ft long by 4 ft deep (Fig. 7). No septic system pipe was found in this trench, but a filled trench approximately 2 ft wide with a north-south orientation was located within the bedrock tuff during the trenching operation. This filled trench was assumed to be the remains of the septic line, indicating that it had already been removed (ICF Kaiser 1993, 06-0104). The filled trench was 4 ft deep, and the soil/bedrock interface was 1.7 ft and 2.3 ft below the surface on either side. The bottom of the filled trench was composed of an aggregate of cement, cinder block fragments, gravel, and construction debris. Three samples (AAA4674, AAA4675, and AAA4676) were collected from trench 1 at depths of 45.6 in., 48 in., and 40.8 in., respectively (Fig. 7).

Septic System Line Trench 2. Trench 2 was excavated approximately 50 ft south of trench 1 (Fig. 7). This trench was 25 ft long and had a maximum depth of 8.5 ft. Broken pieces of clay pipe were found in trench 2 at depths of 6.5 to 6.8 ft. Three samples (AAA4679, AAA4678, and AAA4677) were collected from trench 2 at depths of 81.6 in., 79.2 in., and 78 in., respectively (Fig. 7).

Samples collected from the trenches were submitted to the mobile radiochemistry analytical laboratory (MRAL) for analysis. MRAL results indicated no radioactive contamination, and trenches 1 and 2 were backfilled.

Septic Tank Outfall Area. At the septic tank outfall area, sampling locations were chosen based on professional judgment because the simplicity of the site did not warrant a formal geomorphological survey. During a field reconnaissance visit, a vitrified clay outfall pipe was found in its original location on the mesa top. One sample, AAA4680, and two duplicates, AAA4688 and AAA4689, were collected directly at the mouth of the pipe. These three samples were collected at a depth of 6 to 13 in. Five additional samples were collected from the natural drainage on the southern slope of Pueblo Canyon (AAA4681, AAA4682, AAA4683, AAA4684, and AAA4686) (Fig. 7). These samples were collected at depths of 0 to 6 in. All samples in the

outfall area were collected from sediment traps in order to bias the samples toward detecting any accumulated contamination. Samples were collected with stainless steel bowls and spoons.

4.2 Screening Assessment

This subsection describes the screening assessment performed on analytical results from samples collected at TA-31. Appendix A presents all data used as the basis for the screening assessment, showing a summary of the samples collected and the analyses performed, as well as tables presenting the detected values for organic and inorganic analytes and the background UTLs, RPLs, and SALs used for comparison. Subsection 4.2.1 presents all values for inorganic analytes above LANL background UTLs, PAHs above urban background UTLs, and detected non-PAH organic analytes. Subsection 4.2.2 presents all values for analytes that were above their SALs and analytes that were above background levels with no applicable SAL for comparison.

4.2.1 Background Comparison

Figure 8 shows the locations of inorganic analytes with values above LANL background UTLs, PAHs with values above urban background UTLs, and detected non-PAH organic analytes at TA-31. These analytes will be retained as COPCs and compared to SALs.

Inorganics. All inorganic analytes detected at TA-31 were compared to their natural background UTLs. As discussed in Subsection 3.2.1, the 95% upper confidence value of the 99th percentile was used as the background screening value.

The values for aluminum, antimony, barium, beryllium, cadmium, calcium, chromium, cobalt, iron, magnesium, manganese, nickel, potassium, selenium, sodium, vanadium, and zinc are below their respective background UTLs and are eliminated as COPCs. Table 4 presents the soil concentrations for inorganics that were greater than Los Alamos background concentrations (Longmire et al. in preparation, 1142). The table shows that four analytes are above their respective background UTLs: arsenic, copper, lead, and mercury. These analytes will be advanced to the comparison to SALs (Fig. 8).

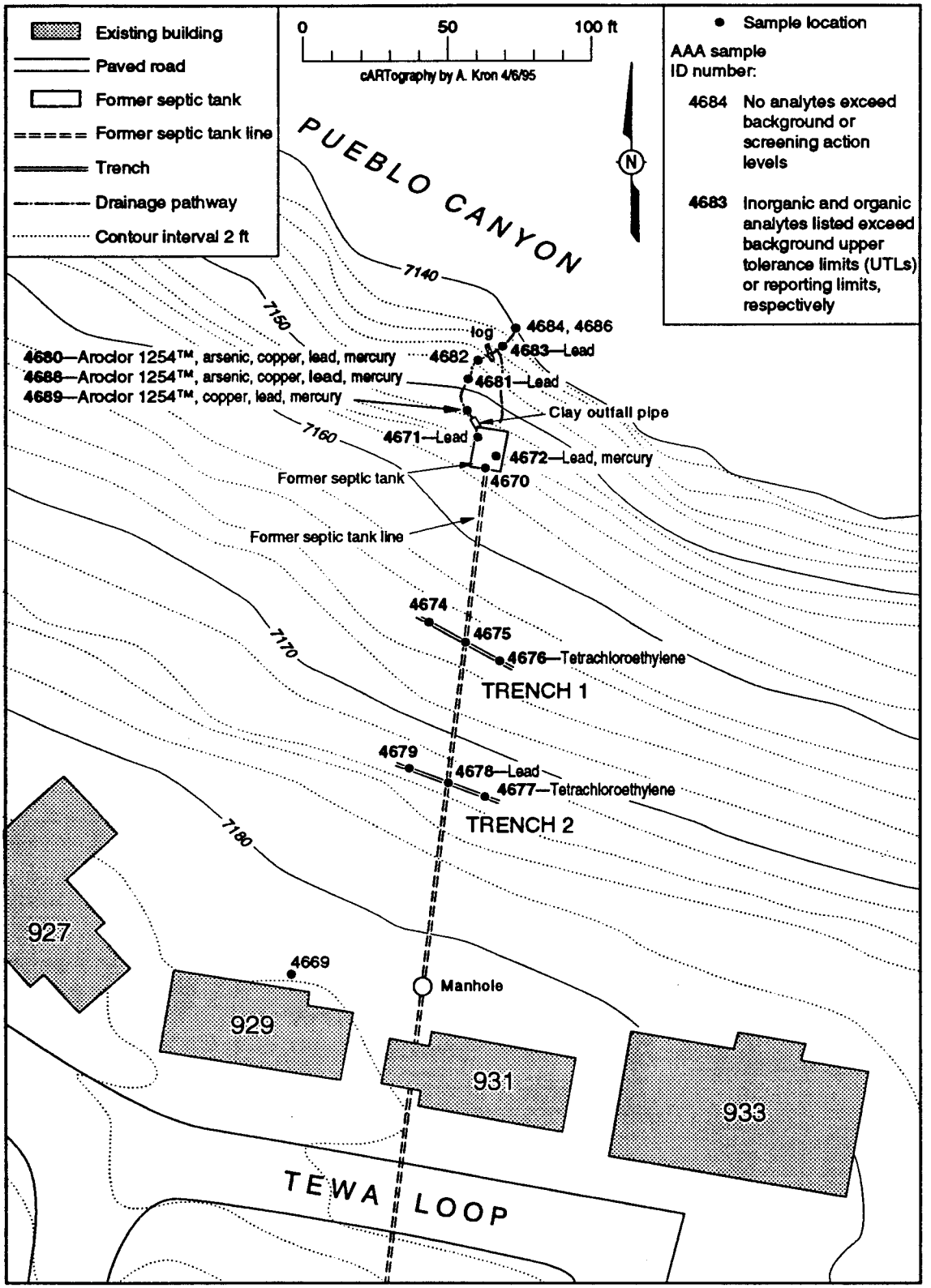


Fig. 8. Locations of analytes with values above background UTLs at SWMU 31-001, the former septic tank system TA-31.

TABLE 4

TA-31 SOIL CONCENTRATIONS FOR INORGANICS WITH VALUES GREATER THAN LOS ALAMOS BACKGROUND CONCENTRATIONS[a]

ANALYTE	SAMPLE ID	SAMPLE VALUE (mg/kg)	BACKGROUND UTL[b] (mg/kg)	SAL[c]	DEPTH (in.)
Arsenic	AAA4688	11.8	11.6	None[d]	6–13
	AAA4680	12.5	11.6	None[d]	6–13
Copper	AAA4688	32	15.7	3 000	6–13
	AAA4689	36	15.7	3 000	6 - 13
	AAA4680	51	15.7	3 000	6 - 13
Lead	AAA4678	40	39.0	400	79.2
	AAA4683	50	39.0	400	0–6
	AAA4671	53	39.0	400	12–15
	AAA4672	55	39.0	400	9–12
	AAA4681	100	39.0	400	0–6
	AAA4689	260	39.0	400	6–13
	AAA4680	290	39.0	400	6–13
	AAA4688	460	39.0	400	6–13
Mercury	AAA4680	0.2	0.1[e]	24	6–13
	AAA4680	0.2	0.1[e]	24	6–13
	AAA4688	0.2	0.1[e]	24	6–13
	AAA4688	0.2	0.1[e]	24	6–13
	AAA4689	0.2	0.1[e]	24	6–13
	AAA4672	0.3	0.1[e]	24	9–12
	AAA4672	0.3	0.1[e]	24	9–12
	AAA4672	0.3	0.1[e]	24	9–12

[a] TA-31 analytical data were extracted from the Facility for Information Management, Analysis, and Display on March 20, 1995.
[b] UTL = Upper tolerance limit.
[c] SAL = Screening action level.
[d] There is no applicable SAL for this analyte.
[e] There was an insufficient number of samples to calculate the UTL for this analyte; therefore, the maximum value in the background range was used (Longmire et al. in preparation, 1142).

PAHs. All PAHs that were detected at TA-31 were compared to their anthropogenic background UTLs as described in Subsection 3.2.1 (Bradley et al. 1994, 1144). All of the PAHs detected at TA-31 were below their respective background UTLs and are eliminated as COPCs, as shown in Table 5.

Organics. All detected non-PAH organic analytes were retained as COPCs, as discussed in Subsection 3.2.1. The PCB Aroclor 1254™ and tetrachloroethylene were detected, as shown in Table 6. These two analytes will be retained as COPCs and advanced to the comparison to SALs.

TABLE 5

TA-31 SOIL CONCENTRATIONS FOR PAHs WITH VALUES GREATER THAN THE RPL COMPARED TO URBAN BACKGROUND CONCENTRATIONS[a]

ANALYTE	SAMPLE ID	SAMPLE VALUE (mg/kg)	RPL[b] (mg/kg)	BACK-GROUND UTL[c] (mg/kg)	SAL[d]	SAMPLE DEPTH (in.)
Benzo[a]anthracene	AAA4679	0.49	0.33	11.9	1	81.6
	AAA4688	0.52	0.33	11.9	1	6–13
	AAA4689	1.7	0.33	11.9	1	6–13
Benzo[a]pyrene	AAA4679	0.41	0.33	11.37	0.1	81.6
	AAA4688	0.67	0.33	11.37	0.1	6–13
	AAA4689	2.2	0.33	11.37	0.1	6–13
Benzo[b]fluoranthene	AAA4679	0.69	0.33	12.08	1	81.6
	AAA4680	0.56	0.33	12.08	1	6–13
	AAA4681	0.47	0.33	12.08	1	0–6
	AAA4688	1	0.33	12.08	1	6–13
	AAA4689	3.3	0.33	12.08	1	6–13
Benzo[g,h,i]perylene	AAA4689	0.72	0.33	5.90	None[e]	6–13
Benzo[k]fluoranthene	AAA4689	1.1	0.33	18.19	1	6–13
Chrysene	AAA4679	0.63	0.33	18.35	96	81.6
	AAA4688	0.45	0.33	18.35	96	6–13
	AAA4689	1.7	0.33	18.35	96	6–13
Fluoranthene	AAA4679	1.1	0.33	30.93	3 200	81.6
	AAA4681	0.65	0.33	30.93	3 200	0–6
	AAA4689	1.2	0.33	30.93	3 200	6–13
Indeno[1,2,3-cd]pyrene	AAA4689	0.79	0.33	5.90	1	6–13
Phenanthrene	AAA4679	0.35	0.33	22.68	None[e]	81.6
Pyrene	AAA4679	0.92	0.33	12.53	2 400	81.6
	AAA4681	0.65	0.33	12.53	2 400	0–6
	AAA4689	1.5	0.33	12.53	2 400	6–13

[a] TA-31 analytical data were extracted from the Facility for Information Management, Analysis, and Display on March 20, 1995.
[b] RPL = Reporting limit.
[c] UTL = Upper tolerance limit (see Appendix B).
[d] SAL = Screening action level.
[e] No applicable SAL is available.

TABLE 6

TA-31 SOIL CONCENTRATIONS FOR ORGANIC ANALYTES WITH VALUES GREATER THAN THE REPORTING LIMIT[a]

ANALYTE	SAMPLE ID	SAMPLE VALUE (mg/kg)	RPL[b] (mg/kg)	SAL[c] (mg/kg)	SAMPLE DEPTH (in.)
Aroclor 1254™	AAA4680	3	1	1	6 - 13
	AAA4688	5	1	1	6 - 13
	AAA4689	12	1	1	6 - 13
Tetrachloroethylene	AAA4676	0.01	0.005	5.9	40.8
	AAA4677	0.013	0.005	5.9	78

[a] TA-31 analytical data were extracted from the Facility for Information Management, Analysis, and Display on March 20, 1995.
[b] RPL = Reporting limit.
[c] SAL = Screening action level.

4.2.2 Screening Action Levels Comparison

This subsection discusses the comparison SALs for the inorganic analytes and PAHs detected at levels greater than their background UTLs, and the detected non-PAH organic analytes in soil samples from TA-31.

Greater than or equal to SAL. The PCB Aroclor 1254™ and lead fall within the greater than or equal to SAL category, as shown in Table 7 and Fig. 9.

Aroclor 1254™ was detected at concentrations above the SAL of 1 mg/kg (McCann 1994, 1145) in one sample (AAA4680) and two field duplicates (AAA4688, and AAA4689) collected at the mouth of the clay outfall pipe at depths of 6 to 13 in. (Fig. 9). The PCB Aroclor 1254™ was detected in sample AAA4680 at a concentration of 3 mg/kg, in sample AAA4688 at a concentration of 5 mg/kg, and in sample AAA4689 at a concentration of 12 mg/kg. Because these samples and duplicates were collected at the same location and depth, it is appropriate to average their values. The average of these three values is 6.67 mg/kg, which is still above the SAL.

Lead was detected in one field duplicate, AAA4688, collected at the mouth of the clay outfall pipe at a depth of 6 to 13 in., at a concentration of 460 mg/kg, which is above the SAL (400 mg/kg) (Fig. 9). A field sample (AAA4680) and another field duplicate (AAA4689) collected from the same location had lower lead concentrations of 290 mg/kg and 260 mg/kg, respectively (Fig. 9). These values are above the background UTL (39 mg/kg) but below

TABLE 7

TA-31 SOIL CONCENTRATIONS WITH VALUES GREATER THAN SALs OR WITHOUT APPLICABLE SALs[a]

ANALYTE	SAMPLE ID	SAMPLE VALUE (mg/kg)	SAL[b] (mg/kg)	SAMPLE DEPTH (in.)
Aroclor 1254™	AAA4680	3	1	6–13
	AAA4688	5	1	6–13
	AAA4689	12	1	6–13
Lead	AAA4688	460	400	6–13
Arsenic	AAA4680	12.5	NA[c]	6–13
	AAA4688	11.8	NA[c]	6–13

[a] TA-31 analytical data were extracted from the Facility for Information Management, Analysis, and Display on March 21, 1995.
[b] SAL = Screening action level. See Appendix J of the Installation Work Plan (LANL 1993, 1071).
[c] NA = No applicable SAL is available
.depth, it is appropriate to average their values. The average of these three values is 330 mg/kg, which falls below the SAL of 400 mg/kg. Therefore, lead is eliminated as a COPC.

the SAL. Because these three samples and duplicates were collected at the same location and depth, it is appropriate to average their values. The average of these three values is 330 mg/kg, which falls below the SAL of 400 mg/kg. Therefore, lead is eliminated as a COPC.

No SAL. One analyte, arsenic, falls into the no SAL category. The SAL for arsenic in the modified RCRA Subpart S (EPA 1990, 0432) is not used here because Los Alamos background levels of arsenic are naturally higher than the listed SAL.

Arsenic was detected in sample AAA4680 at a concentration of 12.5 mg/kg, and in two field duplicates of that sample, AAA4688 and AAA4689, at concentrations of 11.8 mg/kg and 11.6 mg/kg, respectively. These concentrations are greater than or equal to the background UTL (11.6 mg/kg) and there is no applicable SAL. All three samples were collected at the mouth of the clay outfall pipe at a depth of 6 to 13 in. (Fig. 9). Because these samples and duplicates were collected at the same location and depth, it is appropriate to average their values. The average of these three values is 11.9 mg/kg, which is slightly above the background UTL. Because there is no applicable SAL, arsenic will be retained as a COPC and continued through the screening process (Table 7).

Below SAL. Three analytes have measured concentrations above their respective background UTLs or RPLs, but below their respective SALs: copper, mercury, and tetrachloroethylene. These analytes are addressed in the multiple constituent evaluation, shown in Table 8.

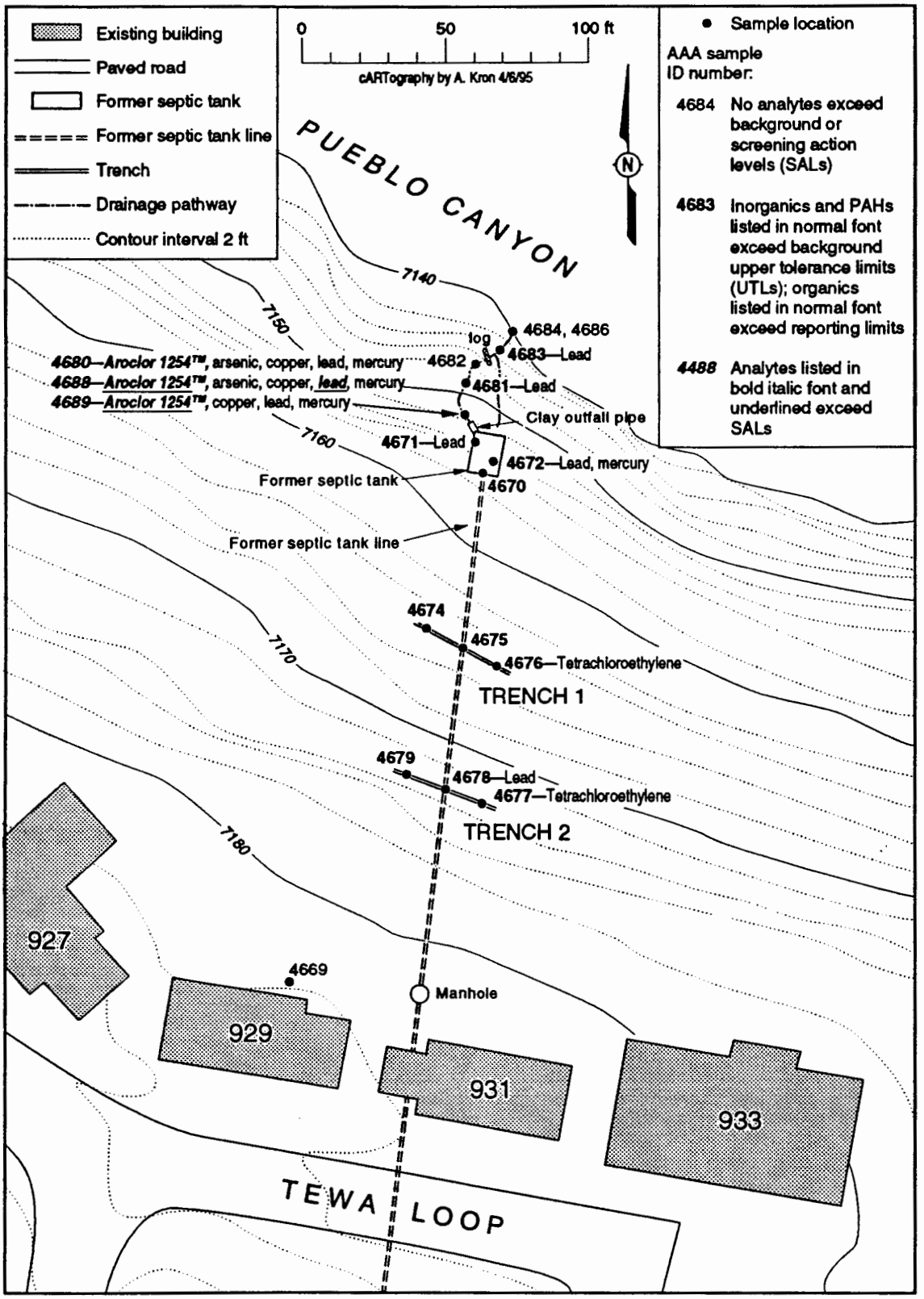


Fig. 9. Locations of analytes with values above background UTLs and analytes with values above SALs at SWMU 31-001, the former septic tank system at TA-31.

TABLE 8

MULTIPLE CONSTITUENT EVALUATION FOR TA-31 DATA

ANALYTE	MAXIMUM CONCENTRATION (mg/kg)	SOIL SAL[a] (mg/kg)	MAXIMUM CONCENTRATION ÷ SAL (NORMALIZED VALUES)
SAL BASED ON NONCARCINOGENIC EFFECTS			
Copper	51	3 000	0.02
Mercury	0.3	24	0.01
Tetrachloroethylene	0.013	5.9	0.002
Total			**0.032**

[a]SAL = Screening action level.

To evaluate multiple constituent effects for this data set, analytes below their respective SALs were grouped according to their toxicological effects (carcinogenic or noncarcinogenic). SALs for all constituents were normalized to one and summed as described in Subsection 3.2.3. There are no analytes in the carcinogenic category. The results of the analysis based on noncarcinogenic effects is less than one at 0.032, indicating that potential resultant adverse health effects from exposure would be unlikely. Therefore, all of the analytes with concentrations below their respective SALs are eliminated as COPCs.

The results of the screening assessment performed thus far on the sampling data from TA-31 show that two analytes require further evaluation: arsenic and the PCB Aroclor 1254™. The remaining analytes occur at levels below their Los Alamos County natural background UTLs or anthropogenic urban background UTLs, or at levels below their respective SALs.

4.2.3 Ecotoxicological Screening Assessment

Ecotoxicological screening of field soil sampling data makes use of simple comparisons to determine if further action is warranted based on potential toxicological effects of hazardous constituents to birds, mammals, and reptiles inhabiting a site. A discussion of the requirements and generic approach for ecological risk assessments is presented in Appendix L of the Installation Work Plan (LANL 1993, 1017).

Due to the sensitive nature of the habitats in middle and lower Pueblo Canyon, screening was conducted on all analytes detected at TA-31 to assess the potential impact of any COPCs found at the site to the biota within the canyon. As shown in Tables 4, 5, and 6, non-PAH organic analytes were removed from further consideration if they were not detected, and inorganic analytes and PAHs were removed from further consideration if they were below their background UTLs. The remaining analytes were compared to their respective ESALs as shown in Table 9 (Ebinger et al. 1994, 06-0102).

TABLE 9

TA-31 OUTFALL AREA SOIL CONCENTRATIONS GREATER THAN THE RPL AND THE BACKGROUND UTL COMPARED TO ESALs

ANALYTE	SAMPLE ID	SAMPLE VALUE (mg/kg)	ESAL[a] (mg/kg)	MOST SENSITIVE ORGANISM	DEPTH (in.)
Aroclor 1254™	AAA4680	3	0.003	Bird, small omnivore	6–13
	AAA4688	5	0.003	Bird, small omnivore	6–13
	AAA4689	12	0.003	Bird, small omnivore	6–13
Arsenic	AAA4688	11.8	No ESAL	Bird, small omnivore	6–13
	AAA4680	12.5	No ESAL	Bird, small omnivore	6–13
Copper	AAA4680	51	No ESAL	Considered a beneficial nutrient	6–13
	AAA4688	32	No ESAL	Considered a beneficial nutrient	6–13
	AAA4689	36	No ESAL	Considered a beneficial nutrient	6–13
Lead	AAA4678	40	0.004	Bird, small omnivore	79.2
	AAA4683	50	0.004	Bird, small omnivore	0–6
	AAA4671	53	0.004	Bird, small omnivore	12–15
	AAA4672	55	0.004	Bird, small omnivore	9–12
	AAA4681	100	0.004	Bird, small omnivore	0–6
	AAA4689	260	0.004	Bird, small omnivore	6–13
	AAA4680	290	0.004	Bird, small omnivore	6–13
	AAA4688	460	0.004	Bird, small omnivore	6–13
Mercury	AAA4680	0.2	0.003	Bird, small omnivore	6–13
	AAA4680	0.2	0.003	Bird, small omnivore	6–13
	AAA4688	0.2	0.003	Bird, small omnivore	6–13
	AAA4688	0.2	0.003	Bird, small omnivore	6–13
	AAA4689	0.2	0.003	Bird, small omnivore	6–13
	AAA4672	0.3	0.003	Bird, small omnivore	9–12
	AAA4672	0.3	0.003	Bird, small omnivore	9–12
	AAA4672	0.3	0.003	Bird, small omnivore	9–12
Tetrachloroethylene	AAA4576	0.01	6.1	Bird, small omnivore	40.8
	AAA4677	0.013	6.1	Bird, small omnivore	78

[a]ESAL = Ecotoxicological screening action level.

Greater than or equal to the ESAL. Four analytes were retained as COPCs because they were detected at concentrations greater than their respective ESALs and background UTLs: the PCB Aroclor 1254™, arsenic, mercury, and lead.

Aroclor 1254™, which is a PCB, was detected in samples AAA4680, AAA4688, and AAA4689, collected at the mouth of the clay outfall pipe, at concentrations of 3 mg/kg, 5 mg/kg, and 12 mg/kg, respectively, relative to an ESAL of 0.003 mg/kg (Fig. 10).

Arsenic was detected in samples AAA4680 and AAA4689, collected at the mouth of the clay outfall pipe, at concentrations of 11.8 mg/kg and 12.5 mg/kg, respectively, relative to an ESAL of 3×10^{-6} mg/kg (Fig. 10).

Mercury was detected at a concentration of 0.02 mg/kg in samples AAA4680, AAA4688, and AAA4689, collected at the mouth of the clay outfall pipe; and at a concentration of 0.03 mg/kg in sample AAA4672, collected at the septic tank location. The ESAL for mercury is 0.003 mg/kg (Fig. 10).

Lead was detected in samples AAA4678 at 40 mg/kg, AAA4683 at 50 mg/kg, AAA4671 at 53 mg/kg, AAA4672 at 55 mg/kg, AAA4681 at 100 mg/kg, AAA4689 at 260 mg/kg, AAA4680 at 290 mg/kg, and AAA4688 at 460 mg/kg, relative to an ESAL of 0.004 mg/kg. Samples AAA4680, AAA4688, and AAA4689 were collected at the mouth of the clay outfall pipe; samples AAA4681 and AAA4683 were collected in the outfall area; samples AAA4671 and AAA4672 were collected at the former septic tank location; and sample AAA4678 was collected from trench 2 (Fig. 10).

No ESAL. One analyte, copper, was evaluated to determine if it should be retained as a COPC because there was no ESAL available for comparison.

Copper was detected at concentrations of 51 mg/kg, 32 mg/kg, and 36 mg/kg, respectively, in samples AAA4680, AAA4688, and AAA4689, collected at the mouth of the clay outfall pipe. These values are above the background UTL and there is no ESAL. Copper can, however, be removed from further consideration because low levels of copper such as these can be beneficial to terrestrial animals as a necessary micronutrient.

Four analytes remain as COPCs because they were detected at concentrations above their ESALs: the PCB Aroclor 1254™, arsenic, mercury, and lead. These analytes will be carried forward as shown on the ecological screening assessment decision tree (Fig. 5).

According to the ecological screening assessment decision tree, an analyte must be retained as a COPC if it is located within a sensitive habitat where a threatened or endangered species

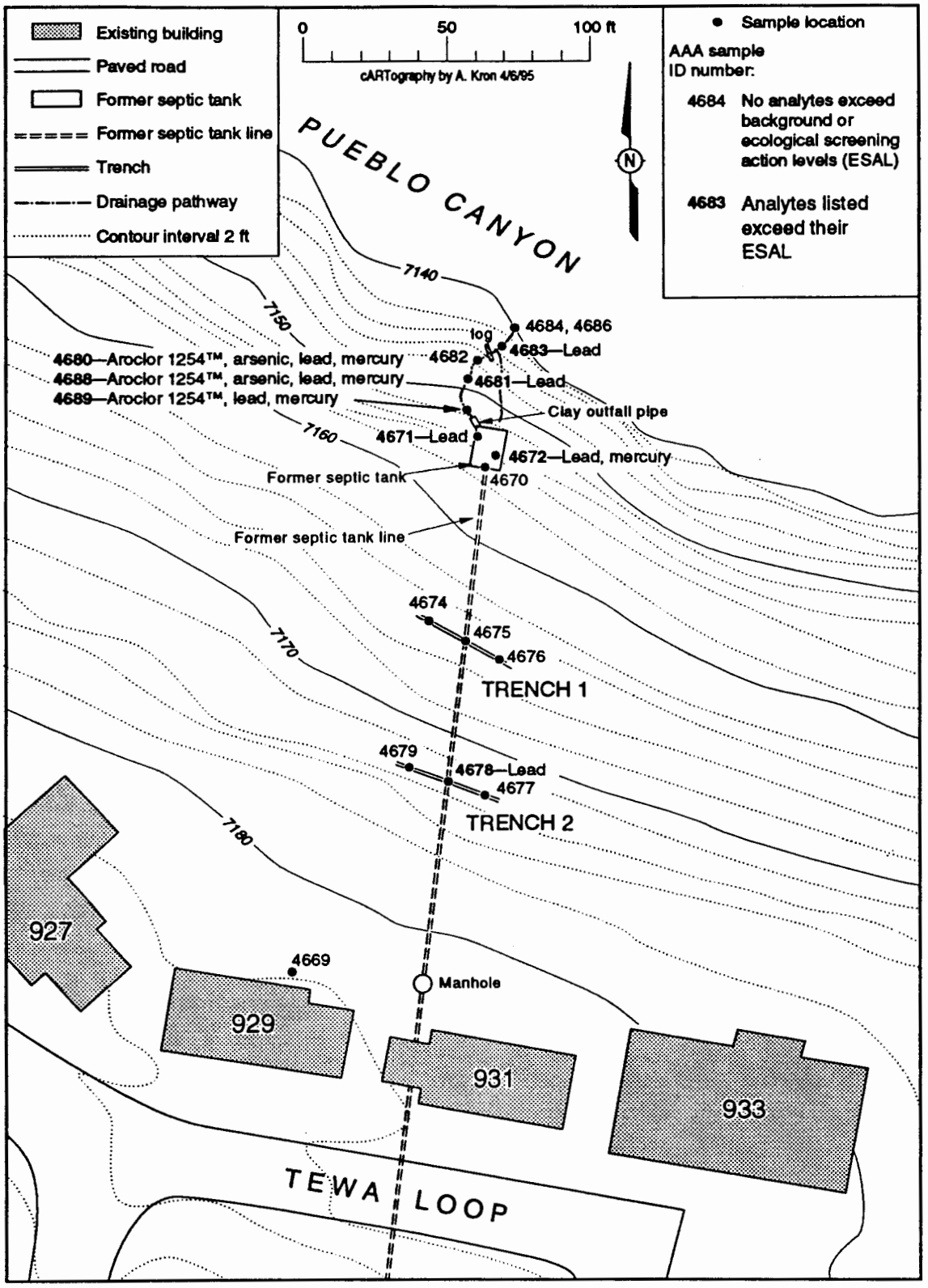


Fig. 10. Locations of analytes with values above ESALs at SWMU 31-001, the former septic tank system at TA-31.

resides. The disturbed habitat on the mesa top can be characterized as urban plant and animal communities, and is not a sensitive habitat. In contrast, the habitats below the outfall on the north-facing cliffside and in middle and lower Pueblo Canyon are not highly disturbed and contain sensitive habitats (Biggs 1993, 06-0101). East of TA-31, the Los Alamos Municipal Sewage Treatment Plant adds sufficient effluent to the intermittent stream to provide artificial perennial stream flow to the Rio Grande. The treated effluent has had a positive impact on lower Pueblo Canyon, creating a streamside riparian habitat that supports a wide variety of hydrophilic vegetation and animals.

Biological surveys did not indicate the presence of any threatened or endangered plant or animal species on the north-facing slopes or along the bottom of middle Pueblo Canyon (Biggs 1993, 06-0101). However, it is possible that the spotted bat (Euderma maculatum), a federal candidate for endangered species status and a protected endangered species in New Mexico, may use the rocky cliffs as a roosting area. Contaminants in the loose soil in the drainages are not expected to impact any of the cliff-face areas where the spotted bat might roost. This highly mobile species could easily adjust to any localized disturbance. It is also possible that portions of the upper canyon bottom habitats may be suitable for the meadow jumping mouse (Zapus hudsonius), a federal candidate for threatened species status and protected as a threatened species in New Mexico. The disturbed canyon bottom with the intermittent stream is considered only a marginal habitat for the jumping mouse.

Lower Pueblo Canyon, however, is known to be a nesting area for the peregrine falcon (Falco peregrinus), federally endangered and protected as an endangered species in New Mexico (Biggs 1993, 06-0101). The peregrine forages throughout the canyon feeding primarily on birds, with a preference for the mourning dove (Foxx and Tierney 1982, 06-0107). Doves are more common in the lower canyon along the stream and near the Rio Grande. A peregrine falcon habitat management plan discusses the present and future nesting and foraging status for this species in Pueblo and Los Alamos Canyons (Johnson 1992, 1097). Pueblo Canyon is considered one of the better peregrine nesting sites in New Mexico because it was occupied by peregrine falcons at a time when this species was at its lowest number in the state and seriously threatened by extinction due to DDT residues. Lower Pueblo Canyon has been designated as a critical habitat for the peregrine falcon through a Memorandum of Understanding between the US Fish and Wildlife Service, the US Department of Energy, the State of New Mexico, and LANL.

The TA-31 septic tank outfall is only one of many outfalls and effluents into Pueblo Canyon, all of which will be assessed collectively as a separate field unit at a later time to determine their cumulative impact on the Pueblo Canyon ecosystem.

4.3 Conclusions, Actions, and Recommendations

One objective of the Phase I investigation at TA-31 was to determine whether the septic line connecting the former main warehouse (TA-31-7) to the former septic tank remained and, if found, to remove it. Evidence of a previously excavated line with a north-south orientation was found in trench 1, indicating that the septic line had already been removed.

Another objective of the Phase I investigation at TA-31 was to corroborate verbal reports that there was no contamination in the former septic tank or surrounding soils. According to the human health-based screening assessment, the only area with analyte concentrations at levels requiring further evaluation is the area below the mouth septic tank outfall pipe. At this location, the PCB Aroclor 1254™ was detected at levels above its SAL, and arsenic was found at levels slightly above the background UTL with no SAL available for comparison.

The ecological screening assessment also identified the area directly beneath the septic tank outfall pipe as the main area with analyte concentrations requiring further evaluation. At this location, the PCB Aroclor 1254™, arsenic, lead, and mercury were detected at levels above their respective ESALs. Mercury was also detected above its ESAL at the former septic tank location, and lead was also detected above its ESAL at locations upgradient and downgradient from the mouth of the clay outfall pipe. However, the small concentration of these COPCs and the small volume of contaminated sediment at the outfall make it unlikely that transport of the residual COPCs down the hillside into the canyon would impact the sensitive habitats further down the canyon. Cleanup of the COPCs at the outfall pipe would prevent any runoff of these contaminants and reduce the potential ecotoxicological impact to the canyon biota.

Considering the data from both the human health and ecological screening assessments, as well as the applicable regulations, a voluntary corrective action (VCA) including soil removal and verification sampling is recommended at the mouth of the septic tank outfall pipe.

The Toxic Substances Control Act (TSCA) provides cleanup levels for PCBs based on PCB concentrations in soil at a site and how the property will be used (EPA 1993, 06-0110). For property of unrestricted access, such as TA-31, the TSCA cleanup level for soil is 10 mg/kg, provided that soil is excavated to a minimum depth of 10 in. The excavated soil is required to be replaced with clean soil containing less than 1 mg/kg of PCBs. Because the area directly

beneath the septic tank outfall pipe is a drainage area, there is the possibility that clean soil would be eroded away. Therefore, the location will be cleaned to a level of 1 mg/kg of PCBs.

In the process of the VCA, arsenic will also be removed from below the mouth of the septic tank outfall pipe to concentrations less than or equal to the background UTL. Coincidentally, lead and mercury, which were retained as COPCs in the ecological screening assessment, will be removed from the area directly beneath the septic tank outfall pipe during the VCA. Remediation at this location will eliminate any human health or ecological risk associated with the TA-31 outfall.

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TABLE A1

SUMMARY TABLE OF SAMPLES COLLECTED AT TA-31

LOCATION	LOCATION ID	SAMPLE ID	SAMPLE TYPE[a]	SAMPLE MATRIX	DEPTH (in.)	ANALYSES PERFORMED				
						TAL[b] METALS	VOCs[c]	SVOCs[d]	PCBs[e]	RAD[f]
NA[g]	31-1000	AAA4669	Field blank	Water	NA[g]	X	X	X	X	X
Septic Tank	31-1001	AAA4670	RFI	Soil	6-9	X	X	X	X	
Septic Tank	31-1002	AAA4671	RFI	Soil	12-15	X	X	X	X	
Septic Tank	31-1003	AAA4672	RFI	Soil	9-12	X	X	X	X	
Trench 1	31-1004	AAA4674	RFI	Soil	45.6	X	X	X	X	
Trench 1	31-1005	AAA4675	RFI	Soil	48	X	X	X	X	
Trench 1	31-1006	AAA4676	RFI	Soil	40.8	X	X	X	X	
Trench 2	31-1007	AAA4677	RFI	Soil	78	X	X	X	X	
Trench 2	31-1008	AAA4678	RFI	Soil	79.2	X	X	X	X	
Trench 2	31-1009	AAA4679	RFI	Soil	81.6	X	X	X	X	
Outfall	31-1010	AAA4680	RFI	Soil	6-13	X	X	X	X	
Outfall	31-1011	AAA4681	RFI	Soil	0-6	X	X	X	X	
Outfall	31-1012	AAA4682	RFI	Soil	0-6	X	X	X	X	
Outfall	31-1013	AAA4683	RFI	Soil	0-6	X	X	X	X	
Outfall	31-1014	AAA4684	RFI	Soil	0-6	X	X	X	X	
NA[g]	NA[g]	AAA4685	Rinsate	Water	NA[g]	X	X	X	X	
Outfall	31-1014	AAA4686	RFI	Soil	0-6	X	X	X	X	
Outfall	31-1010	AAA4688	Duplicate of AAA4680	Soil	6-13	X	X	X	X	
Outfall	31-1010	AAA4689	Duplicate of AAA4680	Soil	6-13	X	X	X	X	

[a] RFI = Samples noted as RFI samples are standard Resource Conservation and Recovery Act facility investigation samples.
[b] TAL = Target analyte list.
[c] VOCs = Volatile organic compounds.
[d] SVOCs = Semivolatile organic compounds.
[e] PCBs = Polychlorinated biphenyls.
[f] RAD = Radionuclides
[g] NA = Not applicable.

TABLE A2

ANALYTICAL RESULTS FOR INORGANICS WITH VALUES GREATER THAN THE REPORTING LIMIT IN TA-31 SAMPLES[a]

		ALUMINUM	ARSENIC	BARIUM	BERYLLIUM	CADMIUM	CALCIUM	CHROMIUM	COBALT	COPPER	IRON	LEAD	MAGNESIUM	MANGANESE	MERCURY	NICKEL	POTASSIUM	SELENIUM	SODIUM	VANADIUM	ZINC
COMPARISON LEVELS FOR SOIL SAMPLES (mg/kg)	SAL[b]	None[c]	None[c]	5 600	None[c]	80	None[c]	400[d]	None[c]	3 000	None[c]	400	None[c]	11 000	24	1 600	None[c]	400	None[c]	560	24 000
	UTL[e]	58 900	11.6	1140	3.31	NC[f]	54 400	34.2	51.1	15.7	35 600	39.0	16 100	1 130	0.1	26.7	6 180	NC[f]	1 880	66	101
	RPL[g]	40	2	40	1	1	1 000	2	10	5	20	0.8	1 000	3	0.1	8	1 000	1	1 000	10	4

	ANALYSIS RESULTS (mg/kg)																			
SAMPLE ID	ALUMINUM	ARSENIC	BARIUM	BERYLLIUM	CADMIUM	CALCIUM	CHROMIUM	COBALT	COPPER	IRON	LEAD	MAGNESIUM	MANGANESE	MERCURY	NICKEL	POTASSIUM	SELENIUM	SODIUM	VANADIUM	ZINC
AAA4678	11 000	3.5	170	0.83	<0.4	3 000	9.4	6	6.3	12 000	40	2 200	380	<0.1	9.2	1 500	0.6	200	23	39
AAA4678R1[h]	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4678R2	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4679	9 500	3.6	250	0.71	<0.4	2 700	8.5	5.8	5.8	10 000	17	2 000	340	<0.1	9	1 300	0.7	220	22	40
AAA4679R1	9 700	.	220	0.75	<0.4	3 000	9.1	5.4	5.6	11 000	12	2 100	370	<0.1	8	1 400	.	230	23	33
AAA4679R2	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4670	3 500	1.7	31	0.41	<0.4	900	2.9	1.1	3	7 700	10	630	260	<0.1	2	590	0.5	63	6.3	41
AAA4670R1	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4670R2	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4671	8 000	3	87	0.72	<0.4	2 800	6.7	2.5	8.3	9 300	53	1 600	270	<0.1	6	1 200	0.6	61	14	46
AAA4671R1	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4671R2	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4672	9 100	3.2	110	0.71	<0.4	3 700	8	3.1	10	9 900	55	1 700	270	0.3	6.3	1 700	0.6	78	17	47
AAA4672R1	.	.	.	.		.	.	.	.	.	.	.	.	0.3	.	.	.	.	.	.
AAA4672R2	.	.	.	.		.	.	.	.	.	.	.	.	0.3	.	.	.	.	.	.
AAA4674	9 000	3.5	120	0.71	<0.4	3 100	7.7	4.4	5.3	9 900	21	1 800	340	<0.1	8	1 300	0.5	100	20	34
AAA4674R1	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4674R2	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4675	9 400	3.3	110	0.74	<0.4	3 300	7.7	4.3	5.3	11 000	32	1 800	350	<0.1	7	1 300	0.7	120	19	38
AAA4675R1	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4675R2	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4676	11 000	3.9	120	0.7	0.5	22 000	10	5.2	12	11 000	26	2 500	390	<0.1	8.6	1 400	0.7	270	22	57
AAA4676R1	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4676R2	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4677	9 600	3.2	140	0.87	0.6	2 800	7.6	5	4.6	10 000	14	1 700	330	<0.1	7.2	1 200	0.6	210	19	34
AAA4677R1	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4677R2	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.

TABLE A2 (CONTINUED)

ANALYTICAL RESULTS FOR INORGANICS WITH VALUES GREATER THAN THE REPORTING LIMIT IN TA-31 SAMPLES[a]

		ALUMINUM	ARSENIC	BARIUM	BERYLLIUM	CADMIUM	CALCIUM	CHROMIUM	COBALT	COPPER	IRON	LEAD	MAGNESIUM	MANGANESE	MERCURY	NICKEL	POTASSIUM	SELENIUM	SODIUM	VANADIUM	ZINC
COMPARISON LEVELS FOR SOIL SAMPLES (mg/kg)	SAL[b]	None[c]	None[c]	5 600	None[c]	80	None[c]	400[d]	None[c]	3 000	None[c]	400	None[c]	11 000	24	1 800	None[c]	400	None[c]	580	24 000
	UTL[e]	58 900	11.8	1140	3.31	NC[f]	54 400	34.2	51.1	15.7	35 600	39.0	16 100	1 130	0.1	26.7	6 180	NC[f]	1 880	88	101
	RPL[g]	40	2	40	1	1	1 000	2	10	5	20	0.8	1 000	3	0.1	8	1 000	1	1 000	10	4

	ANALYSIS RESULTS (mg/kg)																			
SAMPLE ID	ALUMINUM	ARSENIC	BARIUM	BERYLLIUM	CADMIUM	CALCIUM	CHROMIUM	COBALT	COPPER	IRON	LEAD	MAGNESIUM	MANGANESE	MERCURY	NICKEL	POTASSIUM	SELENIUM	SODIUM	VANADIUM	ZINC
AAA4680	11 000	12.5	1 100	0.92	0.5	8 500	19	7.7	51	26 000	290	3 500	750	0.2	13	1 800	1.2	75	35	70
AAA4680R1[h]	.	.	.	.		.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.
AAA4680R2	.	.	.	.		.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.
AAA4681	6 600	3.8	210	0.67	0.5	2 100	8	3	15	8 400	100	1 400	160	0.1	7	1 000	0.6	100	18	60
AAA4681R1	.	.	.	.		.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.
AAA4681R2	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4682	6 500	2.8	110	0.52	0.5	2 000	8.5	3.1	9.3	8 100	36	1 400	280	<0.1	5	970	0.7	100	15	41
AAA4682R1	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4682R2	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4683	7 700	3	180	0.8	<0.4	6 700	7.6	4.1	14	8 300	50	1 700	400	0.1	8	1 400	0.8	100	18	65
AAA4683R1	.	.	.	.		.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.
AAA4683R2	.	.	.	.		.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.
AAA4684	7 300	3.3	100	0.58	0.4	1 500	6.7	3	7.7	9 100	26	1 300	200	<0.1	4	870	0.7	100	18	46
AAA4684R1	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4684R2	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4686	5 800	3.4	120	0.55	0.4	1 900	5.6	2.9	8.2	8 600	32	1 200	230	<0.1	6	750	0.7	80	16	43
AAA4686R1	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4686R2	.	.	.	.		.	.	.	.	.	.	.	.	<0.1	.	.	.	.	.	.
AAA4688	13 000	11.8	860	1	0.5	8 100	16	7.4	32	18 000	460	3 400	690	0.2	11	2 000	1.3	100	33	73
AAA4688R1	.	9.8	.	.		.	.	.	.	.	.	.	.	0.1	.	.	1.2	.	.	.
AAA4688R2	.	.	.	.		.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.
AAA4689	13 000	11.8	1 100	0.98	0.8	8 000	17	7	38	18 000	260	3 500	660	0.1	10	1 800	1.3	84	32	71
AAA4689R1	.	.	.	.		.	.	.	.	.	.	.	.	0.1	.	.	.	.	.	.
AAA4689R2	.	.	.	.		.	.	.	.	.	.	.	.	0.2	.	.	.	.	.	.

[a] All data extracted from the Facility for Information Management, Analysis, and Display on March 29, 1995.
[b] SAL = Screening action level.
[c] There is no applicable SAL available for this analyte.
[d] The SAL used for chromium is the SAL for chromium VI.
[e] UTL = Upper tolerance limit.
[f] NC = Not calculated
[g] RPL = Reporting limit.
[h] Sample IDs followed by an "R1" or "R2" notation were submitted for replicate analyses of one or more analytes.

TABLE A3

ANALYTICAL RESULTS FOR ORGANIC ANALYTES WITH VALUES GREATER THAN THE REPORTING LIMIT IN TA-31 SAMPLES[a]

SAMPLE ID	ANALYTE	ANALYSIS RESULTS (mg/kg)	COMPARISON LEVELS FOR SOIL SAMPLES (mg/kg)		
			SAL[b]	UTL[c]	RPL[d]
AAA4676	Tetrachloroethylene	0.01	5.9	None[e]	0.005
AAA4677	Tetrachloroethylene	0.013	5.9	None[e]	0.005
AAA4679	Pyrene	0.92	2400	12.526	0.33
AAA4679	Benzo[a]anthracene	0.49	1	11.949	0.33
	Benzo[a]pyrene	0.41	0.1	11.368	0.33
	Benzo[b]fluoranthene	0.69	1	12.084	0.33
	Chrysene	0.63	96	18.345	0.33
	Fluoranthene	1.1	3200	30.928	0.33
	Phenanthrene	0.35	None[f]	22.683	0.33
AAA4680	Aroclor 1254™	3	1	None[e]	1.0
	Benzo[b]fluoranthene	0.56	1	12.084	0.33
AAA4681	Benzo[b]fluoranthene	0.47	1	12.084	0.33
	Fluoranthene	0.65	3200	30.928	0.33
	Pyrene	0.65	2400	12.526	0.33
AAA4688	Aroclor 1254™	5	1	None[e]	1.0
	Benzo[a]anthracene	0.52	1	11.949	0.33
	Benzo[a]pyrene	0.67	0.1	11.368	0.33
	Benzo[b]fluoranthene	1	1	12.084	0.33
	Chrysene	0.45	96	18.345	0.33
AAA4689	Aroclor 1254™	12	1	None[e]	1.0
	Benzo[a]anthracene	1.7	1	11.949	0.33
	Benzo[a]pyrene	2.2	0.1	11.368	0.33
	Benzo[b]fluoranthene	3.3	1	12.084	0.33
	Benzo[g,h,i]perylene	0.72	None[f]	5.900	0.33
	Benzo[k]fluoranthene	1.1	1	18.185	0.33
	Chrysene	1.7	96	18.345	0.33
	Indeno[1,2,3-cd]pyrene	0.79	1	6.000	0.33
	Fluoranthene	1.2	3200	30.928	0.33
	Pyrene	1.5	2400	12.526	0.33

[a] All data extracted from the Facility for Information Management, Analysis, and Display on March 29, 1995.
[b] SAL = Screening action level.
[c] UTL = Upper tolerance limit.
[d] RPL = Reporting limit.
[e] No background UTL is available for this analyte because the background level is normally zero.
[f] No applicable SAL is available.

APPENDIX B PAH BACKGROUND COMPARISON

The Toxicological Profile for Polycyclic Aromatic Hydrocarbons (PAHs) Update, US Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry gives the following information about PAHs (Clement International Corporation 1990, 0873).

> PAHs are a group of chemicals that are formed during the incomplete burning of coal, oil, gas, wood, garbage, or other organic substances, such as tobacco and charbroiled meat. PAHs can be either anthropogenic or occur naturally. Most PAHs have no known use except for research purposes. A few of the PAHs are used in medicines and to make dyes, plastics, and pesticides, while others are contained in asphalt used in road construction. They are found through the environment in the air, water, and soil. There are more than 100 different PAH compounds.
>
> PAHs are released to the environment through natural and anthropogenic sources with emissions largely to the atmosphere. Natural sources include emissions from volcanoes and forest fires. Anthropogenic sources provide a much greater release volume than natural sources; the largest single source is the burning of wood in homes. Automobile and truck emissions are also major sources of PAHs. Improper disposal of used motor oil can be the source of PAHs to the soil or water.
>
> The greatest sources of exposure to PAHs for most of the United States population are active or passive inhalation of the compounds in tobacco smoke, wood smoke, and contaminated air, and ingestion of compounds in grilled or smoked foodstuffs. Exposure can also be made through skin contact with soot and tars.

The Assessments Council of Los Alamos National Laboratory (LANL) has issued a draft memorandum, Interim Guidance for Evaluating Polycyclic Aromatic Hydrocarbons in Soil. While the memorandum has not been finalized, excerpts are provided below which establish the guidance followed for this Resource Conservation and Recovery Act Facility Investigation report (LANL in preparation, 06-0108):

> **Interim Guidance**
>
> Information regarding background levels of PAHs in soil in the vicinity of the Laboratory is not currently available. This interim guidance represents a phased approach that will initially rely upon a surrogate

background data set based on data published in the scientific literature. If a potential release site (PRS) fails this initial comparison, then PRS-specific background samples may be collected during Phase II sampling to determine the need for further action. As data specific to LANL become available, the surrogate background data set will be reevaluated, and the background distributions will be adjusted as necessary. Ultimately, sufficient site-specific data that are representative of local background conditions will be collected such that inclusion of surrogate data will no longer be necessary.

Surrogate Background Data Set

Various researchers have published background concentrations of PAHs in rural, agricultural, and/or urban soils collected throughout the United States and the world. Ideally, the surrogate background data set would be composed of data collected under conditions as close as possible to site-specific conditions at LANL PRSs. The Assessments Council has reviewed several existing data sets; however, most are not applicable to LANL and/or do not contain sufficient information to be useful [e.g., analysis of benzo(a)pyrene only]. At this time, the Assessments Council has adopted data from a single source (Bradley et al. 1994, 1144) to be used as the surrogate background data set. This data set was chosen because the analyses included all of the individual PAHs in which the Environmental Restoration (ER) Project is interested, the analytical methods and quality assurance/quality control measures were consistent with those used by the ER Project, and the data were collected specifically to identify background concentrations of PAHs in soil.

The Bradley et al. data are summarized in Table B1, and are the only data to be used at this time. As noted above, this data set will be amended as more information becomes available. A new memorandum will be issued by the Assessments Council each time the surrogate background data set is refined.

In February 1995 the Assessments Council issued a draft position paper on background comparisons for metals and radionuclides (LANL 1995, 06-0105). The draft position paper describes two types of comparisons:

TABLE B1

COMPARING PRS DATA TO SURROGATE BACKGROUND DATA SET

COMPOUND	MINIMUM DETECT (mg/kg)	MAXIMUM DETECT (mg/kg)	ARITHMETIC MEAN (mg/kg)	FREQUENCY OF DETECTION	
				SAMPLES > LOD	TOTAL SAMPLES
2-Methylnapthalene	0.017	0.64	0.151	19	62
Acenaphthene	0.024	0.34	0.201	30	62
Acenaphthylene	0.018	1.1	0.173	24	62
Anthracene	0.029	5.7	0.351	54	62
Benzo(a)anthracene	0.048	15	1.319	58	62
Benzo(a)pyrene	0.04	13	1.323	57	62
Benzo(b)fluoranthene	0.049	12	1.435	55	62
Benzo(g,h,i)perylene	0.2	5.9	0.891	36	62
Benzo(k)fluoranthene	0.043	25	1.681	59	62
Chrysene	0.038	21	1.841	60	62
Dibenzo(a,h)anthracene	0.02	2.9	0.388	32	62
Fluoranthene	0.11	39	3.047	60	62
Fluorene	0.022	3.3	0.214	35	62
Indeno(1,2,3-cd)pyrene	0.093	6	0.987	43	62
Napthalene	0.018	0.66	0.125	35	62
Phenanthrene	0.071	36	1.838	61	62
Pyrene	0.082	11	2.398	61	62

a hot measurement test involving comparison of the maximum detected concentration with an estimated upper tolerance limit (UTL) of the background distribution, and a distributional shift test involving a comparison of the distribution of measured concentrations to the entire background distribution. At this time, the Assessments Council is recommending that only the hot measurement test be used for PAHs, because UTLs can be estimated from the summary data presented in Table B1, and the distributional shift test requires the raw data, which Bradley et al. have not agreed to release to LANL.

It should be noted that the Assessments Council's position paper on background comparisons is currently being revised, and will contain several additional statistical tests that may be used to perform background comparisons. One or more of these additional tests may be applicable in cases where the raw data are not available. If so, a new memorandum regarding PAHs will be issued by the Assessments Council.

The UTLs estimated from Bradley et al.'s summary data are presented in Table B2. In general, if the maximum concentration detected at a PRS falls below the UTL of the surrogate background concentration for a particular PAH, then no further evaluation of that PAH may be necessary. It is strongly recommended, however, that historical site information and process knowledge be considered in this decision, especially if the measured concentrations of all PAHs are below their respective UTLs and no further action at the site may be recommended. In addition, the presence of other potential chemicals of concern may also affect the decision to further evaluate PAHs, even if they are present at concentrations below the UTLs.

TABLE B2

ESTIMATED UTLs FROM BRADLEY ET AL.[a]

COMPOUND	UTL (mg/kg)[b]
2-Methylnapthalene	0.640
Acenaphthene	3.400
Acenaphthylene	1.100
Anthracene	4.016
Benzo(a)anthracene	11.949
Benzo(a)pyrene	11.368
Benzo(b)fluoranthene	12.084
Benzo(g,h,i)perylene	5.900
Benzo(k)fluoranthene	18.185
Chrysene	18.345
Dibenz(a,h)anthracene	2.900
Fluoranthene	30.928
Fluorene	3.300
Indeno(1,2,3-cd)pyrene	6.000
Napthalene	0.660
Phenanthrene	22.683
Pyrene	12.526

[a] Bradley et al. 1994, 1144.
[b] UTL = Upper tolerance limit. The UTL is used except when more than 20% of the samples had non-detectable amounts of the compound of interest, then the maximum observed value is given.