LA-UR 95-3625
#71300

ESHID-603490

RFI Report for Field Unit 3

Operable Unit 1122

Technical Area 33

RFI Report for PRSs

33-003(a)

33-004(a)

33-007(c)

33-009

33-011(d)

33-013

33-016

33-017

Revised Sampling Plans for PRSs

33-003(b)

33-004(k)

33-008(a)

33-008(b)

C-33-001

C-33-002

Environmental Restoration Project

Los Alamos National Laboratory

A Department of Energy

Environmental Cleanup Project

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EXECUTIVE SUMMARY

Between 1947 and 1972 Technical Area (TA)-33 was a test site for components of nuclear weapons called initiators. This Resource and Recovery Conservation Act (RCRA) Facility Investigation (RFI) report discusses potential release sites (PRSs) at various locations within TA-33 at Main Site, Area 6 , South Site, and East Site.

Phase I sampling was performed at Area 6 and Main Site between May and November 1993. This RFI report documents the findings at eight (PRSs) proposed for voluntary corrective action (VCA), expedited cleanup (EC), or Phase II sampling. In seven of these eight PRSs, contamination was above screening action levels (SALs).

Information discovered after the RFI Work Plan was submitted in 1992 indicates that sampling and analysis plans for six PRSs require modification. Revised Phase I sampling and analysis plans for these PRSs are presented in Section 5.0 of this report. In addition, information gathered after the work plan was submitted indicates that solid waste management unit (SWMU) 33-003(a) can be recommended for no further action (NFA). All PRSs discussed in this RFI report are listed in Table ES-1. The year the PRS was included in the Los Alamos National Laboratory (LANL) Hazardous and Solid Waste Amendments (HSWA) Permit is listed in column two.

Holding times were met for all analyses used for decision-making purposes. All samples specified in the work plan were collected with the exception of samples from within the septic system seepage pits at SWMU 33-004(a). Seepage pit samples from SWMU 33-004(a) were collected from boreholes drilled beside the pits.

The following is a summary of the PRSs included in this report for which Phase I sampling has been completed. When referring to a specific PRS, the term solid waste management unit (SWMU) is used in accordance with RCRA terminology.

SWMU 33-003(a) is underground chamber TA-33-4 at Material Disposal Area (MDA) D. Although polychlorinated biphenyls (PCBs) or their combustion products may be present in the chamber, SWMU 33-003(a) is proposed for NFA based on results of an assessment that indicated absence of exposure pathways.

SWMU 33-004(a) is the septic system at Main Site. Organic compounds were detected in sludge from the septic tank. Several organics, including benzo[a]pyrene above its SAL, were detected at trace levels in the sample taken adjacent to the tank at a depth of 3 to 5 ft. Organics detected in the drain field are derived from construction material. Lead was detected above SAL. Because the septic system is active, no action is planned at this SWMU.

TABLE ES-1

TA-33 PRSs IN THIS RFI REPORT

PRS ID	HSWA PERMIT	NFA[a]	ACCELERATED CLEANUP	FURTHER INVESTIGATION	RATIONALE
[redacted]	1990	X			No pathway (4.1)
[redacted]	1990			Phase I	PCB extent (5.1)
[redacted]	1990		DA[b]		Active system (4.2)
33-004(k)	1990			Phase I	Outfall not found (5.2)
[redacted]	1990		EC[c]		Uranium chunks (4.3)
[redacted]	1990			Phase I	Revised plan (5.3)
[redacted]	1990			Phase I	Revised plan (5.3)
[redacted]	1990			Phase II	PCB extent (4.4)
[redacted]	1994			Phase II	Uranium spots (4.5)
[redacted]	1990			Phase II	Inorganic extent (4.6)
[redacted]	1994		VCA[d]		VCA Completed (4.7)
[redacted]	1990			Phase II	Organic extent (4.8)
[redacted]	No			Phase I	Never sampled (5.4)
[redacted]	No			Phase I	Never sampled (5.4)

[a] NFA = No further action.
[b] DA = Deferred action.
[c] EC = Expedited cleanup.
[d] VCA = Voluntary corrective action.

SWMU 33-007(c) is the firing sites at Area 6. During 1994 trenching in the catcherboxes, subsurface uranium deposits were discovered. When the RFI report LA-UR-95-882 was submitted in January 1995, no results had been received for inorganic analyses of the catcherbox samples. This RFI report contains results of those analyses, but only for the catcherbox segment of SWMU 33-007(c). An EC is recommended to remove the uranium contamination.

SWMU 33-009 is a surface disposal area at Area 6. Low levels of PCBs were found in samples over the face of the disposal area. SWMU 33-009 is targeted for Phase II sampling.

SWMU 33-011(d) is an area once used for storage outside warehouse TA-33-20. Lead, uranium, and tritium were detected above SAL in one asphalt sample and its duplicate. A radiological survey and cleanup is proposed for uranium. A Phase II sampling plan is presented to determine the extent of lead contamination.

SWMU 33-013 is a surface disposal area on pavement east of the former tritium facility, TA-33-86. Cadmium, chromium, and tritium were measured above SALs. Beryllium was measured above soil background levels. However, elevated inorganics were associated with serious problems in the quality control data. A Phase II sampling plan is presented to determine the extent of contamination.

SWMU 33-016 is a sump and outfall at bunker TA-33-23. Organics above SALs were discovered in the sump sludge. A VCA, consisting of cleaning and filling the tank, has been completed at this SWMU.

SWMU 33-017 encompasses the eastern section of the fenced area at Main Site. Elevated levels of lead and organic compounds are associated with samples from an area east of shop TA-33-39. This area is known as the vehicle maintenance area. A risk assessment for lead in this area was presented in Subsection 4.4.4 of RFI Report LA-UR-95-882 (LANL 1995, 1212). In this RFI report, the vehicle maintenance area is proposed for Phase II sampling to determine concentrations and extent of organic contamination.

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1.0 INTRODUCTION

1.1 Site History

Technical Area-(TA)33 is located in the southeastern section of Los Alamos National Laboratory (LANL) (Fig. 1-1). TA-33 was used between 1947 and 1972 as a site to test components of nuclear weapons called initiators. TA-33 contains five sites (Fig. 1-2).

- Area 6, South Site, and East Site are inactive firing sites occasionally used for short-term experiments.
- The National Radio Astronomy Observatory (NRAO) Site was a storage area that now houses a radiotelescope.
- Main Site contains offices, a warehouse, and shops. Main Site is an active site behind a security fence.

Initiator testing activities ended in 1972. Later operations were confined to office and storage activities for a geology group until 1989, when an electronics development group occupied Main Site. The firing sites are inactive except for occasional short-term experiments. This RFI report evaluates contamination at potential release sites (PRSs) at Main Site, Area 6, and East Site. Revised sampling plans are proposed for PRSs at East and South Sites.

1.2 RFI Overview

Resource and Recovery Conservation Act (RCRA) Facility Investigation (RFI) Work Plan for Operable Unit (OU) 1122 was submitted to the Environmental Protection Agency (EPA) Region 6 in May 1992 and was approved with minor modifications by EPA in July 1993 (LANL 1992, 0784; EPA 1993, 02-090). The technical approach in the RFI work plan utilizes phased sampling plans to ensure that any environmental impacts associated with LANL activities are investigated in compliance with the LANL Hazardous and Solid Waste Amendments (HSWA) Module VIII of the LANL RCRA Facility Permit (EPA 1990, 0306). Specific PRSs in this report are either solid waste management units (SWMUs) or Areas of Concern (AOCs).

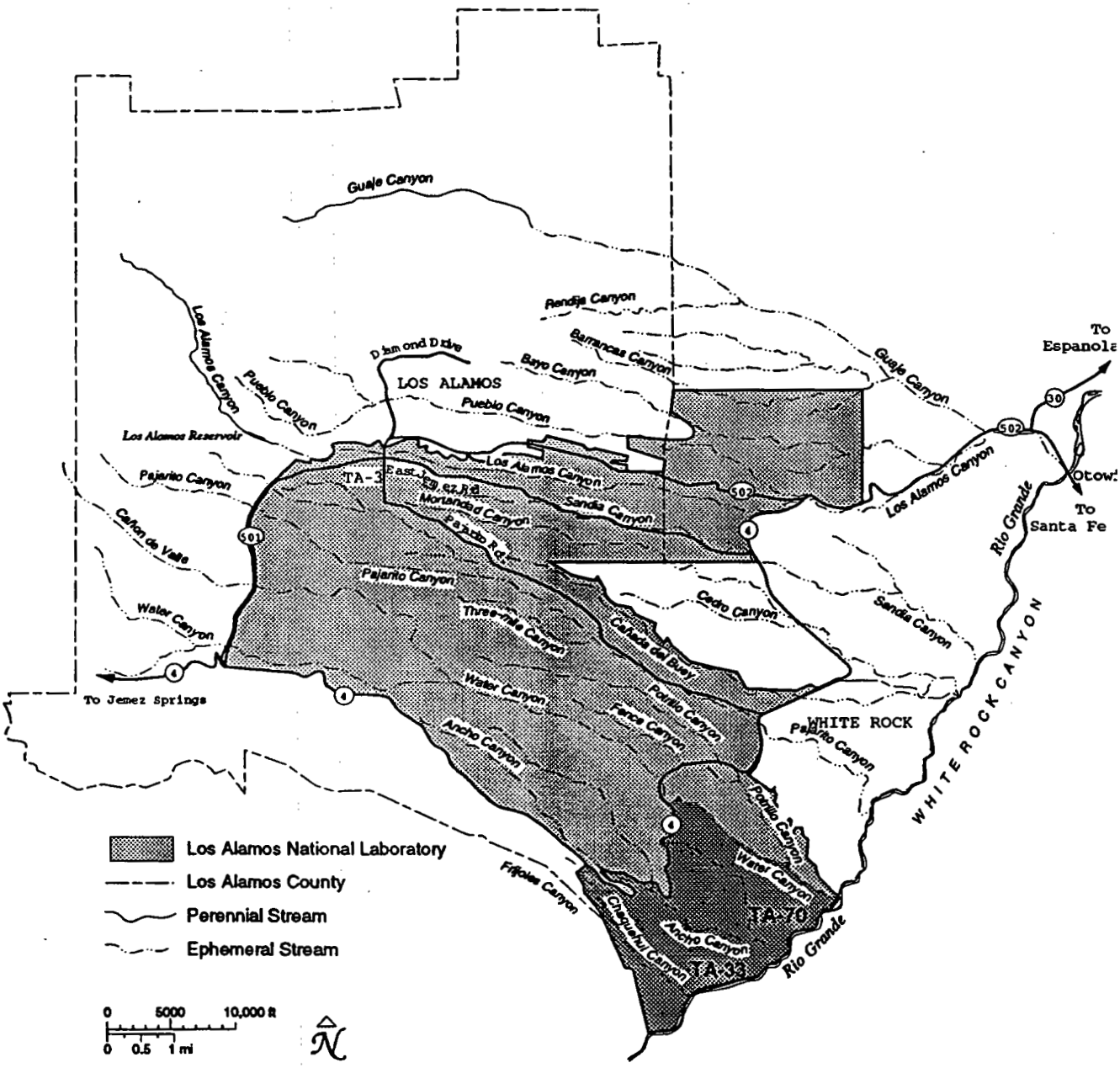


Fig. 1-1. Location of TA-33.

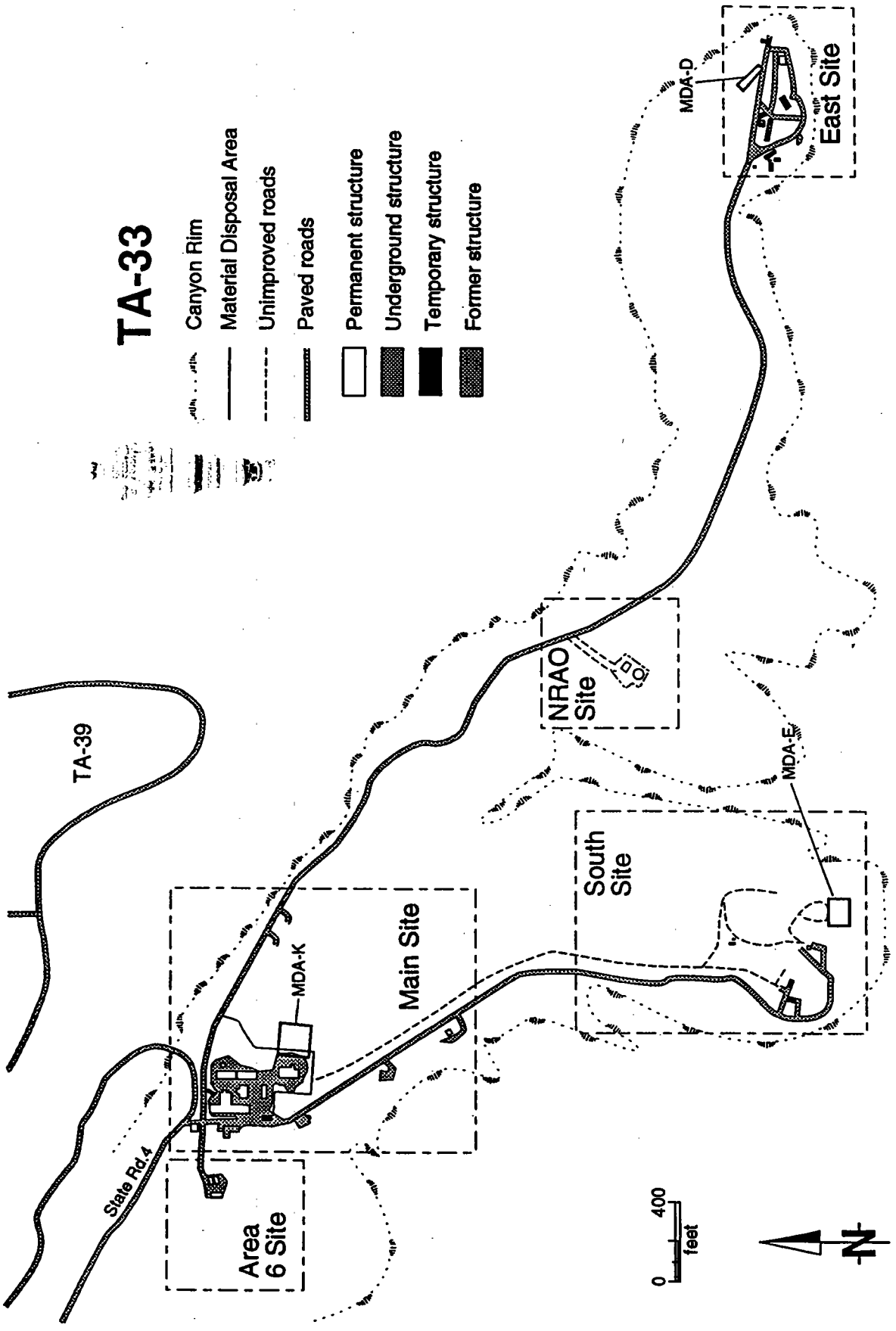


Fig. 1-2. The five sites at TA-33.

1.2.1 RFI Objectives

Because little was known of contamination levels at TA-33, the objective of the first phase of RFI sampling plans was to ascertain presence, levels, and distribution of contaminants. Options for subsequent actions for each PRS based on the Phase I analytical results include the following:

- No further action (NFA) and request for removal of the PRS from the LANL HSWA permit;
- Voluntary corrective action (VCA);
- Expedited Cleanup (EC);
- Phase II study to provide data for baseline risk assessment, which may lead to VCA, EC or to NFA; or,
- Corrective measures study (CMS).

In the RFI work plan, the following field activities were planned to facilitate sampling decisions.

- Accurate land and geophysical surveys and channel mapping
- Radiation surveys
- Surface sampling to identify:
    1) areas of elevated contamination associated with PRSs
    2) transport of contaminants along stream channels
    3) average contaminant concentrations around gun-firing areas
    4) average concentrations and trends with distance from a potential source
    5) spatial variability and predictability of contaminant concentrations
- Subsurface sampling to identify:
    1) possible vapor phase plumes from sumps and septic tanks
    2) contaminated soil and solid material in berms

RFI sampling plans were devised to provide data for preliminary risk assessments should analyses indicate that contamination is present. Three conceptual exposure models were developed for current activities, construction, and recreational scenarios as described in Chapter 3, page 3-11, of the RFI Work Plan for OU 1122 (LANL 1992, 0784).

For the PRSs in Section 4.0, this RFI report concludes Phase I of the RFI work plan. Data from sampling and analyses are available in the environmental restoration (ER) Project Facility for Information Management, Analysis, and Display (FIMAD) database, as stated in Appendix A. Phase II sampling and analysis plans for SWMUs 33-009, 33-011(d), 33-013, and 33-017 are given in Appendix B.

1.3 Field Activities

Field activities at Main Site and Area 6 were conducted by ICF Kaiser Engineers (ICF KE) personnel during the 1993 sampling season from May to November (ICF Kaiser 1994, 02-095).

1.3.1 Field Surveys

Field surveys included land surveys, radiation surveys, and geophysical surveys. The land survey established geodetic control points, coordinates for all sample locations, and grids for the radiation and geophysics surveys. The land survey was conducted by Santiago Romero, Jr. and Associates to established geodetic control points at Main Site and Area 6. Grid systems were then established as required by the RFI work plan for OU 1122 to identify measurement points for the radiation and geophysical surveys (LANL 1992, 0784). Sample locations for the May 1993 sampling activities were surveyed by Santiago Romero, Jr. and Associates or by ICF KE personnel using a Brunton™ compass and surveyor's tape.

Radiation surveys were conducted by Afftrex, Ltd. on approximately 568 grid locations at Main Site and Area 6. The surveys were conducted using a Ludlum Model 12S Micro-R Meter™ held at 3 ft above the ground surface. This instrument uses an internal nominal one-inch sodium-iodide detector to measure low-energy gamma radiation for the detection of uranium, plutonium, and americium. The objective of the surveys was to redirect the locations of reconnaissance samples if above-background radiation levels were found. Data from the radiation surveys at Main Site and Area 6 were recorded on LANL's daily activity logs and radiation survey forms.

Geophysical surveys were conducted at Main Site and Area 6 by ICF KE personnel. The RFI Work Plan for OU 1122 states that electromagnetic (EM) and magnetometer/gradiometer (MAG) readings are to be reported for each node of 5-ft and 10-ft grids at Main Site and Area 6 (LANL 1992, 0784). The stated objectives of the survey were:

- to delineate drain fields and drain lines,
- to locate buried projectiles, and
- to define saturated areas.

To achieve these three objectives, the EM method was used to assess shallow geophysical anomalies (e.g., septic tanks and drain fields). The MAG method was used to locate shallow, buried, metallic objects (projectiles). The EM instrumentation consisted of a Geonics EM31-DL™ ground conductivity meter and an Omnidata™ data logger. The MAG instrumentation was a GEM GSM-19™ proton precession magnetometer/gradiometer.

1.3.2 Field Sampling

Field sampling activities for the PRSs in this RFI report included surface soil and sediment sampling, structure sampling (e.g., sludge from sumps), and shallow subsurface soil sampling (using a hand auger and hollow-stem auger drill rig). Sample locations at TA-33 were selected using the criteria outlined in the RFI Work Plan for OU 1122. The work plan identifies the criteria for selecting reconnaissance (biased) sample locations, characterization (random) sample locations, and collocated or neighbor sample locations (LANL 1992, 0784).

- Reconnaissance sample locations were selected specifically to maximize the likelihood of detecting any contamination that might be present within the PRS of interest.
- Characterization samples were selected within PRSs of interest without regard to specific site characteristics. Freedom from judgmental influences on selecting sample locations was achieved by the use of a grid-based randomization protocol and an area-based randomization protocol.
- Collocated and neighbor samples were collected in the field to provide data for estimating spatial variability of contaminants in the surface and subsurface soils and sediments. Collocated samples (designated as field duplicates in the work plan) were selected from nine percent of the grid-

based sample locations at SWMUs 33-017 and 33-007(c). Locations of the collocated samples were established one foot north of their respective grid-based sample locations.

Before each sample was taken, the health physics technician and a field team member checked the undisturbed sample location for the presence of above-background levels of radioactivity and volatile organic compounds (VOC). If VOCs or elevated levels of radioactivity were detected, the site was evacuated and sampling procedures for that site were re-evaluated. If VOCs or elevated levels of radioactivity were not detected, the samplers then proceeded to collect the sample, document weather and site conditions, take photos where appropriate, and document the environmental sample. All samples were cooled with ice packs in portable ice chests as soon as possible after sample collection. Samples collected in the morning and mid-afternoon were submitted to LANL's mobile radiation laboratory on the day of collection. Samples collected in the late afternoon were maintained in coolers at the site and submitted to the mobile radiation laboratory the following morning.

LANL ER Project Standard Operating Procedures (SOPs) were used for all field documentation and sampling activities (LANL 1993, 0875). Field documentation was carried out conforming to LANL-ER-SOP-1.04, Sample Control and Field Documentation. This documentation includes field notes, sample collection logs, and chain of custody forms. Chain-of-Custody/request for analysis forms were completed at the time of sampling to identify and document personnel responsible for safeguarding sample integrity. These forms provide a record of sample collection and transfer between field personnel and personnel at LANL's mobile radiation laboratory.

All surface sample collection activities at Main Site and Area 6 during 1993 conformed to LANL-ER-SOP-06.09, Spade and Scoop Method for Collection of Soil Samples. Surface soil samples are defined in the work plan as samples taken from the surface to a depth of 6 in. Surface soil samples were taken to this depth and within a diameter of approximately 6 to 8 in. Soil was collected from each sample location using a dedicated (single use) stainless steel spoon. The soil was placed in a dedicated stainless steel bowl and homogenized by mixing with the spoon.

All fluid and sludge sample collection activities at Main Site during 1993 conformed to LANL-ER-SOP-06.15, Coliwasa Samples for Liquids and Slurries. A HAZCO™ Teflon mucksucker sampler was used to collect fluid and sludge samples from septic tanks and

sumps. This translucent plastic sampler consists of sampling tube, stop-cock, and closure system. The mucksucker was inserted into the tanks, the fluid or sludge was drawn, up and then transferred directly to the appropriate sample containers.

All shallow hand auger sample collection activities at Main Site during 1993 conformed to the procedures described in LANL-ER-SOP-06.10, Hand Auger and Thin-Wall Tube Sampler. Subsurface soil samples were recovered from depths up to 10 ft using a stainless steel hand-held auger that was manually driven into the soil. The soil or sediment was removed from the auger, placed into a stainless steel bowl, and homogenized with a stainless steel spoon.

All shallow borehole drilling activities at Main Site during 1993 conformed to LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management. A hollow-stem auger rig was used to drill boreholes at locations where sample depths or subsurface obstacles precluded the use of the hand auger. Shallow borehole drilling was performed by Rodgers Environmental Services, Inc. with the following equipment:

- C.M.E. 75™ auger rig,
- 3.75-in.-inner-diameter heavy-duty augers and bit, and
- stainless steel split-spoon samplers, 2-ft by 3-in.

Samples were collected from the borehole using a stainless steel split-spoon sampler according to LANL-ER-SOP-06.24, Sample Collection from Split-Spoon Samplers and Shelby Tube Samplers. The split-spoon samplers were monitored for radiation and VOCs immediately after opening. At SWMU 33-004(a), the sample was also monitored for mercury using a Jerome Mercury Analyzer™. The core material was then removed from the split-spoon sampler and placed into a stainless steel bowl. Samples that were to be analyzed for VOCs were immediately placed into 40-ml sample containers. The remaining material was broken up, mixed with a stainless steel spoon, and placed into the appropriate sample containers.

All samples specified in the work plan were collected. Samples for the seepage pits at the Main Site septic system, SWMU 33-004(a), were collected beside the pits. Quality assurance (QA) field activities are discussed in Subsection 3.1 of this report.

2.0 ENVIRONMENTAL SETTING

2.1 Climate

Weather at TA-33 is similar to other areas of LANL. Subsection 2.5.3 of the LANL ER Installation Work Plan (IWP) describes a semiarid, temperate, mountain climate (LANL 1993, 1017). TA-33 is at the lower elevations of the laboratory; summers are hotter and winter snow cover of shorter duration than at most areas of the Laboratory, which are at higher elevations.

2.2 Geology

2.2.1 Geologic Setting

Main Site and Area 6, the subjects of this RFI report, are located near the head of the TA-33 mesa. Both sites were leveled during construction. Adjacent terrain is generally level or gently sloping. Canyon sides are moderately sloping, with the exception of the west side of Area 6 at SWMU 33-009, where a tributary to Chaquehui Canyon becomes fairly steep sided. Detailed descriptions of terrain are provided with each PRS description. Exposed bedrock at Main Site and Area 6 consists of Unit 3 of the Tshirege Member of the Bandelier Tuff (Reneau et al. 1995, 02-092). Deep drilling at Main Site established that tuff formations extend approximately 200 ft deep. Underlying the tuff are basalt flows of the Cerros del Rio volcanic field, which lie on sedimentary formations of the Santa Fe Group. Part of the Area 6 firing site is built on an exposed basaltic cinder cone that predates the formation of the tuff units. Deep drilling into tuff at MDA K intercepted basaltic cinders of the subsurface shoulders of the Area 6 cone, indicating that this formation underlies the tuff at Main Site. Extent of the cone's base is unknown. The deep drilling terminated at basalts of the Cerros del Rio flows. Reneau et al. (1995, 02-092) provides a detailed description of the geology and geomorphology at TA-33.

2.2.2 Soils

Soils at Main Site and Area 6 are classified as Hackroy Rock (Nyhan et al 1978, 0161). Soils range in appearance from sandy loam to fine clay. Pumice pebbles are deposited on the surface. Drainage catchments collect sand, pumice pebbles, and sediments. Soils are generally shallow, with bedrock exposed at many areas on the mesa. Shallow hand-auger drilling during the 1993 sampling campaign indicated that depths of most soils ranged from 2 to 5 ft. The deepest soil sampled was at a depth of 15 ft at the Main Site septic tank, which is built in fill formed by grading of Main Site.

2.3 Hydrology

Ephemeral surface water flow may be expected in the major canyons during the spring snowmelt and summer thunderstorm seasons. Groundwater is expected to be at a considerable depth below the mesa tops. Deep drilling conducted at Main Site (elevation 6 530 ft) in 1993 reached a depth of 315 ft (elevation 6 215 ft) without encountering any perched water. The nearest evidence of groundwater is at Ancho Spring in Ancho Canyon at an elevation of 5 700 ft. The depth to groundwater in the vicinity of Main Site at TA-33 is therefore expected to be between 315 and 830 ft. There is no information available on the existence of alluvial aquifers in Ancho or Chaquehui Canyons. There are no data available concerning water transport through fissures and fractures of bedrock at TA-33.

2.4 Biological and Cultural Surveys

Biological and cultural surveys were performed at TA-33 prior to sampling. As described in Appendix B of the RFI Work Plan for OU 1122, no sensitive habitats were identified on the mesas; sensitive habitats are limited to areas in Ancho, Chaquehui, and White Rock Canyons (LANL 1992, 0784). Cultural surveys found 64 archaeological sites on the 782.63 acres surveyed at TA-33 during the summer of 1991. Three archaeological sites near the tritium facility, TA-33-86, were listed as being located in potentially contaminated areas (LANL 1994, 02-0103). The report is in error; these sites are not within the boundaries of any PRS, nor were they affected by sampling activities.

3.0 APPROACH TO DATA ASSESSMENT AND ANALYSIS

3.1 Summary of Quality Assurance/Quality Control Activities

Field quality-control samples were collected during the 1993 field campaign at TA-33 to provide means of assessing the quality of the data that resulted from these activities. Field quality-control samples were collected during the investigation as specified and defined in LANL's ER Generic Quality Assurance Project Plan (QAPjP) for RCRA Facility Investigations (LANL 1991, 0412). All quality control samples were collected at a minimum frequency of 1 per 20 samples. The frequency was higher if less than 20 samples were collected per sampling period. Field quality-control samples include field blanks, rinsate blanks, and field duplicates.

Field blank samples are checked for sample contamination from sample collection and handling procedures. Field blanks collected before October 1993 were taken from "clean" soil collected from a site near Bandelier National Monument. Samples were collected using the same methods and under the same conditions as the environmental field samples. The field blanks collected after October 1993 were taken from distilled and deionized water supplied by LANL's EM-9 laboratory. These samples were also collected under the same conditions as the environmental field samples. The discrepancy in types of material submitted as field blanks was a result of different interpretations of LANL's QAPjP requirements.

Rinsate blank samples were checked for potential cross-contamination of samples resulting from ineffective decontamination procedures. Following decontamination of non-dedicated equipment, the equipment was rinsed again with commercially packaged distilled water. This rinsate was collected in dedicated stainless steel bowls. Rinsate blank samples were collected from this water under the same conditions as the environmental field samples.

Field duplicate samples are analyzed to check for both sampling and laboratory analytical reproducibility. The collection procedure for duplicate samples varied slightly from the environmental sample procedure in that more material was placed into the stainless steel sampling bowl before homogenizing the material. This practice ensured that enough homogenized material was available for both samples before the samples were removed from the sampling bowl. The off-site and the mobile radiation laboratories were not told which samples were duplicates.

All samples used for decision purposes in this report met holding times.

A detailed assessment of quality assurance/quality control (QA/QC) data and the derivation of local background concentrations for inorganic and radionuclide constituents was presented in OU 1122 RFI Report LA-UR-95-882 (LANL 1995, 1212) submitted to EPA in January 1995. This subsection summarizes that assessment.

3.1.1 Inorganic Analyses

Two laboratories performed inorganic analyses over the course of 11 to 14 months. Statistical analyses indicate that no systematic differences were noted between the two laboratories. Inspection of quality control data indicate that analytical processes, especially for arsenic and selenium, were occasionally outside of EPA-defined limits. However, all results were accepted as valid.

3.1.2 Organic Analyses

Four laboratories performed organic analyses over the course of a year. No systematic differences were noted between laboratories. Anomalies that occurred are detailed in Subsection 3.1.3 of RFI report LA-UR-95-882. Inspection of quality control data indicates that individual surrogates and quality control analytes in blind samples were occasionally outside of EPA-defined limits. However, all results were accepted as valid.

3.1.3 Radiochemical Analyses

No systematic differences were noted among three laboratories performing radiochemical analyses. QA/QC data indicate that recoveries in duplicates and blinds were generally satisfactory. Cesium-137 recoveries were occasionally from 25 to 45% high. Uranium and plutonium recoveries from blind samples were satisfactory. Tritium recoveries from control samples were often low, sometimes high, possibly tritium was present in QC samples near its detection limit. Anomalies that occurred are detailed in Subsection 3.1.4 of RFI Report LA-UR-95-882.

3.1.4 High Explosives Analyses

Two laboratories analyzed high explosives (HE) samples. Holding times were met for all samples. Blank QC samples were all in control. No spiked or blind samples were analyzed.

3.1.5 Quality Assessment Samples

The following field QA samples were collected for the purpose of assessing the entire collection and analysis procedures.

- Seventeen soil field banks: uncharacterized, homogenized soil from an off site location, about a mile west of TA-33 near the entrance to Bandelier National Monument
- Seven rinsate blanks to assess decontamination procedures of equipment
- Thirty-two samples split in the field after collection
- Sixteen collocated samples, each within one foot of another sample

The following section summarizes QA assessment associated with PRSs included in this RFI report.

Field blank samples One of the soil field blank samples, sample AAA2188, appeared to be contaminated with silver (7 mg/kg), cadmium (6.6 mg/kg), and chromium (46 mg/kg). These observations are all well above background values. Sample AAA2188 was analyzed for the standard inorganics suite together with approximate 20 other samples included in Report 21424. This report includes sample AAA2035, a sample from PRS 33-013 with high levels of silver (10 mg/kg), cadmium (620 mg/kg) and chromium (670 mg/kg). Also included in this report is grid sample AAA2099 with silver at 4.6 mg/kg, cadmium at 5.2 mg/kg and chromium at 35 mg/kg. Other samples in this batch appear to be unaffected. However, the inorganics results for field blank samples AAA2099 and AAA2188 are considered unusable, because this unusual pattern may be the result of cross contamination or a measurement process out of control. Other evidence from an associated quality control blank sample suggests a laboratory rather than a field problem. The inorganics results for sample AAA2035 from SWMU 33-013 are suspect, but possibly real. PRS 33-013 is a former storage site behind TA-33-86 (Subsection 4.6 of this RFI report). Two other samples from this site showed only background-level inorganics. Phase II investigations are planned for this area to see if the high observations can be replicated and to determine the extent of contamination.

The only organics positively identified in field blanks were bis(2-ethylhexyl)phthalate (at 0.36 mg/kg in sample AAA2240) and di-n-butyl phthalate (at 3.2 mg/kg in sample AAA2248 and 3.6 mg/kg in sample AAA2249). Organic compounds were tentatively identified in 10 of the 17 field blanks. These field blanks were sent to external laboratories for semivolatile analysis; the LANL organics laboratory does not report tentatively identified compounds (TICs). The possibility of some cross contamination is indicated, but not strongly. It is more likely that the TICs represent background levels of organic compounds.

Rinsate samples These samples were collected for the purpose of assessing procedures used to decontaminate equipment, such as an auger, that was to be reused during the sampling campaign. The only organic compound reported in any rinsate blank was 4-hydroxy-4-methyl-2-pentanone, tentatively identified at 11 µg/L in sample AAA2198. The same compound was tentatively identified at 14 mg/kg in sample AAA2063, a sample from the SWMU 33-017 drainages to the east of Main Site that was included in the same batch of samples. Sample AAA2063 was a surface sample that was not collected with an auger, so its presence in the rinsate blank does not indicate a problem with the decontamination procedure.

Some inorganics (barium, nickel, lead, selenium, and zinc) and radionuclides (plutonium and uranium) were reported in the remaining rinsate blanks. Generally, these reported values are barely above detection level, and the associated uncertainty estimate is unrealistically small. Possible exceptions are:

- Plutonium-238 was detected at 0.035 pCi/L in sample AAA2208, a rinsate sample from the coliwasa tube used to collect sample AAA1915 from the 33-002(a) septic tank and samples AAA2040 and AAA2041 from the 33-016 sump. The septic tank sample had a trace (0.013 pCi/L) of plutonium-238. The 33-016 field samples were not analyzed for plutonium, which was not a contaminant of potential concern at this sump. No explanation can be made for this anomaly.

- Lead (4.5 µg/L) and zinc (170 µg/L) were detected in sample AAA6870, a rinsate sample associated with field samples from SWMU 33-011(d). Two samples, AAA6866 and AAA6867, a pavement sample and a soil sample from beneath the asphalt, had high concentrations of lead and zinc. It is possible that decontamination of the pick used to excavate through the asphalt was incomplete.

With the possible exception of the last rinsate sample, these results indicate no significant problem with the decontamination procedures used at TA-33.

Collocated and split samples Sampling and analysis results include 16 pairs of collocated samples, 42 independent pairs of samples from 32 locations, and 45 samples for which the laboratory measurements were replicated for some analytes. The most significant replicability discrepancies were observed between field duplicates (either splits or laboratory samples) and in reported laboratory uncertainties reported for tritium. Reported uncertainty in this case underestimates the replicability of the measurement process. For other radionuclides, the uncertainty appears to represent approximately "two sigma," although uranium data indicate that the measurement process is much better than the reported uncertainties suggest.

Table 3-1 summarizes the observed replicability of QA/QC analytes specific to the 1993 sampling season at TA-33 (columns 2, 3 and 4) and compares the estimates to the uncertainty claimed by the analytical laboratories (column 5).

TABLE 3-1

ESTIMATES OF REPLICABILITY OF MEASUREMENTS OF RADIONUCLIDES AND INORGANICS IN SOIL SAMPLES

ANALYTE	BETWEEN COLLOCATED SAMPLES	BETWEEN SPLITS OF ONE SAMPLE	BETWEEN LABORATORY REPLICATES	TYPICAL REPORTED UNCERTAINTY
Arsenic	4%	4%	2%	20%
Barium	3%	<1%	<0.1%	10%
Beryllium	7%	1%	1%	10%
Cadmium	7%	4%	a	20%
Cesium-137	13%	13%	5%	30%
Chromium	7%	2%	<1%	10%
Lead	9%	5%	<1%	20%
Nickel	29%	11%	8%	13%
Plutonium-238	65%	25%	20%	65%
Plutonium-239	50%	22%	3%	30%
Tritium	30%	30%	a	1%
Uranium	3%	1%	a	20%
Zinc	6%	1%	<1%	10%

[a] Insufficient data.

3.2 Screening Assessment Methodology

3.2.1 Background Comparison

For Main Site and Area 6, samples were collected to calculate background ranges of inorganics and radionuclides. RFI report LA-UR-95-882 contains a detailed analysis of these background data and compares them to LANL-wide background ranges. Comparing both local and LANL background ranges with results of analyses at individual PRSs identifies areas that may have received releases from past LANL activities at TA-33. The values are then compared with screening action levels (SALs) to estimate hazards that may be present.

Table 3-2 presents a comparison of local background concentrations with the LANL-wide framework studies concentrations (Longmire et al in preparation, 1142). TA-33 grid data and background results from cinder cone samples at Area 6 were combined to calculate the local background concentrations(LANL 1995, 1212). Results are compared both with respect to the data ranges (minimum and maximum observations), and with respect to estimated upper tolerance limits (99%, 0.95 UTLs). As indicated in the third column of the table, calculations were performed on the logarithms of the data for several analytes.

Table 3-3 compares radionuclide data from the TA-33 grid with the surveillance data from perimeter stations around LANL. Results are compared both with respect to the data ranges (minimum and maximum observations), and with respect to estimated upper tolerance limits.

3.2.2 Screening Action Levels Comparison

All analytical results relevant to each PRS, by nature of their locations within the PRS or receiving runoff from the PRS, were compared to their respective SALs. PRSs with sampling points failing this test received further evaluation in the form of a preliminary risk assessment or the proposal of EC, VCA, or a Phase II sampling and analysis plan. Sampling points with more than one constituent above background but below SALs were subject to multiple constituent analysis. A detailed discussion of the use of screening methods is found in Appendix J of the IWP (LANL 1993, 1017).

TABLE 3-2

RANGE (EXCLUDING OUTLIERS) AND UPPER TOLERANCE LIMITS FOR INORGANICS IN SOIL SAMPLES

ANALYTE	LOG?	FRAMEWORK DATA			TA-33 LOCAL BACKGROUND		
		MIN (mg/kg)	MAX (mg/kg)	UTL[a] (99%,0.95) (mg/kg)	MIN (mg/kg)	MAX (mg/kg)	UTL (99%,0.95) (mg/kg)
Antimony	NA[b]	<5	<5	2.5 (MAX)	<0.02	0.27	NC[c]
Arsenic	No	0.7	11.2	11.6	1	3.6	4.36
Barium	Yes	27	730	1 140	31	260	268
Beryllium	No	0.31	4	3.31	0.31	1.4	1.51
Cadmium	NA[b]	<0.4	2.7	2.7 (MAX)	<0.4	2.7	NC[c]
Chromium	Yes	1.9	37	34.2	3.4	19	20.7
Lead	No	<4	38	39	7	28	39[d]
Nickel	No	<2	19	26.7	<2	32	17.0[e]
Selenium	NA[b]	<0.6	1.7	1.7 (MAX)	<0.6	1.39	NC[c]
Uranium	Yes	<0.2	2.4	2.82	1.8	5	4.84
Zinc	No	14	120	101	16	76	62.3

[a] UTL = Upper tolerance limit.
[b] These data sets have too many below-detection-level observations to calculate background UTLs.
[c] NC = Not calculated.
[d] The distribution of lead on the grid was too nonnormal to obtain a reliable background UTL. However, the upper tail of the local background data (excluding outliers) is very similar to that of the framework studies data; so the framework background UTL of 39 mg/kg may be used.
[e] Nickel in cinder cone samples is significantly different from nickel in either the background data or on the general grid. A reasonable background UTL for the grid is 17 mg/kg. A more representative background UTL for the combined distribution is 33.4 mg/kg, based on log transformed data.

TABLE 3-3

RANGE (EXCLUDING OUTLIERS) AND UPPER TOLERANCE LIMITS FOR RADIONUCLIDES IN SOIL SAMPLES

ANALYTE	LOG?	SURVEILLANCE DATA			TA-33 GRID DATA		
		MIN (pCi/g)	MAX (pCi/g)	UTL[a] (99%,0.95) (pCi/g)	MIN (pCi/g)	MAX (pCi/g)	UTL (99%,0.95) (pCi/g)
Cesium-137	No	<0.01	1.4	1.5	<1	2.61	2.75
Plutonium-238	No	<0.001	0.140	NN[b]	0.001	0.008	0.0074
Plutonium-239	No	<0.001	0.052	0.025	0.003	0.174	0.058
Tritium	Yes	NA[c]	NA	NA	0.08	43.6	23.2

[a] UTL = Upper tolerance limit.
[b] The distribution of plutonium-238 is too nonnormal to obtain a reliable background UTL. Surveillance plutonium-238 data has more undetected Plutonium-238 than the TA-33 grid data, but the ranges are comparable.
[c] Tritium is not available in pCi/g in the surveillance data (only pCi/ml are given). In terms of pCi/ml, about half of the TA-33 grid observations are above the surveillance maximum of 13 pCi/ml.

3.2.3 Ecotoxicological Screening Assessment Methodology

Ecotoxicological risk assessment is a method of determining effects of hazardous activities on the environment. Several legislative acts provide directives for including ecotoxicological risk assessment to estimate environmental impacts of a number of practices, including releases of hazardous wastes. The directives were formulated to protect the environment and human health, to ensure compliance with state and federal environmental regulations, and to provide a means of recovering damage to natural resources caused by release of hazardous materials. As a result of environmental legislation, the EPA developed guidelines for ecotoxicological risk assessment (EPA, 1992, 0989). The methods for ecotoxicological risk assessment are presently evolving.

Although LANL is addressing management and possible remediation of hazardous wastes under RCRA and a HSWA permit, the LANL ER Project is also currently developing methods for incorporating ecotoxicological assessment. This activity is being undertaken in consultation with EPA and will result in ER guidance documents for ecotoxicological risk assessments. The TA-33 assessment team considered ecotoxicological risk assessment in a manner that was consistent with evolving ER Project and EPA guidance. A review of Main Site and Area 6 by a LANL ecologist indicated that no critical habitat exists in that area. It is unlikely that significant risk is associated with the PRSs discussed in this report.

3.3 Risk Assessment Methodology

The first step of risk assessment methodology is hazard identification. Other steps include assessing the potential for human exposure to contamination, assessing the toxicity of contaminants of concern, and characterizing the site-specific risk to human health. A complete discussion of risk assessment at LANL is described in Appendix K of the IWP (LANL 1993, 1017).

In evaluating the results of the 1993 RFI sampling at TA-33, measured concentrations were compared directly with LANL and TA-33 background UTLs and with media-specific SALs. A complete discussion of the assumptions used in developing SALs can be found in Appendix J

of the IWP (LANL 1993, 1017). SALs provide estimates of environmental concentrations that could affect human health under chronic exposure scenarios. These levels of concern are adjusted downward when more than one contaminant is present close to its SAL. Comparisons with background are used for a small number of constituents (e.g., arsenic and beryllium in soil) for which the calculated SALs are below natural background levels.

3.4 Development of Conclusions and Recommendations

The RFI work plan technical approach was based on a phased effort using reconnaissance (biased) sampling to detect contamination, if present. Conclusions and recommendations in this RFI report are based on sampling and analysis results specified in the RFI work plan. After all results were assembled for a PRS, each sampling point and its data were examined as to appropriateness for the decisions being made for that PRS. Analytical results were compared to TA-33 and LANL background UTLs and to SALs. Recommendations were developed following procedures described in Appendix I of the IWP (LANL 1993, 1017). At many PRSs discussed in this report, contamination above SALs failed a preliminary risk assessment. These PRSs are proposed for either cleanup or Phase II sampling to determine extent of contamination as input for a risk assessment. A brief cleanup proposal or Phase II sampling and analysis plan is included in each discussion. Cleanup plans will be submitted to EPA in accordance with ER Project directives.

4.0 SITE-SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

Assessment of 1993 Phase I sampling and analysis data identified seven PRSs in which hazardous materials were observed above SALs. Contaminants included VOCs, semivolatile organic compounds (SVOCs), lead, and uranium. Data and evaluation for these PRSs are presented in this section, together with recommendations of VCA, EC, or Phase II sampling. Information located after the RFI work plan was submitted leads to a recommendation of NFA for SWMU 33-003(a), chamber TA-33-4, at material disposal area (MDA D). The PRSs, together with known contaminants, are listed in Table 4-1.

TABLE 4-1

PRSs RECEIVING PHASE I EVALUATIONS IN THIS RFI REPORT

PRS[a]	ACTION	DESCRIPTION	CONTAMINANTS
33-003(a)	NFA[b]	Chamber at MDA D	No pathway for PCB[c] exposure
33-004(a)	Defer action	Active Main Site septic tank	SVOCs[d], VOCs[e] in sludge
33-004(a)	VCA[f]	Abandoned drain field	Lead, SVOCs in drain field
33-007(c)	EC[g]	Area 6 firing site	Uranium
33-009	Phase II	Area 6 surface disposal	PCBs, uncharacterized debris
33-011(d)	Phase II	Storage area, TA-33-20	Uranium, lead
33-013	Phase II	Storage, TA-33-86	Cadmium, chromium
33-016	VCA	TA-33-23 sump	SVOCs in sump sludge
33-017	Phase II	Vehicle maintenance area	SVOCs

[a] PRS= Potential release site.
[b] NFA = No further action.
[c] PCB = Polychlorinated biphenyls.
[d] SVOCs = Semivolatile organic compounds.
[e] VOCs = Volatile organic compounds.
[f] VCA = Voluntary corrective action.
[g] EC = Expedited cleanup.

All PRSs in this section were subject to the initial radiation survey prior to sampling as specified in the RFI Work Plan for OU 1122. In addition, each sample was individually screened at the time of collection as required by the OU 1122 site-specific health and safety plan. Radiation above background was detected at SWMU 33-011(d), described in section 4.4. No radiation was detected at any other site.

4.1 SWMU 33-003(a) Chamber TA-33-4 at MDA D

SWMU 33-003(a) is chamber TA-33-4 at MDA D in East Site. It is discussed in the RFI Work Plan for OU 1122, Subsections 3.5.2.1 and 4.5.3.1 (LANL 1992, 0784). Polychlorinated biphenyls (PCBs) may be present in the chamber. SWMU 33-003(a) is proposed for NFA based on the absence of exposure pathways.

Two chambers were constructed at MDA D in 1948. The chambers are 18 ft by 18 ft octagonal, vault-like structures 11 ft high. They are buried with the roof approximately 30 ft below grade. Access was through a 4 ft by 6 ft elevator shaft at the side of the chamber. The shaft was approximately 46 ft deep. The chambers were used for initiator tests involving milligram

quantities of beryllium. Polonium-210 (half-life 138 days) was used as a source of alpha particles. Chamber TA-33-4 was used once. No debris broke the surface and no radioactive contamination was detected following the test (Buckland 1948, 02-048).

MDA D is located at East Site. From the mid-1950s until 1989, chamber TA-33-4 was buried by the arm of a large berm. The overburden was removed by Weston personnel in 1989 in order to sample the chamber. The remaining surface indication of the chamber is an 8 by 12 ft concrete pad surrounded by chamisa bushes. The chamber lies in a slight depression approximately 25 ft north of the paved loop road at East Site.

4.1.1 Previous Investigation

In 1989 personnel from Roy F. Weston, Inc. drilled three boreholes at TA-33-4 (Fig. 4-1). Samples from the boreholes were analyzed for inorganics, radionuclides, and HE. One sample was analyzed for VOCs and SVOCs. Results are discussed in Subsection 4.1.3.1 of this RFI report.

In 1994 an archival search was conducted to determine the probable contents of the chambers, with emphasis on the composition of the neutron counters. The search revealed the following: steel, copper, and aluminum were present in kilogram amounts; lead from solder was probably present in gram amounts. The chamber contained capacitors which may have contained a total of 5 lb of PCBs at most. No shielding material (lead, cadmium, paraffin) was used. No scintillation fluids or uranium were used (Morgan 1994, 02-088). Beryllium was present in milligram amounts.

4.1.2 Field Investigation

No ER samples were taken directly relevant to the chamber.

4.1.3 Screening Assessment

4.1.3.1 Comparison to Background/SALs

Weston sample LAN33-0022-3, collected at 44 ft beside the chamber, contained 7.7 mg/kg uranium. No other analytes above LANL and TA-33 background UTLs were detected in the Weston boreholes.

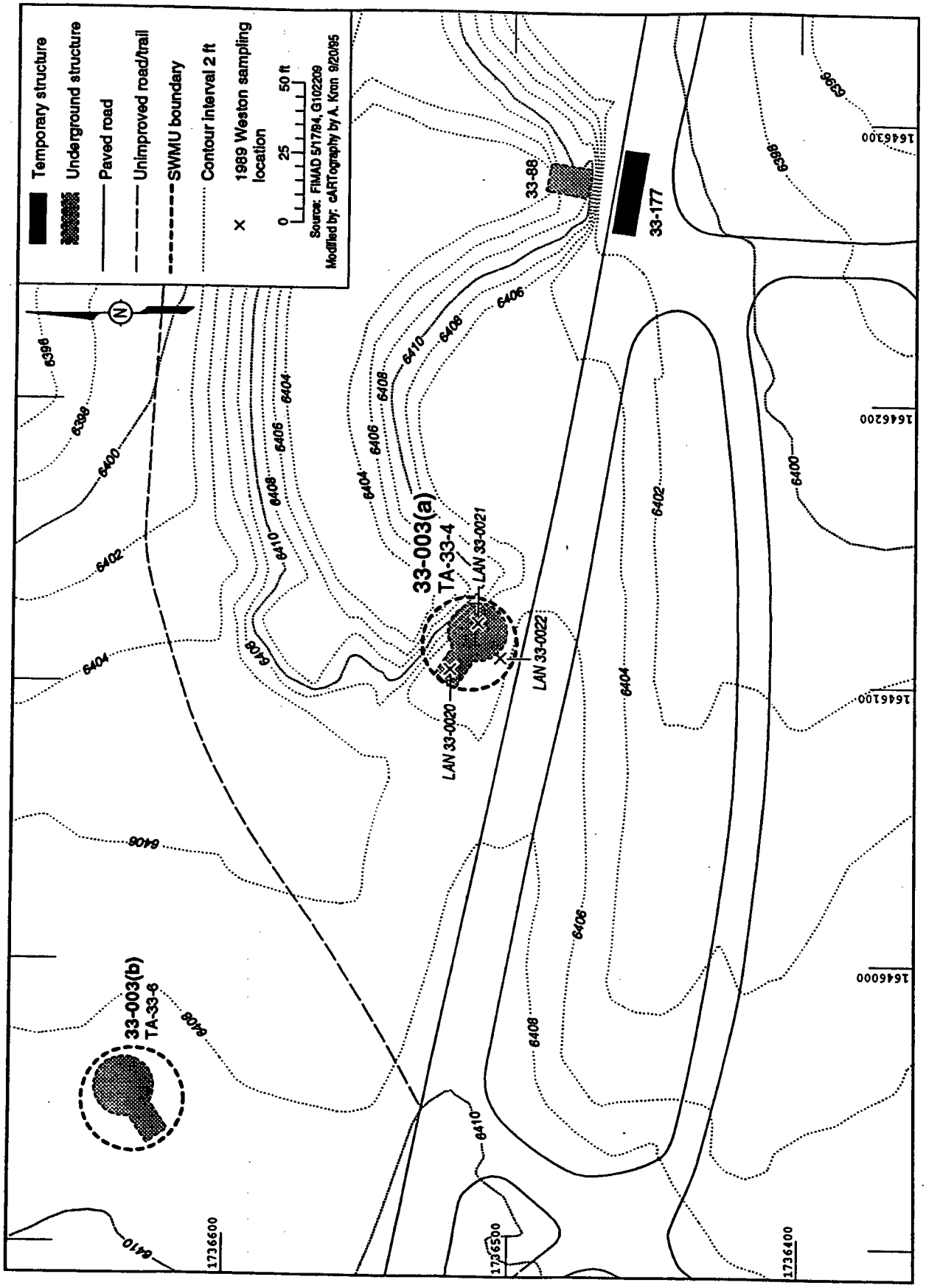


Fig. 4.1. SWMU 33-003(a), chamber TA-33-4 at MDA D.

4.1.3.2 Data Interpretation

Although Weston results have not undergone ER data validation, QA/QC documentation provided with the analyses indicate that the data are credible. No contamination was found near hazardous levels.

4.1.3.3 Risk Assessment

No risk assessment was performed for SWMU 33-003(a). The following is a discussion of pathway from the chamber to receptors.

The recommendation for NFA is based on the absence of any credible exposure pathways for humans to come in contact with contaminants in the chambers. The rationale for this recommendation is as follows:

An exposure pathway describes a unique mechanism by which an individual or population is exposed to chemicals or physical agents at, or originating from, a site. The following four elements must be present for an exposure pathway to exist.

- A source and mechanism of chemical release,
- A retention or transport medium (e.g., soil),
- A point of potential human contact with the contaminated medium (e.g., exposure point), and
- An exposure route (e.g., ingestion, inhalation, or dermal contact).

Material within the underground chambers is the source of contamination at the MDA D chamber and possibly the elevator shaft. Based upon documentation of experiments at MDA D, materials that may be present in the underground chambers include steel, copper, aluminum, PCBs, and zinc. Gram amounts of lead and sub-gram amounts of beryllium may be present. Trinitrotoluene (TNT) and its combustion products may also be present. PCBs from detector components may be present in the chambers in amounts estimated at a total less than 5 lb (Morgan 1994, 02-088). No research data on the generation of PCB detonation products have been found. Therefore, no statement can be made as to the form of PCB waste in the chamber.

There was no indication that chamber TA-33-4 was breached by the test shot (Buckland 1948, 02-048). Subsequent investigation of the identical chamber at MDA D, TA-33-6, indicated that it was intact after its first test shot (Blackwell 1952, 02-034). Therefore, it is reasonable to presume that the identically designed chamber TA-33-4 maintained its integrity.

Engineering drawing ENG-C 426 indicate that the chambers contain eight vent holes of 6-in. diameter at 3 ft above the bottom of the chamber. Consequently, there is potential for some small fraction of contaminants to escape the chamber. Considering the depth of the chamber (50 ft) and the tendency of PCBs to adsorb on clay particles or concrete, it is unlikely that PCBs or combustion products can migrate upward to a depth (12 ft below surface) where exposure to humans or the environment is feasible. Any undetonated PCBs remaining in chamber TA-33-4 are expected to be adsorbed on the concrete chamber walls, where they become immobile.

Engineering drawing ENG-C 427 indicates that a vent from the chambers extended to the surface. This surface was disturbed during building of the berms and further mixed when the chamber surface features were excavated for Weston sampling in 1989. It is reasonable to presume that any PCBs that may have escaped during detonation in the chamber have been mixed with soil so as to be undetectable.

4.1.3.4 Ecotoxicological Screening Assessment

A global ecotoxicological assessment is presented in Subsection 3.2.3 of this RFI report.

4.1.4 Conclusion and Recommendation

The potential for future migration of PCBs and other potential contaminants from the chamber is negligible because of the lack of a driving force to bring contaminants to the surface, the depth to groundwater (greater than 660 ft to the spring in Ancho Canyon), and the inaccessibility of material in the chambers to potential receptors. Because the floor of the chamber is approximately 50 ft below grade, contaminants are not accessible to LANL workers or visitors. A potential future construction scenario is unlikely to expose workers to chamber contamination because excavation would not occur at depths greater than 12 ft, the average depth of a typical basement. Using the same logic, a residential scenario would not result in exposure to contamination. For these reasons, the chamber is recommended for NFA under LANL ER NFA Criterion 2, "no release to the environment has occurred" (Environmental Restoration Project 1995, 1173).

4.2 SWMU 33-004(a) Main Site Septic System

SWMU 33-004(a) is an active septic system at Main Site. It is discussed in the RFI Work Plan for OU 1122, Subsections 3.2.2.3 and 4.2.3.1 (LANL 1992, 0784). VOCs and SVOCs were detected in sludge. Several SVOCs, including benzo[a]pyrene, were detected at trace levels in the sample taken adjacent to the tank at a depth of 3 to 5 ft. SVOCs and lead were detected in the abandoned drain field. Because the system is active, no remediation is proposed at this time.

The septic system serves all major buildings at Main Site except the tritium facility. The system consists of a 1 360 gal. septic tank, TA-33-31, associated drain lines, two seepage pits, and an abandoned drain field. The system was originally built for sanitary waste. Overflow from the septic tank was directed to a tiled drain field northeast of the tank. The system was redesigned in 1951 to accept industrial waste, primarily from laboratories in TA-33-19, TA-33-113, TA-33-114, and shop TA-33-39. Overflow was rerouted to two 50 ft-deep seepage pits and the drain field was abandoned. Potential contaminants from operations in these buildings over the years were inorganics, industrial solvents (VOCs), photochemical solutions, radionuclides, and SVOCs.

The septic tank lies east of the paved area near shops TA-33-39 and TA-33-113. It is located at the bank cut about 10 ft below the level of the pavement. The entire bank and area around the tank is covered by a dense thicket of chamisa. Below the tank is a channel leading through a densely vegetated area into a shallow tributary of Chaquehui Canyon. The tributary has eroded to bedrock. A National Pollutant Discharge Elimination System (NPDES) noncontact cooling water outfall, EPA-04A147, also drains into this channel. The seepage pits and abandoned drain field are northeast of the tank in a more level area. Lines connecting buildings to the septic tank criss-cross the entire Main Site paved area.

4.2.1 Previous Investigations

No previous investigations were conducted at this PRS.

4.2.2 Field Investigation

Of the samples taken for SWMU 33-004(a), one was sludge and two were liquid taken from the tank itself. Four samples were taken from a borehole drilled adjacent to the tank at 6 in. (in duplicate), 3 to 5 ft, and 13 to 15 ft depths. Boreholes were drilled to a depth of approximately 50 ft adjacent to each of the two seepage pits, and four samples were taken from each borehole. Four samples were collected at joints in the vitrified clay tiles of the abandoned drain field. The remaining samples, 7 surface and 2 subsurface, were taken at random locations in the drain field. Samples AAA2078 and AAA2079 from the sampling grid for SWMU 33-017 (operational releases) also fell within the drain field boundaries. Three other samples, also related to SWMU 33-017, were collected in the drainage below the septic tank, within 100 ft of the tank.

All samples were analyzed for inorganics, SVOCs, uranium, radionuclides by gamma spectroscopy, and tritium. Liquid, sludge, and all subsurface samples were also analyzed for VOCs. Five samples were also analyzed for herbicides, pesticides, and PCBs.

4.2.2.1 Results of Field Surveys

All sampling points were surveyed. No other field surveys were associated with SWMU 33-004(a).

4.2.2.2 Results of Field Screening

No radiation was detected during routine field screening of sampling locations at SWMU 33-004(a).

4.2.3 Screening Assessment

4.2.3.1 Comparison to Background/SALs

Fluid/sludge Inorganics and organic analytes were found in fluid and sludge samples. Table 4-2 lists inorganic analyte concentrations. Table 4-3 lists organic analytes detected. Although UTLs and SAL are not relevant to components of septic tanks, soil UTLs and SALs and drinking water SALs are listed here merely as points of reference.

TABLE 4-2

INORGANIC COMPOUNDS IN FLUID AND SLUDGE SAMPLES FROM SEPTIC TANK TA-33-31

ANALYTE	SAMPLE ID	DEPTH (in.)	MEDIUM	CONCEN-TRATION	LANL UTL[a]	TA-33 UTL	SAL[b]	UNITS
Arsenic	AAA1949	Tank	Sludge	3	11.6	4.4	None	mg/kg
Barium	AAA1948	Tank	Fluid	41	NA[c]	NA	2 000	µg/L
	AAA2232	Tank	Fluid	36	NA	NA	2 000	µg/L
	AAA1949	Tank	Sludge	271	1 140	268	5 600	mg/kg
Cadmium	AAA1949	Tank	Sludge	12.7	2.7	2.7	80	mg/kg
Chromium	AAA2232	Tank	Fluid	7.8	NA	NA	100	µg/L
	AAA1949	Tank	Sludge	50.6	34.3	20.7	400	mg/kg
Nickel	AAA1949	Tank	Sludge	26.8	26.7	17	1 600	mg/kg
Mercury	AAA1948	Tank	Fluid	0.21	NA	NA	2	µg/L
	AAA2232	Tank	Fluid	0.18	NA	NA	2	µg/L
Lead	AAA1948	Tank	Fluid	14.5	NA	NA	50	µg/L
	AAA2232	Tank	Fluid	14.5	NA	NA	50	µg/L
	AAA1949	Tank	Sludge	64.4	39	39	400	mg/kg
Silver	AAA1949	Tank	Sludge	9.2	ND[d]	NA	400	mg/kg
Uranium	AAA1948	Tank	Fluid	1	NA	NA	20	µg/L
	AAA2232	Tank	Fluid	1	NA	NA	20	µg/L
	AAA1949	Tank	Sludge	5	2.82	4.84	95	mg/kg
Zinc	AAA1948	Tank	Fluid	223	NA	NA	10 000	µg/L
	AAA2232	Tank	Fluid	209	NA	NA	10 000	µg/L
	AAA1949	Tank	Sludge	770	101	62.3	24 000	mg/kg

[a] Upper tolerance limit for soil.
[b] Screening action level for soil.
[c] NA = Not applicable.
[d] ND = Not determined.

TABLE 4-3

ORGANICS DETECTED IN FLUID AND SLUDGE SAMPLES FROM SEPTIC TANK TA-33-31

ANALYTE	SAMPLE ID	DEPTH	MEDIUM	RESULT	SAL[a]	EQL[b]	UNIT
Benzo[a]anthracene	AAA1949	Tank	Sludge	*28*	*0.64*	*0.33*	mg/kg
Benzo[a]pyrene	AAA1949	Tank	Sludge	*28*	*0.1*	*0.33*	mg/kg
Benzo[b]fluoranthene	AAA1949	Tank	Sludge	*24*	*0.7*	*0.33*	mg/kg
Benzo[g,h,i]perylene	AAA1949	Tank	Sludge	20	*44*	*0.33*	mg/kg
Benzo[k]fluoranthene	AAA1949	Tank	Sludge	*23*	*1.5*	*0.33*	mg/kg
Bis(2-ethylhexyl)phthalate	AAA2232	Tank	Fluid	*11*	*4*	*0.33*	µg/L
Bis(2-ethylhexyl)phthalate	AAA1949	Tank	Sludge	*1500*	*50*	*0.33*	mg/kg
Butanone [2-]	AAA1949	Tank	Sludge	1.6	*4 000*	*0.02*	mg/kg
Butyl benzyl phthalate	AAA1949	Tank	Sludge	26	*16 000*	*0.33*	mg/kg
Butylbenzene [n-]	AAA1949	Tank	Sludge	0.7	*NC[c]*	*0.005*	mg/kg
Butylbenzene [sec-]	AAA1949	Tank	Sludge	0.62	*NC*	*0.005*	mg/kg
Butylbenzene [tert-]	AAA1949	Tank	Sludge	0.85	*NC*	*0.005*	mg/kg
Carbon disulfide	AAA1949	Tank	Sludge	0.24	*7.4*	*0.005*	mg/kg
Chloroform	AAA1948	Tank	Fluid	9.1	*100*	*0.005*	µg/L
Chloroform	AAA2232	Tank	Fluid	8.6	*100*	*0.005*	µg/L
Chloroform	AAA1949	Tank	Sludge	*5.1*	*0.21*	*0.005*	mg/kg
Chrysene	AAA1949	Tank	Sludge	*36*	*22*	*0.33*	mg/kg
Di-n-butyl phthalate	AAA1949	Tank	Sludge	48	*8 000*	*0.33*	mg/kg
Di-n-octyl phthalate	AAA1949	Tank	Sludge	10	*1 600*	*0.33*	mg/kg
Dichlorobenzene (1,4) [p-]	AAA1949	Tank	Sludge	5.3	*290*	*0.005*	mg/kg
Dichloroethane [1,1-]	AAA1949	Tank	Sludge	3.9	*410*	*0.005*	mg/kg
Ethylbenzene	AAA1949	Tank	Sludge	1.9	*3 100*	*0.005*	mg/kg
Fluoranthene	AAA1949	Tank	Sludge	42	*3 200*	*0.33*	mg/kg
Indeno[1,2,3-cd]pyrene	AAA1949	Tank	Sludge	*18*	*0.41*	*0.33*	mg/kg
Isopropylbenzene	AAA1949	Tank	Sludge	0.73	*NC*	*0.005*	mg/kg
Isopropyltoluene [4-]	AAA1949	Tank	Sludge	1.8	*NC*	*0.005*	mg/kg
Methylene chloride	AAA1949	Tank	Sludge	0.51	*5.6*	*0.005*	mg/kg
Methylphenol [4-]	AAA1948	Tank	Fluid	*210*	*175*	*0.33*	µg/L
Methylphenol [4-]	AAA2232	Tank	Fluid	*240*	*175*	*0.33*	µg/L
Methylphenol [4-]	AAA1949	Tank	Sludge	*600*	*400*	*0.33*	mg/kg
Phenanthrene	AAA1949	Tank	Sludge	37	*NC*	*0.33*	mg/kg
Phenol	AAA1948	Tank	Fluid	20	*21 000*	*0.33*	µg/L
Phenol	AAA2232	Tank	Fluid	27	*21 000*	*0.33*	µg/L
Propylbenzene	AAA1949	Tank	Sludge	2.4	*NC*	*0.005*	mg/kg
Pyrene	AAA1949	Tank	Sludge	47	*2 400*	*0.33*	mg/kg
Tetrachloroethane [1,1,2,2-]	AAA1949	Tank	Sludge	0.76	*3.9*	*0.005*	mg/kg
Tetrachloroethylene	AAA1949	Tank	Sludge	0.51	*5.9*	*0.005*	mg/kg
Toluene	AAA1948	Tank	Fluid	30	*1 000*	*0.005*	µg/L
Toluene	AAA2232	Tank	Fluid	20	*1 000*	*0.005*	µg/L
Toluene	AAA1949	Tank	Sludge	32.8	*890*	*0.005*	mg/kg
Trichloro-1,2,2-trifluoroethane [1,1,2-]	AAA1949	Tank	Sludge	80.4	*NC*	*0.005*	mg/kg
Trichloroethane [1,1,1-]	AAA1949	Tank	Sludge	78.6	*1 000*	*0.005*	mg/kg
Trichloroethene	AAA1949	Tank	Sludge	*91.2*	*3.2*	*0.005*	mg/kg
Trimethylbenzene [1,2,4-]	AAA1949	Tank	Sludge	2.7	*NC*	*0.005*	mg/kg
Xylenes (o + m + p) [mixed-]	AAA1949	Tank	Sludge	1.8	*160 000*	*0.005*	mg/kg

[a] SAL = Screening action level.
[b] EQL = Estimated quantitation limit.
[c] NC = Not calculated due to insufficient toxicity data.

Borehole In the borehole drilled next to the septic tank, organics were found at the 3 to 5 ft level. Uranium (5.2 mg/kg) was detected slightly above TA-33 background UTL in sample AAA1952. These analytes are listed in Table 4-4.

TABLE 4-4

ANALYTES DETECTED IN THE BOREHOLE ADJACENT TO THE SEPTIC TANK

ANALYTE	SAMPLE ID	DEPTH (in)	MEDIUM	RESULT (mg/kg)	SAL[a] (mg/kg)	EQL[b] (mg/kg)
Benzo[a]anthracene	AAA1952	36-60	Soil	0.41	*1*	*0.33*
Benzo[a]pyrene	AAA1952	36-60	Soil	*0.41*	*0.1*	*0.33*
Benzo[k]fluoranthene	AAA1952	36-60	Soil	0.4	*1*	*0.33*
Chrysene	AAA1952	36-60	Soil	0.45	*96*	*0.33*
Di-n-butyl phthalate	AAA1951	0-6	Soil	0.52	*8 000*	*0.33*
Di-n-butyl phthalate	AAA2242	0-6	Soil	0.47	*8 000*	*0.33*
Di-n-butyl phthalate	AAA1952	36-60	Soil	0.53	*8 000*	*0.33*
Fluoranthene	AAA1952	36-60	Soil	0.89	*3 200*	*0.33*
Phenanthrene	AAA1952	36-60	Soil	0.7	*NC[c]*	*0.33*
Pyrene	AAA1952	36-60	Soil	0.83	*2 400*	*0.33*
Uranium	AAA1952	36-60	Soil	5.2	*95*	*1.4*

[a] SAL = Screening action level.
[b] EQL = Estimated quantitation limit.
[c] NC = Not calculated due to insufficient toxicity data.

Seepage pits The seepage pits could not be sampled directly as called for in Subsection 4.2.4 of the RFI Work Plan for OU 1122 (LANL 1992, 0784) because the pits were filled with large stones. Instead, 50-ft boreholes were drilled as close as feasible to each pit to assess possible contaminant migration. No contaminants were found above background UTLs in samples from these boreholes except di-n-butylphthalate in sample AAA1967, which was also found in the laboratory blanks, suggesting laboratory contamination of the samples.

Drain field Polycyclic aromatic hydrocarbons (PAHs) were found well above SAL. These are listed in Table 4-5. Inorganics detected above LANL and TA-33 background UTLs in the drain field are listed in Table 4-6.

TABLE 4-5

ORGANICS FOUND ABOVE LANL AND TA-33 BACKGROUND UTLs IN THE DRAIN FIELD AT SWMU 33-004(a)

ANALYTE	SAMPLE ID	DEPTH (in)	MEDIUM	RESULT (mg/kg)	SAL[a] (mg/kg)	EQL[b] (mg/kg)
Acenaphthene	AAA9366	36	Soil	0.61	*4 800*	*Not listed*
Acenaphthylene	AAA9362	42	Soil	2.6	*NC*[c]	*0.33*
Acenaphthylene	AAA9364	36	Soil	1.4	*NC*	*0.33*
Acenaphthylene	AAA9366	36	Soil	7.7	*NC*	*0.33*
Acenaphthylene	AAA9368	24	Soil	0.68	*NC*	*0.33*
Anthracene	AAA9362	42	Soil	5.4	*24 000*	*0.33*
Anthracene	AAA9364	36	Soil	2.3	*24 000*	*0.33*
Anthracene	AAA9366	36	Soil	15	*24 000*	*0.33*
Anthracene	AAA9368	24	Soil	1.3	*24 000*	*0.33*
Benzo[a]anthracene	AAA9362	42	Soil	19	*1*	*0.33*
Benzo[a]anthracene	AAA9364	36	Soil	9.8	*1*	*0.33*
Benzo[a]anthracene	AAA9366	36	Soil	64	*1*	*0.33*
Benzo[a]anthracene	AAA9368	24	Soil	5.4	*1*	*0.33*
Benzo[a]pyrene	AAA9362	42	Soil	13	*0.1*	*0.33*
Benzo[a]pyrene	AAA9364	36	Soil	8.2	*0.1*	*0.33*
Benzo[a]pyrene	AAA9366	36	Soil	56	*0.1*	*0.33*
Benzo[a]pyrene	AAA9368	24	Soil	4.7	*0.1*	*0.33*
Benzo[b]fluoranthene	AAA9362	42	Soil	15	*1*	*0.33*
Benzo[b]fluoranthene	AAA9364	36	Soil	6.6	*1*	*0.33*
Benzo[b]fluoranthene	AAA9366	36	Soil	43	*1*	*0.33*
Benzo[b]fluoranthene	AAA9368	24	Soil	3.7	*1*	*0.33*
Benzo[g,h,i]perylene	AAA9362	42	Soil	2.8	*NC*	*0.33*
Benzo[g,h,i]perylene	AAA9364	36	Soil	2.5	*NC*	*0.33*
Benzo[g,h,i]perylene	AAA9366	36	Soil	4.3	*NC*	*0.33*
Benzo[g,h,i]perylene	AAA9368	24	Soil	2.1	*NC*	*0.33*
Benzo[k]fluoranthene	AAA9362	42	Soil	12	*1*	*0.33*
Benzo[k]fluoranthene	AAA9364	36	Soil	7.1	*1*	*0.33*
Benzo[k]fluoranthene	AAA9366	36	Soil	47	*1*	*0.33*
Benzo[k]fluoranthene	AAA9368	24	Soil	4.8	*1*	*0.33*
Bis(2-ethylhexyl)phthalate	AAA9362	42	Soil	2.6	*50*	*0.33*
Bis(2-ethylhexyl)phthalate	AAA9364	36	Soil	0.48	*50*	*0.33*
Bis(2-ethylhexyl)phthalate	AAA9366	36	Soil	1.8	*50*	*0.33*
Bis(2-ethylhexyl)phthalate	AAA9368	24	Soil	0.97	*50*	*0.33*
Chrysene	AAA9362	42	Soil	14	*96*	*0.33*
Chrysene	AAA9364	36	Soil	7.5	*96*	*0.33*
Chrysene	AAA9366	36	Soil	58	*96*	*0.33*
Chrysene	AAA9368	24	Soil	5.1	*96*	*0.33*
Di-n-butyl phthalate	AAA9362	42	Soil	1.3	*8 000*	*0.33*
Di-n-butyl phthalate	AAA9366	36	Soil	0.72	*8 000*	*0.33*
Di-n-butyl phthalate	AAA9368	24	Soil	0.44	*8 000*	*0.33*

TABLE 4-5 (CONTINUED)

INORGANICS FOUND ABOVE LANL AND TA-33 BACKGROUND UTLs IN THE DRAIN FIELD AT SWMU 33-004(a)

ANALYTE	SAMPLE ID	DEPTH (in)	MEDIUM	RESULT (mg/kg)	SAL[a] (mg/kg)	EQL[b] (mg/kg)
Dibenzo[a,h]anthracene	AAA9362	42	Soil	1.4	0.1	0.33
Dibenzo[a,h]anthracene	AAA9364	36	Soil	1.4	0.1	0.33
Dibenzo[a,h]anthracene	AAA9366	36	Soil	2.6	0.1	0.33
Dibenzo[a,h]anthracene	AAA9368	24	Soil	1.1	0.1	0.33
Fluoranthene	AAA9362	42	Soil	37	3 200	0.33
Fluoranthene	AAA9364	36	Soil	20	3 200	0.33
Fluoranthene	AAA9366	36	Soil	120	3 200	0.33
Fluoranthene	AAA9368	24	Soil	9.7	3 200	0.33
Fluorene	AAA9362	42	Soil	1.1	3 200	0.33
Fluorene	AAA9366	36	Soil	0.4	3 200	0.33
Fluorene	AAA9368	24	Soil	2.2	3 200	0.33
Indeno[1,2,3-cd]pyrene	AAA9362	42	Soil	4.5	1	0.33
Indeno[1,2,3-cd]pyrene	AAA9364	36	Soil	3.9	1	0.33
Indeno[1,2,3-cd]pyrene	AAA9366	36	Soil	56	1	0.33
Indeno[1,2,3-cd]pyrene	AAA9368	24	Soil	3.2	1	0.33
Phenanthrene	AAA9362	42	Soil	8.6	NC	0.33
Phenanthrene	AAA9364	36	Soil	3.7	NC	0.33
Phenanthrene	AAA9366	36	Soil	25	NC	0.33
Phenanthrene	AAA9368	24	Soil	2.3	NC	0.33
Pyrene	AAA9362	42	Soil	31	2 400	0.33
Pyrene	AAA9364	36	Soil	17	2 400	0.33
Pyrene	AAA9366	36	Soil	100	2 400	0.33
Pyrene	AAA9368	24	Soil	8.1	2 400	0.33

[a] UTL = Upper tolerance limit.
[b] SAL = Screening action level.
[c] NA = Not available.
[d] ND = Not determined.

TABLE 4-6

INORGANICS DETECTED IN THE DRAIN FIELD AT SWMU 33-004(a)

ANALYTE	SAMPLE ID	DEPTH (ft)	MEDIUM	CONCEN-TRATION (mg/kg)	LANL UTL[a] (mg/kg)	TA-33 UTL (mg/kg)	SAL[b] (mg/kg)
Chromium	AAA9362	3.5	Soil	38.5	34.3	20.7	400
	AAA9368	2	Soil	40.7	34.3	20.7	400
Mercury	AAA9362	3.5	Soil	0.5	0.1	NA[c]	24
	AAA9364	3	Soil	0.86	0.1	NA	24
	AAA9366	3	Soil	0.5	0.1	NA	24
	AAA9368	2	Soil	1.4	0.1	NA	24
Lead	AAA9362	3.5	Soil	68	39	39	400
	AAA9364	3	Soil	59	39	39	400
	AAA9366	3	Soil	54	39	39	400
	AAA9362	3.5	Soil	467	39	39	400
Silver	AAA9362	3.5	Soil	10.3	ND[d]	ND	400
	AAA9364	3	Soil	8.3	ND	ND	400
	AAA9366	3	Soil	2.8	ND	ND	400
	AAA9362	3.5	Soil	15.4	ND	ND	400
Uranium	AAA9362	3.5	Soil	5	2.8	4.8	95
Zinc	AAA9362	3.5	Soil	146	101	62.3	24 000
	AAA9364	3	Soil	111	101	62.3	24 000
	AAA9368	2	Soil	226	101	62.3	24 000

[a] Upper tolerance limit.
[b] Screening action level.
[c] Not determined.

Drainage Inorganics detected above background in the three drainage samples are listed in Table 4-7. No organics were detected in these samples.

Low levels of tritium were found in all samples, all well below the soil SAL of 810 pCi/g. TICs were noted in 17 of the 36 samples. PCBs were listed as TICs in several surface samples. Analytical results as well as physical indications noted during sampling at the septic tank indicated that the tank or associated structures are leaking. All sampling points are shown in Fig. 4-2.

TABLE 4-7

INORGANIC CONTAMINANTS FOUND ABOVE LANL AND TA-33 BACKGROUND UTLs IN THE DRAINAGE AT SWMU 33-004(a)

ANALYTE	SAMPLE ID	DEPTH (In.)	MEDIUM	CONCEN-TRATION	LANL UTL[a] (mg/kg)	TA-33 UTL (mg/kg)	SAL[b] (mg/kg)
Nickel	AAA2052	0-6	Soil	87	26.7	17	1 600
	AAA2053	0-6	Soil	35	26.7	17	1 600
Lead	AAA2052	0-6	Soil	46	39	39	400
	AAA2053	0-6	Soil	98	39	39	400
Silver	AAA2053	0-6	Soil	8.8	ND[c]	ND	400
	AAA2054	0-6	Soil	46	ND	ND	400
Zinc	AAA2053	0-6	Soil	330	101	62.3	24 000
	AAA2054	0-6	Soil	350	101	62.3	24 000

[a] UTL = Upper tolerance limit.
[b] SAL = Screening action level.
[c] ND = Not determined.

4.2.3.2 Data Interpretation

Results of sampling and analysis indicate that the septic tank has received hazardous effluent in the form of organics. High concentrations of bis(2-ethylhexyl)phthalate (1 500 mg/kg) may be due to plastics in the sample or may be indication of plasticizing operations at Main Site at some time. PAHs in the sludge may come from several sources, including asphalt caulking.

PAH contamination in the drain field is due to tar paper used in construction, shown in engineering drawing ENG-C 11641. Although results from boreholes adjacent to the seepage pits do not indicate the spread of contamination, the contents of the pits could not be sampled, nor was the possibility of a plume beneath the pits explored.

4.2.3.3 Risk Assessment

No risk assessment was performed for this PRS.

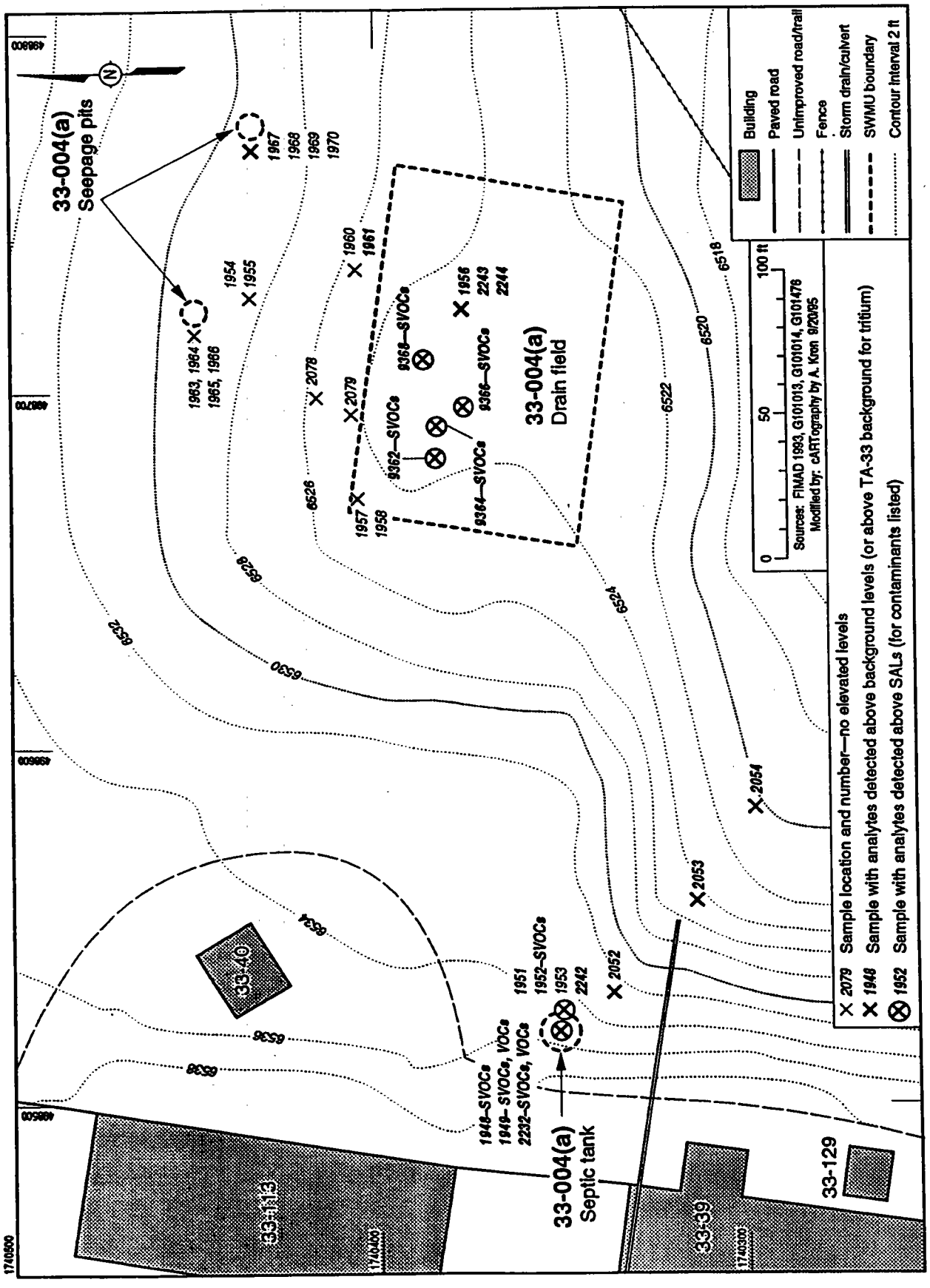


Fig. 4-2. Main Site: SWMU 33-004(a), septic system.

4.2.3.4 Ecotoxicological Screening Assessment

A global ecotoxicological assessment is presented in Subsection 3.2.3 of this RFI report.

4.2.4 Conclusion and Recommendation

The septic system is active and is expected to remain so for the foreseeable future because TA-33 sanitary waste streams will not be routed to the LANL sewage treatment plant. Most of the contamination is concentrated in the sludge, although low levels of SVOCs may be migrating from the tank. Physical evidence indicates that the tank is leaking. The leaking septic tank was reported to Johnson Controls, Inc. and the TA-33 operating group in 1994. Because the septic system is active and PAHs in the drain field have no viable pathway to receptors, no additional action is proposed until decommissioning.

PCBs were detected in surface samples from the drain field. These will be investigated in conjunction with Phase I sampling for C-33-001 discussed in Subsection 5.4 of this report.

4.3 SWMU 33-007(c) Firing Site Catcherboxes

SWMU 33-007(c) is the firing site at Area 6. The SWMU was discussed at length in RFI Report LA-UR-95-882, Subsection 4.11 submitted in January 1995 (LANL 1995, 1212). During 1994 trenching at the catcherboxes, subsurface uranium chunks were discovered. At the time of submittal of LA-UR-95-882, no results had been received for inorganic analyses of the 1994 soil samples. This subsection reports those analyses; it discusses only the catcherboxes in SWMU 33-007(c). An EC is proposed to remove uranium.

4.3.1 Previous Investigations

Results of sampling and analysis from SWMU 33-007(c) were discussed in detail in the January 1995 RFI report for TA-33. Because of incomplete data, no recommendation was made for the SWMU. During trenching, several intact experimental devices were unearthed. No external radiation was detected. Composition of the devices is unknown; casings appear to be steel. The devices are kept in locked storage at TA-33.

4.3.2 Field Investigation

Trenching during the 1994 sampling season uncovered chunks of corroded uranium metal oxidized to hydrated uranyl hydroxides. At that time, nine samples were collected and analyzed for uranium and inorganics.

4.3.2.1 Results of Field Surveys

All sampling points were surveyed. No other field surveys were associated with SWMU 33-007(c).

4.3.2.2 Results of Field Screening

During trenching in the catcherboxes, radiation was detected during routine field screening of soil in backhoe buckets. Radioactive soil was segregated during trenching and reburied during demobilization.

4.3.3 Screening Assessment

4.3.3.1 Comparison to Background/SALs

This comparison addresses only samples taken from the catcherboxes. Of inorganics, only uranium was found above SALs. Inorganics detected above LANL and TA-33 background UTLs are listed in Table 4-8, as are uranium results.

TABLE 4-8

INORGANICS DETECTED ABOVE LANL AND TA-33 BACKGROUND UTLS AT SWMU 33-007(c) CATCHERBOXES

ANALYTE	SAMPLE ID	DEPTH (ft)	MEDIUM	CONCEN-TRATION (mg/kg)	LANL UTL[a] (mg/kg)	TA-33 UTL (mg/kg)	SAL[b] (mg/kg)
Lead	AAA9846	4	Soil	160	39	39	400
Nickel	AAA9843	0-0.5	Soil	51.5	26.7	17	1 600
	AAA9844	0-0.5	Soil	31.8	26.7	17	1 600
	AAA9848	0-0.5	Soil	104	26.7	17	1 600
	AAA9916	2	Soil	48	26.7	17	1 600
Silver	AAA9846	4	Soil	1	ND[c]	ND	400
	AAA9847	4	Soil	2	ND	ND	400
Uranium	AAA9844	0-0.5	Soil	6 770	2.8	4.8	95
	AAA9848	0-0.5	Soil	218	2.8	4.8	95
Zinc	AAA9846	4	Soil	1 200	101	62.3	24 000

[a] UTL = Upper tolerance limit.
[b] SAL = Screening action level.
[c] ND = Not determined.

Because several inorganics were detected within a small volume of material, a multiconstituent analysis is presented in Table 4-9 using the highest result detected in any sample. The contaminant fraction is determined by dividing the concentration of an analyte by its SAL. If the sum of contaminant fractions is less than one, then the multiple contamination does not pose a hazard. This analysis is intended to determine if soil should be cleaned of contamination other than uranium. Lead is included in the multiconstituent analysis, although its toxicological effect, neurological damage to young children, is distinct from the systemic effects of the other contaminants.

TABLE 4-9

MULTICONSTITUENT ANALYSIS OF INORGANICS AT SWMU 33-007(c) CATCHERBOXES, EXCLUDING URANIUM

ANALYTE	SAMPLE ID	CONCENTRATION (mg/kg)	SAL[a] (mg/kg)	CONTAMINANT FRACTION
Lead	AAA9846	160	400	0.15
Nickel	AAA9848	104	1 600	0.065
Silver	AAA9846	2	400	0.005
Zinc	AAA9846	1 600	24 000	0.067
SUM	NA[b]	NA	NA	0.287

[a] SAL = Screening action level.
[b] NA = Not applicable.

4.3.3.2 Data Interpretation

At least one pocket of uranium contamination is known in the catcherboxes, both by visual observation and sampling and analysis. Multiconstituent analysis of inorganics was performed using the highest value of each contaminant found in the eight samples collected. The resulting sum of each fraction (0.287) is less than one, indicating that the estimated volume of 240 cu yd of soil does not contain sufficient contamination to present an inorganic hazard. As is noted in Subsection 3.2.2 of RFI Report LA-UR-95-882, which discusses derivation of TA-33 background UTLs, the grid sample set from the cinder cone at Area 6 contained several outliers with elevated lead, nickel, and zinc. These data imply that at least some of the elevated inorganic levels may be background related.

4.3.3.3 Risk Assessment

No risk assessment was performed for SWMU 33-007(c).

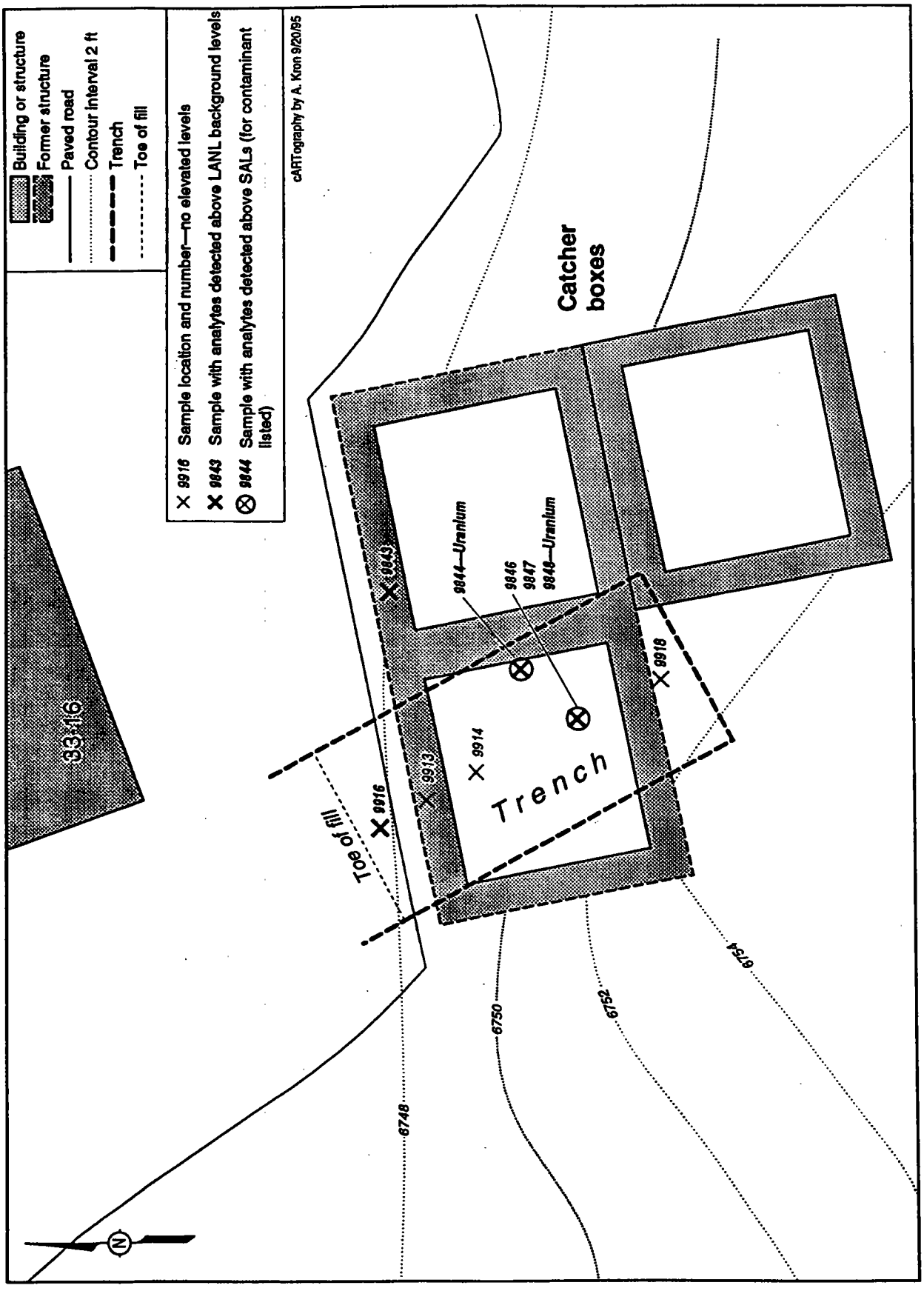


Fig. 4-3. Catcher boxes at SWMU 33-007(c).

4.3.3.4 Ecotoxicological Screening Assessment

A global ecotoxicological assessment is presented in Subsection 3.2.3 of this RFI report.

4.3.4 Conclusions and Recommendations

An EC is proposed for uranium in the catcherboxes at SWMU 33-007(c). Experimental debris will be removed. Options for uranium include drumming and removal, soil separation and cleaning of contaminated soil by an *in-situ* leaching technique, or offsite treatment and disposal. An EC plan will be prepared.

4.4 SWMU 33-009 Area 6 Surface Disposal

SWMU 33-009 is a surface disposal area at Area 6. It is discussed in the RFI Work Plan for OU 1122, Subsections 3.3.2.4 and 4.3.3.1 (LANL 1992, 0784). Sampling found low levels of PCBs over the surface of the SWMU. In one sample, PCBs were detected qualitatively as a TIC in an SVOC analysis. SWMU 33-009 is targeted for Phase II investigation.

The disposal area was created for two firing pads at Area 6. After the Area 6 firing site was abandoned, the level area and slope of the cinder cone were used for disposal of various materials, including uranium chips from the shops at Main Site, metal chunks, spent light bulbs, old tires, drums of unknown content, and like debris. The site was cleaned in 1974, although the cleanup did not remove all trash from the area. Debris, mostly broken glass and metal chunks, remains on the slope.

Between 1967 and 1974, defective capacitors from Project Sherwood were stored at the disposal site. Most capacitors were removed during the 1974 cleanup. In 1994 an empty capacitor was found partially buried in the cinders. Analyses indicated PCB contamination (140 and 195 mg/kg) in the small amounts of oil remaining in the capacitor, but only 2 mg/kg in the surrounding soil.

Potential contaminants listed for this SWMU were uranium, beryllium, other inorganics, and PCBs.

SWMU 33-009 includes the excavated area and adjacent slope of the basaltic cinder cone at Area 6. The leveled area in the cone is approximately 75 ft by 100 ft. Excavation has produced a vertical wall about 10 ft high at the eastern end. A moderately sloping area extends approximately 100 ft west, then becomes a steep, 80-ft slope of basaltic cinder pebbles descending into a tributary of Chaquehui Canyon at the western edge of Area 6. Shrubs,

primarily chamisa, grow at the top of the slope but much of the face consists of bare, loose pebbles. A drainage channel has formed at the south edge of the slope. At the north end is a natural drainage formed in tuff. Small, unconsolidated, basalt-cinder pebbles constitute the body of the slope. The site does not collect or retain water.

The cinder cone predates deposition of Bandelier Tuff units that form the mesas at TA-33. Based on drilling at MDA K, cone deposits extends approximately 300 ft below the surface and overlie a unit of "Pajarito Plateau" tholeiitic basalt, as shown in Fig. 5 of Reneau et al. (1994, 02-092). Observations indicate that there is no soil-tuff interface under most of the slope at SWMU 33-009. Cinder pebbles abut tuff in the drainage at the north end of the SWMU due to excavation when Area 6 was developed.

4.4.1 Previous Investigations

No previous investigations were conducted at this PRS.

4.4.2 Field Investigation

Of the surface samples collected at SWMU 33-009, seven samples, including one duplicate, were taken from the face of the slope at random locations. Four random samples from SWMU 33-007(c) are located within the sloping surface of the disposal area. Four additional samples were taken in the drainage leading from the base of the slope toward Chaquehui Canyon. The drainage channel of outfall SWMU 33-004(g), where five samples were collected, bounds the area to the north (Fig. 4-4). Results of these 20 samples were used in decisions for SWMU 33-009.

All samples were analyzed for SVOCs, inorganics, uranium, PCBs, and gamma emitters. Four samples were analyzed for HE, two were analyzed for herbicides, and one for pesticides.

4.4.2.1 Results of Field Surveys

All sampling points were surveyed. Because of a history of dumping metal objects at the SWMU, magnetic and electromagnetic geophysical surveys were performed at SWMU 33-009. No anomalies were detected that could not be attributed to known features at the site despite high background due to elevated iron concentrations in the basaltic cinders.

4.4.2.2 Results of Field Screening

No radiation was detected during routine field screening of sample locations at SWMU 33-009.

4.4.3 Screening Assessment

4.4.3.1 Comparison to Background/SALs

PCBs were detected in 15 samples relevant to SWMU 33-009. PCB-containing samples are discussed in Subsection 4.4.3.2. Table 4-10 lists concentrations of analytes other than PCBs detected above LANL or TA-33 background UTLs at SWMU 33-009. Sample AAA2145 was taken at the outfall from building TA-33-16. Inorganics found at that sampling point were collected for SWMU 33-004(g), as discussed in Subsection 4.2 of RFI Report LA-UR-95-882 submitted in January 1995 (LANL 1995, 1212). Sampling points are shown in Fig. 4-4.

TABLE 4-10

ANALYTES DETECTED ABOVE LANL AND TA-33 UTLs AT SWMU 33-009[a]

ANALYTE	SAMPLE ID	DEPTH (in.)	MEDIUM	CONCENTRATION (mg/kg)	LANL UTL[b] (mg/kg)	TA-33 UTL (mg/kg)	SAL[c] (mg/kg)
Nickel	AAA2147	0-6	Soil	46	26.7	17	1 600
	AAA2148	0-6	Soil	38	26.7	17	1 600
	AAA2149	0-6	Soil	52	26.7	17	1 600
	AAA2150	0-6	Soil	44	26.7	17	1 600
	AAA2152	0-6	Soil	60	26.7	17	1 600
	AAA2155	0-6	Soil	67	26.7	17	1 600
	AAA2166	0-6	Soil	46	26.7	17	1 600
	AAA2167	0-6	Soil	32	26.7	17	1 600
	AAA2168	0-6	Soil	45	26.7	17	1 600
	AAA2169	0-6	Soil	34	26.7	17	1 600
	AAA2171	0-6	Soil	33	26.7	17	1 600
	AAA2173	0-6	Soil	36	26.7	17	1 600
	AAA2174	0-6	Soil	28	26.7	17	1 600
	AAA2175	0-6	Soil	31	26.7	17	1 600
Uranium	AAA2168	0-6	Soil	5.5	2.8	4.8	95
Zinc	AAA2147	0-6	Soil	108	101	62.3	24 000
	AAA2168	0-6	Soil	130	101	62.3	24 000

[a] PCBs are excluded because they are discussed in Subsection 4.4.3.2.
[b] UTL = Upper tolerance limit.
[c] SAL = Screening action level.

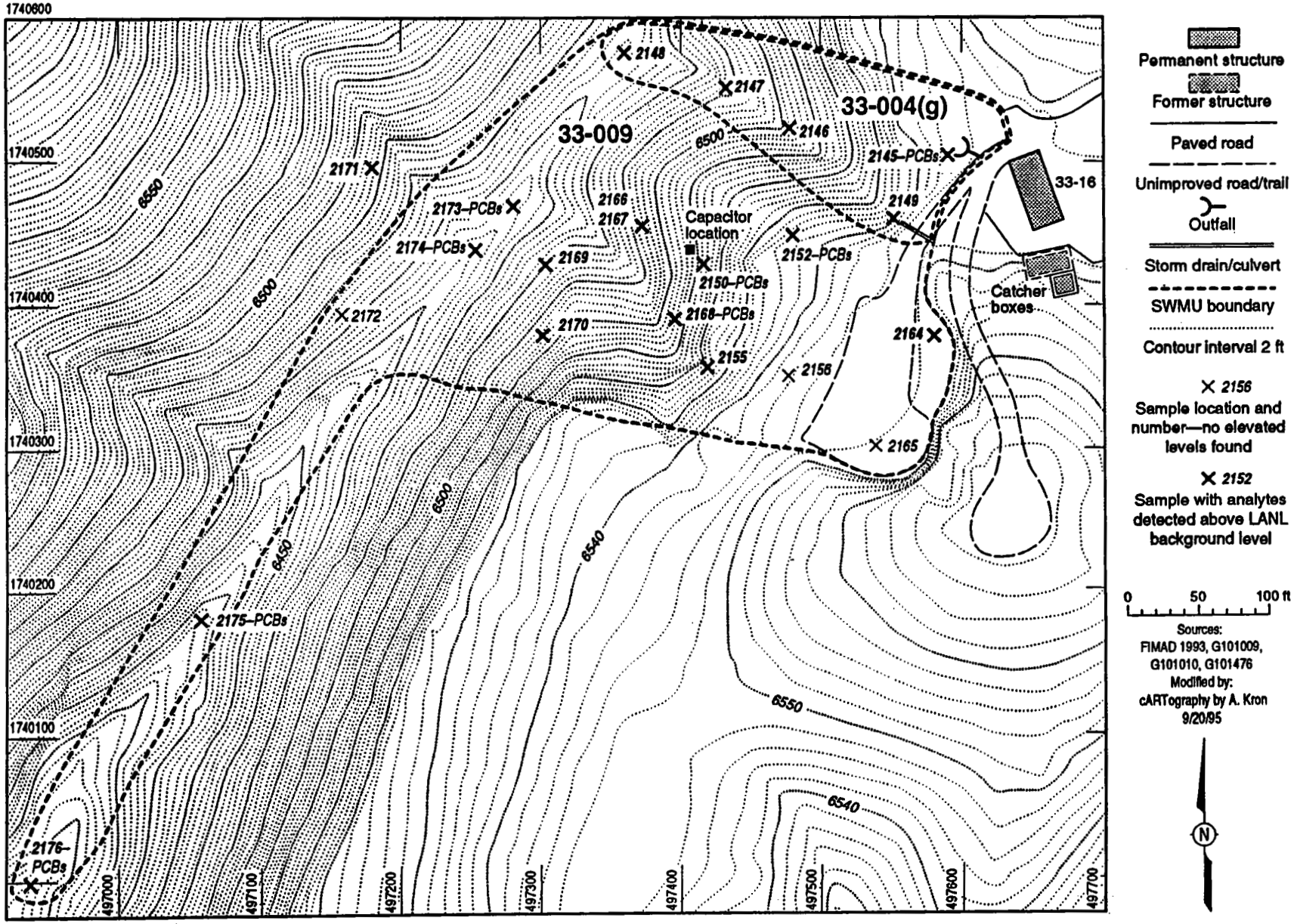


Fig. 4-4. Area 6: SWMU 33-009 showing overlapping SWMU 33-004(g).

4.4.3.2 Data Interpretation

The primary concern at PRS 33-009 is the low levels of PCBs (0.10 to 1.57 mg/kg) found in samples AAA2168, AAA2150, and AAA2152 collected at the top of the slope and in the four drainage samples, AAA2173 to AAA2176. No PCBs were found in samples from the lower half of the slope (samples AAA2167 to AAA2170). These analyses were performed using the SW-846 gas chromatography/electron capture method for PCBs and pesticides. Neither PCB nor SVOC analyses were requested for SWMU 33-007(c) samples that overlap SWMU 33-009, but PCB results were obtained for two samples, AAA2150 and AAA2152, submitted for pesticide analysis. PCBs were tentatively identified by SVOC analysis for sample AAA2145 from SWMU 33-004(g); results are qualitative only. This sample is located at the outfall from TA-33-16, which suggests that capacitors may have been stored as far north as this point along the rim of the level area.

4.4.3.2.1 Computations For PCBs at Area 6

PCB data are reported for: 11 Phase I samples from SWMU 33-009 (seven surface samples, including one collocated pair and four drainage samples), two surface samples from SWMU 33-007(c), and one surface sample taken at the SWMU 33-004(g) outfall. In addition, results are available for a surface soil sample collected at the site of the capacitor that was removed from the slope of SWMU 33-009.

The SWMU 33-004(g) samples were not analyzed for PCBs; the reported results are TICs from one SVOC analysis [no PCBs were identified in the remaining 33-004(g) samples], and are reported as a range of values for mixed Aroclors™. The remaining samples were analyzed following the standard procedure for PCBs. The primary PCB identified was Aroclor 1254™. Aroclor 1260™ was identified in one sample from PRS 33-007(c). No other specific Aroclors™ were identified above detection levels in any sample, but mixed Aroclors™ were also reported (generally at the level given for Aroclor 1254™) for the samples from SWMU 33-009. The data for Aroclor 1254™ and for mixed Aroclors™ are presented in Table 4-11. Also shown in the table are imputed values for mixed Aroclors™ for the two SWMU 33-007(c) samples and the 1994 result of analyzing under the capacitor.

Table 4-12 shows means and 95% upper confidence limits (UCLs) for the means of the data subsets in Table 4-11. Customarily, it is the UCL that is compared with regulatory standards. In computing these statistics, values less than the detection limit have been replaced by one-half the reported detection limit (DL), as recommended in EPA guidance documents (EPA 1989, 0305). The upper end of the reported range of TIC values is used for mixed Aroclors™ in AAA2145.

TABLE 4-11

PCB CONCENTRATIONS FOR AREA 6

PRS[a]	LOCATION	SAMPLE ID	AROCLOR™ (mg/kg)	
			1254	MIXED
33-004(g)	Outfall	AAA2145	None	0.57-2.5(TIC)[b]
33-007(c)	Surface	AAA2150	<0.0875	*0.0703*[c]
33-007(c)	Surface	AAA2152	0.0535	*0.0535*[c]
33-009	Surface	AAA2166	<0.0373	<0.0758
33-009	Surface	AAA2167[d]	<0.0370	<0.0370
33-009	Surface	AAA2168	1.3800	1.3800
33-009	Surface	AAA2169	<0.0381	<0.0381
33-009	Surface	AAA2170	<0.0370	<0.0370
33-009	Surface	AAA2171	<0.0365	<0.0365
33-009	Surface	AAA2172	<0.0368	<0.0368
33-009	Drainage	AAA2173	0.1000	0.1000
33-009	Drainage	AAA2174	1.5700	1.5700
33-009	Drainage	AAA2175	0.5200	0.5200
33-009	Drainage	AAA2176	0.1700	0.1700
33-009	Capacitor	94.00131	2.0000	*2.0000*

[a] PRS = Potential release site.
[b] Tentatively identified compound.
[c] Inputed values for mixed Aroclors™ for cases where only specific Aroclors™ were reported. In particular, the value for AAA2150 is the reported value for Aroclor 1260™ in this sample, which was the only Aroclor™ reported above detection limit (DL) for this sample.
[d] Sample colocated with sample AAA2166.

TABLE 4-12

MEANS AND 95% UPPER CONFIDENCE LIMITS FOR PCBS AT AREA 6

POPULATION	STATISTIC[a]	NO. SAMPLES	AROCLOR™ (mg/kg)	
			1254	MIXED
Surface	Mean	8	0.1963	0.2020
	95% UCL[b]		0.5389	0.5431
Surface with capacitor	Mean	9	0.3967	0.4018
	95% UCL		0.8895	0.8928
Drainage with outfall	Mean	4-5	0.5900	0.9720
	95% UCL		1.5121	2.0772
All	Mean	13-14	0.4562	0.6054
	95% UCL		0.8194	1.0320

[a] In computing means and UCLs, values less than DL are replaced by one-half the reported DL. All means and UCLs are computed without the collocated sample AAA2167. Means and UCLs for Aroclor 1254™ are computed without imputing any value to the SWMU 33-004(g) outfall sample AAA2145. However, means and UCLs for mixed Aroclors™ in drainages and overall are computed using the upper bound of the TIC values for AAA2145, i.e., 2.5 ppm.

[b] UCL = Upper confidence limit.

4.4.3.3 Risk Assessment

No risk assessment was performed for this PRS.

4.4.3.4 Ecotoxicological Screening Assessment

A global ecotoxicological assessment is presented in Subsection 3.2.3 of this report.

4.4.4 Conclusion and Recommendation

Phase II is proposed for SWMU 33-009, as discussed in Appendix B. Because PCBs were detected in one sample at outfall SWMU 33-004(g), the boundary of SWMU 33-009 has been extended to include the outfall and its drainage (Fig. 4-4). Although PCBs were not reported in samples from the lower part of the slope, a spent capacitor was discovered there in 1994. Therefore, metal-detecting geophysical studies are proposed for all parts of the site where cinder pebbles might cover additional buried capacitors. If found, such capacitors will be removed and the soil beneath them sampled to determine whether PCBs have been released to the environment.

4.5 SWMU 33-011(d) Storage at TA-33-20

SWMU 33-011(d) is the area used for storage south of warehouse TA-33-20. It is discussed in the RFI Work Plan for OU 1122 in Subsections 3.2.2.7 and 4.2.3.1 (LANL 1992, 0748). Lead, uranium, and tritium were detected above SAL in one asphalt sample and its duplicate. A radiological survey and cleanup is proposed for uranium. A Phase II sampling plan is presented to determine extent of lead contamination. The contaminated spot has been covered and posted.

SWMU 33-011(d) is located on the asphalt paving at warehouse TA-33-20. Site workers indicated that uranium and beryllium were stored in and around the warehouse until 1972. Scrap from recovered shots and material intended for recovery were also stored south of the building. All such material has been removed. The building is now used for storage and much of the surrounding paved area is used for parking. Potential contaminants included uranium, beryllium, and possibly other inorganics.

The site is within the developed area at Main Site. It is level and paved with asphalt.

4.5.1 Previous Investigations

No previous investigations were conducted at this PRS.

4.5.2 Field Investigation

Prior to sampling at TA-33, Main Site was surveyed for radiation on a grid as specified in the work plan. No radioactivity was detected. However, at the time of sample collection, radioactivity was detected on asphalt at SWMU 33-011(d). As specified in the work plan, two asphalt samples and three soil samples from below the asphalt were taken at three locations. Of these, one asphalt and one soil sample (AAA6866 and AAA6867) were taken at the radioactive point. All samples were analyzed for inorganics, uranium, and gamma emitters. Five of the samples (AAA6863, AAA6864, AAA6866, AAA6867, and AAA6868) were also analyzed for tritium and plutonium.

4.5.2.1 Results of Field Surveys

All sampling points were surveyed. No other field surveys were associated with SWMU 33-011(d).

4.5.2.2 Results of Field Screening

Radiation was detected during routine field screening. A sample was collected later by a sampler certified to collect radioactive samples. The entire area around the point was screened for radiation.

4.5.3 Screening Assessment

4.5.3.1 Comparison to Background/SALs

Samples AAA 6866 and AAA6867 taken from the radioactive spot contained uranium levels far above SAL. Lead was above background UTLs in most samples and above soil SAL in asphalt sample AAA6866. Other inorganics were found above background UTLs in this same asphalt sample. Tritium was above background UTL in samples AAA 6864 and AAA6868 and above the soil SAL in the asphalt sample AAA6863. Plutonium above the background UTL was detected at this location (Fig. 4-5). Table 4-13 is a summary of analytes detected above background UTLs. Neither UTLs nor SALs apply to asphalt; soil UTLs and SALs are listed in the table as a point of reference only.

4.5.3.2 Data Interpretation

Phase I sampling results suggest that contamination, both radioactive and inorganic, is patchy and not extensive. The highest levels of inorganic contamination were found in the same asphalt sample that contained over 3 200 mg/kg of uranium. High uranium, lead, and nickel concentrations were also found in the soil sample collected below the pavement at the same location.

4.5.3.3 Risk Assessment

No risk assessment was performed for this PRS.

4.5.3.4 Ecotoxicological Screening Assessment

A global ecotoxicological assessment is presented in Subsection 3.2.3 of this report.

4.5.4 Conclusion and Recommendation

Because the initial TA-33 grid for radioactive screening was too coarse to detect the radioactive spot at SWMU 33-011(d), the area around the warehouse is proposed for further investigation. A Phase II sampling and analysis plan is presented to investigate lead and uranium contamination (Appendix B).

TABLE 4-13

ANALYTES ABOVE LANL AND TA-33 BACKGROUND UTLs AND SALs AT SWMU 33-011(d)

ANALYTE	SAMPLE ID	DEPTH (in.)	MEDIUM	CONCENTRATION (mg/kg)	LANL UTL[a] (mg/kg)	TA-33 UTL (mg/kg)	SOIL SAL[b] (mg/kg)
Cadmium	AAA6866	0-6	Asphalt	4	2.7	2.7	80
Lead	AAA2028	0-6	Soil[c]	110	39	39	400
	AAA6863	0-6	Asphalt	45	39	39	400
	AAA6864	0-12	Soil	40	39	39	400
	AAA6866	0-6	Asphalt	690	39	39	400
	AAA6867	0-12	Soil	139	39	39	400
	AAA6868	0-12	Soil	40	39	39	400
Nickel	AAA6866	0-6	Asphalt	240	26.7	17	1 600
Uranium	AAA2028	0-6	Soil	6.8	2.8	4.8	95
	AAA2274	0-6	Soil	6.7	2.8	4.8	95
	AAA2275	0-6	Soil	6.3	2.8	4.8	95
	AAA6864	0-12	Soil	5.1	2.8	4.8	95
	AAA6866	0-6	Asphalt	3 200	2.8	4.8	95
	AAA6867	0-12	Soil	899	2.8	4.8	95
Zinc	AAA6866	0-6	Asphalt	470	101	62.3	24 000
	AAA6867	0-12	Soil	120	101	62.3	24 000
ANALYTE	**SAMPLE ID**	**DEPTH (in.)**	**MEDIUM**	**ACTIVITY (pCi/g)**	**LANL UTL (pCi/g)**	**TA-33 UTL (pCi/g)**	**SAL (pCi/g)**
Plutonium-238	AAA6863	0-6	Asphalt	0.055	0.01	0.01	27
	AAA6864	0-12	Soil	0.083	0.01	0.01	27
	AAA6866	0-6	Asphalt	0.405	0.01	0.01	27
	AAA6867	0-12	Soil	0.032	0.01	0.01	27
	AAA6868	0-12	Soil	0.04	0.01	0.01	27
Plutonium-239	AAA6866	0-6	Asphalt	0.083	0.01	0.058	24
	AAA6867	0-12	Soil	0.225	0.01	0.058	24
Tritium	AAA6863	0-6	Asphalt	3 028 pCi/g	ND[d]	23.2	810
	AAA6864	0-12	Soil[c]	304 pCi/g	ND	23.2	810
	AAA6868	0-12	Soil[c]	472 pCi/g	ND	23.2	810

[a] UTL = Upper tolerance limit.
[b] SAL = Screening action level.
[c] Soil depth under 3-4 in. of asphalt.
[d] ND = Not determined.

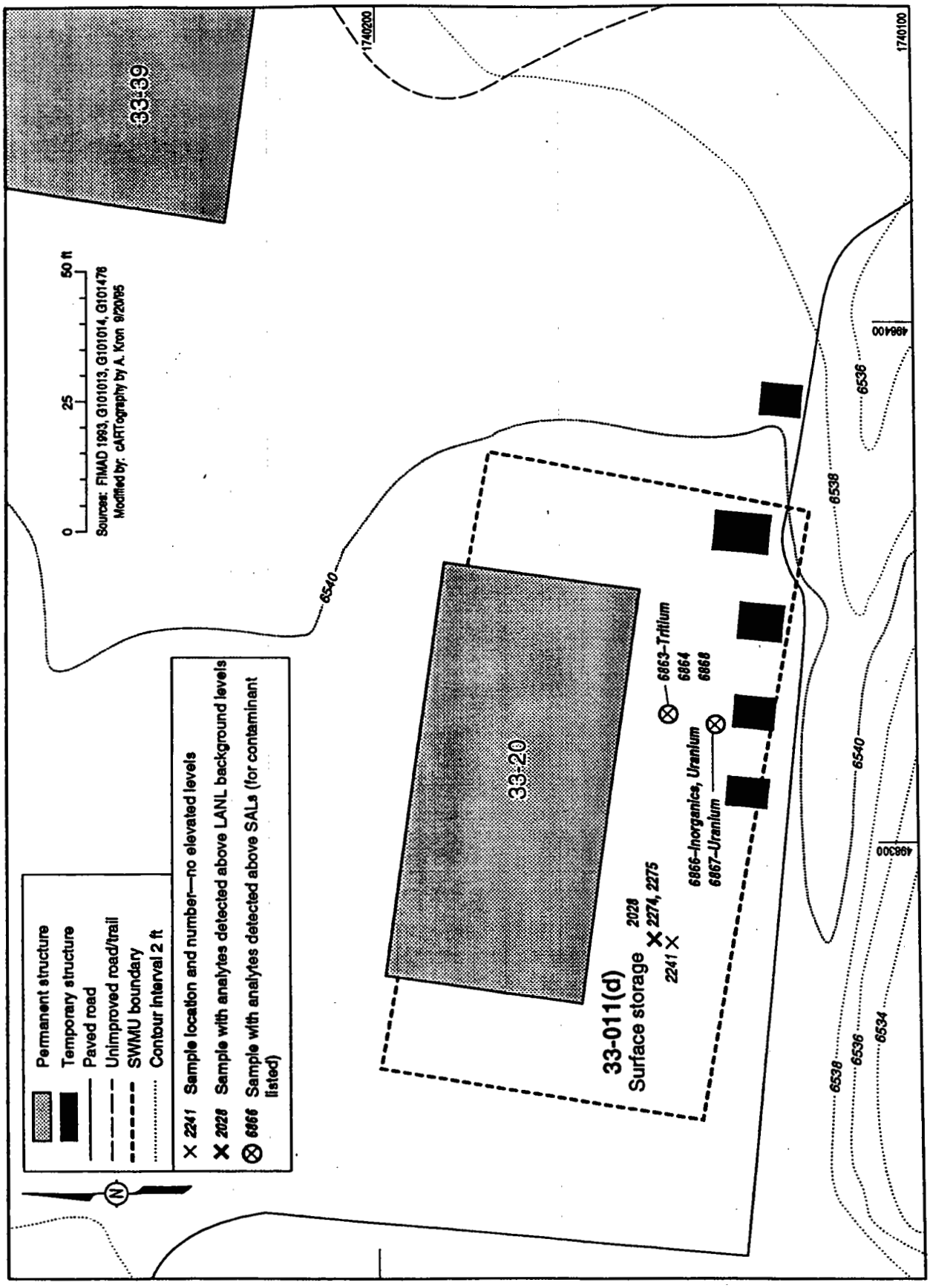


Fig. 4-5. Main Site: SWMU 33-011(d), surface storage.

4.6 SWMU 33-013 Liquid Waste Storage at the Tritium Facility

SWMU 33-013 is a surface disposal area on pavement east of the tritium facility TA-33-86. It is discussed in the RFI Work Plan for OU 1122, Subsections 3.2.2.8 and 4.3.4 (LANL 1992, 0784. Cadmium, chromium, and tritium were observed above SALs. Beryllium was measured above soil background levels. However, elevated inorganics were associated with problems in the QA/QC data. A Phase II sampling plan is presented to determine the extent of contamination.

SWMU 33-013 is an asphalt pad once used as a storage area for liquid waste. The SWMU is located northeast of TA-33-86 and lies within the fence surrounding the TA-33-86. Long-time employees describe the northeast section within the fence as a storage area for material awaiting disposal. Items for disposal included vacuum pumps from throughout LANL, barrels of waste oil, and dumpsters of miscellaneous wastes. No effort was made to cover the area. Many containers leaked and several containers remained in the area for years.

The area is level, about 50 ft square, paved with asphalt as an extension of the parking lot and driveway around the building. Weeds grow in the soil on three sides of the pad and in cracks in the pavement. Runoff from the area is to the east, toward the drainage leading to Chaquehui Canyon. East of the fence the ground slopes at a moderate grade without obvious channeling. There the surface material, soil with pumice, is sparsely vegetated; some of it may be fill from grading the site for building TA-33-86.

4.6.1 Previous Investigations

No previous investigations were conducted at this PRS.

4.6.2 Field Investigation

Three samples were taken at random locations 0-6 in. under the asphalt paving, which is 2 to 3 in. thick (Fig. 4-6). All SWMU 33-013 samples were analyzed for inorganics, gamma emitters and SVOCs. Two samples were analyzed for tritium and one for herbicides.

4.6.2.1 Results of Field Surveys

All sampling points were surveyed. No other field surveys were associated with SWMU 33-013.

4.6.2.2 Results of Field Screening

No radiation was detected during routine field screening of sampling locations at SWMU 33-0013.

4.6.3 Screening Assessment

4.6.3.1 Comparison to Background/SALs

One sample contained inorganics above background UTLs. Two elements, cadmium and chromium, were measured above their SALs in this sample. Both samples analyzed for tritium contained tritium above the TA-33 background UTL, with one concentration above SAL. Sample AAA2037 analyzed for SVOCs had trace levels of pyrene, benzo(b)fluoranthene, and fluoranthene. SVOC results were low enough so that a multiconstituent screening was deemed unnecessary. No herbicides were detected. Table 4-14 lists concentrations of contaminants found above LANL and TA-33 background UTLs.

TABLE 4-14

ANALYTES EXCEEDING UTLs AT SWMU 33-013

ANALYTE	SAMPLE ID	DEPTH (in.)	MEDIUM	CONCENTRATION (mg/kg)	LANL UTL[a] (mg/kg)	TA-33 UTL (mg/kg)	SAL[b] (mg/kg)
Beryllium	AAA2035	0-6	Soil under asphalt	7.8	3.31	1.51	None
Cadmium	AAA2035	0-6	Soil under asphalt	620	2.7	2.7	80
Chromium	AAA2035	0-6	Soil under asphalt	670	34.2	20.7	400
Nickel	AAA2035	0-6	Soil under asphalt	100	26.7	17	1 600
Silver	AAA2035	0-6	Soil under asphalt	10	ND[c]	ND	400
Tritium	AAA2036	0-6	Soil under asphalt	3 342 pCi/g	ND	23.2 pCi/g	810 pCi/g
Tritium	AAA2037	0-6	Soil under asphalt	27 pCi/g	ND	23.2 pCi/g	810 pCi/g

[a] UTL = Upper tolerance limit.
[b] SAL = Screening action level.
[c] ND = Not determined.

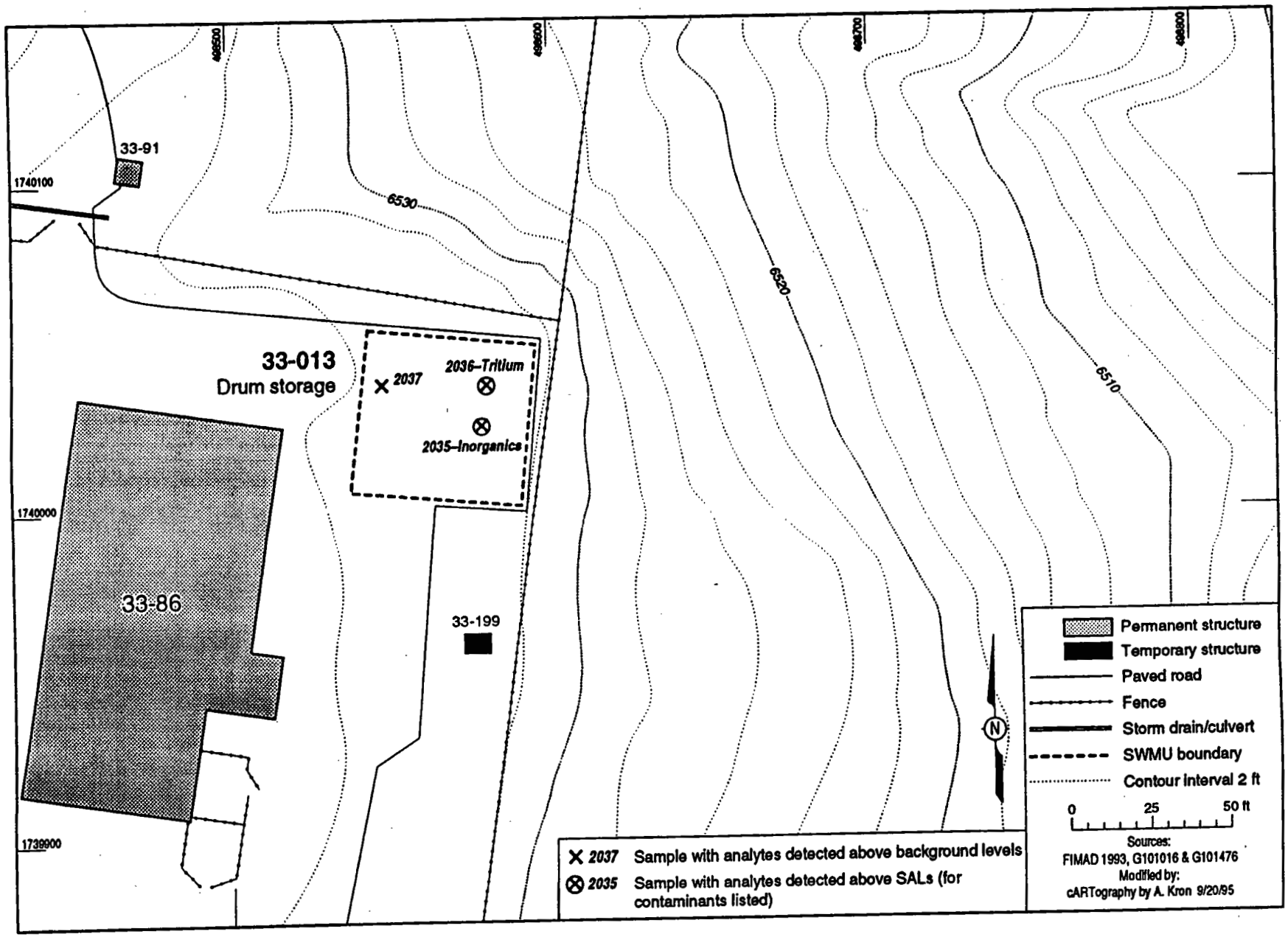


Fig. 4-6. Main Site: SWMU 33-013, drum storage.

4.6.3.2 Data Interpretation

The analytical request that included the three samples from SWMU 33-013 (request number 14594, report number 21424) also included two field blank samples and several grid samples. High levels of silver, cadmium, chromium and zinc were reported in field blank sample AAA2188 and in grid sample AAA2099. In addition, results for cadmium, chromium and zinc were biased high for one of two blind liquid QC samples included with this batch of samples. The result for nickel was biased low. The observations for field blank sample AAA2188 are anomalous. All other field blanks, which were splits of a single sample collected from an offsite location near Bandelier National Monument, were within TA-33 and LANL background ranges. Results from grid sample AAA2099 may be anomalous as well; this grid point lies just south of TA-33-86 and has tritium contamination within the TA-33 background range, but is not in an area that would have been affected by site activities other than stack releases. These anomalous observations could be the result of cross contamination either in the field or in the laboratory, or of an out-of-control laboratory process. All of these samples were collected May 12, 1993. According to the field logs, the samples from SWMU 33-013 were collected in the afternoon, while the grid sample and the field blank were collected in the morning, ruling out cross-contamination due to the field sample collection process. The data validation narrative associated with report number 21424 indicates that all of the run-time QC samples were statistically acceptable, which would preclude an out-of-control laboratory process. Cross-contamination in the laboratory, either from sample AAA2035 or from some other source, remains a possibility.

The QA/QC conditions lend uncertainty to the analytical results for inorganics obtained from the three samples. However, inorganics appear to be elevated above SALs at isolated points within PRS 33-013.

4.6.3.3 Risk Assessment

No risk assessment was performed for this SWMU.

4.6.3.4 Ecotoxicological Screening Assessment

A global ecotoxicological assessment is presented in Subsection 3.2.3 of this report.

4.6.4 Conclusion and Recommendation

High tritium in sample AAA2036 is expected because this storage pad is immediately adjacent to the tritium facility and fluids stored at the site were contaminated with tritium. Tritium is addressed in an RFI report for MDA K (in preparation). A risk assessment for tritium at Main

Site, discussed in the RFI report for MDA K, indicated a 1993 tritium exposure of 11.9 mrem/year, well below the DOE effective dose equivalent of 30 mrem/year.

Because the source of high inorganic concentrations reported in one sample is uncertain, however, Phase II sampling will be conducted before further decisions are made (Appendix B).

4.7 SWMU 33-016 Sump at TA-33-23

SWMU 33-016 is a sump and outfall at bunker TA-33-23. It is discussed in the RFI Work Plan for OU 1122, Subsections 3.2.2.14 and 4.3.4 (LANL 1992, 0784). SVOCs above SALs were discovered in the sump sludge. A VCA of the sump was completed in 1995.

The sump served a sink and floor drain in TA-33-23, a trim building used in the early 1950s to prepare propellant charges for use at South Site. Until 1994 the bunker was used for storage by a LANL geological group, but is now empty. The sump is located west of the door to TA-33-23. Prior to the VCA, it was covered by a wooden lid.

At the time of construction, the area in front of TA-33-23 was graded and paved. One side of the sump is adjacent to the building. Two sides are surrounded by pavement and the fourth side is a tuff embankment, cut when the site was built. A pipe exits the sump and leads under the pavement to an outfall about 250 ft west of the building on the sloping side of Chaquehui Canyon. The slope is covered with pinyon and juniper trees and sparse grasses. Soil is thin with bedrock tuff outcrops. No drainage channel has formed at the outfall.

4.7.1 Previous Investigations

No previous investigations were conducted at this PRS.

4.7.2 Field Investigation

All sampling locations at SWMU 33-016 were selected to increase the chances of detecting contamination. Five samples were taken from the sump, two of fluid and two of sludge. A borehole adjacent to the sump yielded one surface sample, one sample at 3 to 5 ft, and one sample at 10 to 12 ft. Four surface samples were taken at the outfall (Fig. 4-7). All samples were analyzed for SVOCs and HE. Liquid and subsurface samples were also analyzed for VOCs.

4.7.2.1 Results of Field Surveys

All sampling points were surveyed. No other field surveys were associated with SWMU 33-016.

4.7.2.2 Results of Field Screening

No radiation was detected during routine field screening of sampling locations at SWMU 33-016.

4.7.3 Screening Assessment

4.7.3.1 Comparison to Background/SALs

No inorganic analyses were performed at SWMU 33-016. Table 4-15 lists organics detected in the sump sludge. Carcinogenic polycyclic aromatic hydrocarbons (cPAHs) were found. Although SALs are not relevant to sludge, soil SALs are listed as points of reference. QA comments indicate that these results are based on dry weight of sample. In addition, TICs were detected in the sludge samples. No analytes were reported in the water samples. Only trace levels of a plasticizer were found in samples from the outfall.

TABLE 4-15

ORGANICS DETECTED IN SUMP SLUDGE AT SWMU 33-016

ANALYTE	SAMPLE ID	DEPTH (in.)	MEDIUM	RESULT (mg/kg)	SAL[a] (mg/kg)	EQL[b] (mg/kg)
Acenaphthene	AAA2204	Tank	Sludge	8.4	*4 800*	*unknown*
Acetone	AAA2043	36	Tuff	0.024	*8 000*	*0.33*
Acetone	AAA2044	120	Tuff	0.031	*8 000*	*0.33*
Anthracene	AAA2041	Tank	Sludge	6	*24 000*	*0.33*
Anthracene	AAA2204	Tank	Sludge	11	*24 000*	*0.33*
Benzo[a]anthracene	AAA2041	Tank	Sludge	*23*	*1*	*0.33*
Benzo[a]anthracene	AAA2204	Tank	Sludge	*20*	*1*	*0.33*
Benzo[a]pyrene	AAA2041	Tank	Sludge	*16*	*0.1*	*0.33*
Benzo[a]pyrene	AAA2204	Tank	Sludge	*18*	*0.1*	*0.33*
Benzo[b]fluoranthene	AAA2041	Tank	Sludge	*13*	*1*	*0.33*
Benzo[b]fluoranthene	AAA2204	Tank	Sludge	*12*	*1*	*0.33*
Benzo[g,h,i]perylene	AAA2041	Tank	Sludge	8.8	*NC*[c]	*0.33*
Benzo[g,h,i]perylene	AAA2204	Tank	Sludge	15	*NC*	*0.33*
Benzo[k]fluoranthene	AAA2041	Tank	Sludge	*19*	*10*	*0.33*
Benzo[k]fluoranthene	AAA2204	Tank	Sludge	*19*	*10*	*0.33*
Bis(2-ethylhexyl)phthalate	AAA2041	Tank	Sludge	24	*50*	*0.33*
Bis(2-ethylhexyl)phthalate	AAA2047	0-6	Soil	0.42	*50*	*0.33*
Bis(2-ethylhexyl)phthalate	AAA2204	Tank	Sludge	*110*	*50*	*0.33*
Butylbenzene [sec-]	AAA2041	Tank	Sludge	1.6	*NC*	*0.005*
Butylbenzene [sec-]	AAA2204	Tank	Sludge	3.5	*NC*	*0.005*
Chrysene	AAA2041	Tank	Sludge	24	*96*	*0.33*
Chrysene	AAA2204	Tank	Sludge	24	*96*	*0.33*
Di-n-butyl phthalate	AAA2041	Tank	Sludge	60	*8 000*	*0.33*
Di-n-butyl phthalate	AAA2204	Tank	Sludge	65	*8 000*	*0.33*
Dibenzofuran	AAA2204	Tank	Sludge	9.3	*NC*	*0.33*
Dinitrobenzene [1,3-]	AAA2041	Tank	Sludge	6.1	*NC*	*0.33*
Dinitrotoluene [2,4-]	AAA2204	Tank	Sludge	*2.5*	*1*	*0.33*

TABLE 4-15 (CONTINUED)

ORGANICS DETECTED IN SUMP SLUDGE AT SWMU 33-016

ANALYTE	SAMPLE ID	DEPTH (in.)	MEDIUM	RESULT (mg/kg)	SAL[a] (mg/kg)	EQL[b] (mg/kg)
Ethylbenzene	AAA2041	Tank	Sludge	0.24	*3 100*	*0.005*
Ethylbenzene	AAA2204	Tank	Sludge	1.4	*3 100*	*0.005*
Fluoranthene	AAA2041	Tank	Sludge	35	*3 200*	*0.33*
Fluoranthene	AAA2204	Tank	Sludge	40	*3 200*	*0.33*
Fluorene	AAA2204	Tank	Sludge	11	*3 200*	*0.33*
Indeno[1,2,3-cd]pyrene	AAA2041	Tank	Sludge	*9.7*	*1*	*0.33*
Indeno[1,2,3-cd]pyrene	AAA2204	Tank	Sludge	*15*	*1*	*0.33*
Isopropylbenzene	AAA2041	Tank	Sludge	0.28	*3 200*	*0.33*
Isopropylbenzene	AAA2204	Tank	Sludge	1.2	*3 200*	*0.33*
Isopropyltoluene [4-]	AAA2041	Tank	Sludge	1.6	*NC*	*0.33*
Isopropyltoluene [4-]	AAA2204	Tank	Sludge	2.1	*NC*	*0.33*
Methylene chloride	AAA2041	Tank	Sludge	0.042	*5.6*	*0.005*
Methylnaphthalene [2-]	AAA2204	Tank	Sludge	31	*NC*	*0.33*
Naphthalene	AAA2204	Tank	Sludge	16	*3 200*	*0.33*
Phenanthrene	AAA2041	Tank	Sludge	19	*NC*	*0.33*
Phenanthrene	AAA2204	Tank	Sludge	47	*NC*	*0.33*
Propylbenzene	AAA2041	Tank	Sludge	0.75	*NC*	*0.005*
Propylbenzene	AAA2204	Tank	Sludge	6.9	*NC*	*0.005*
Pyrene	AAA2041	Tank	Sludge	25	*2 400*	*0.33*
Pyrene	AAA2204	Tank	Sludge	34	*2 400*	*0.33*
RDX[d]	AAA2041	Tank	Sludge	50	*64*	*Not listed*
Toluene	AAA2041	Tank	Sludge	0.18	*910*	*0.005*
Toluene	AAA2204	Tank	Sludge	2.9	*910*	*0.005*
Trimethylbenzene [1,2,4-]	AAA2041	Tank	Sludge	1.6	*40*	*0.005*
Trimethylbenzene [1,2,4-]	AAA2204	Tank	Sludge	7.3	*40*	*0.005*
Trimethylbenzene [1,3,5-]	AAA2041	Tank	Sludge	1.3	*32*	*0.005*
Trimethylbenzene [1,3,5-]	AAA2204	Tank	Sludge	8.6	*32*	*0.005*
Xylenes (o + m + p) [mixed-]	AAA2041	Tank	Sludge	0.31	*160 000*	*0.005*
Xylenes (o + m + p) [mixed-]	AAA2204	Tank	Sludge	1.9	*160 000*	*0.005*

[a] SAL = Screening action level.
[b] EQL = Estimated quatitation level.
[c] Not calculated due to insufficient toxicity data.
[d] RDX is the high explosive cyclonite.

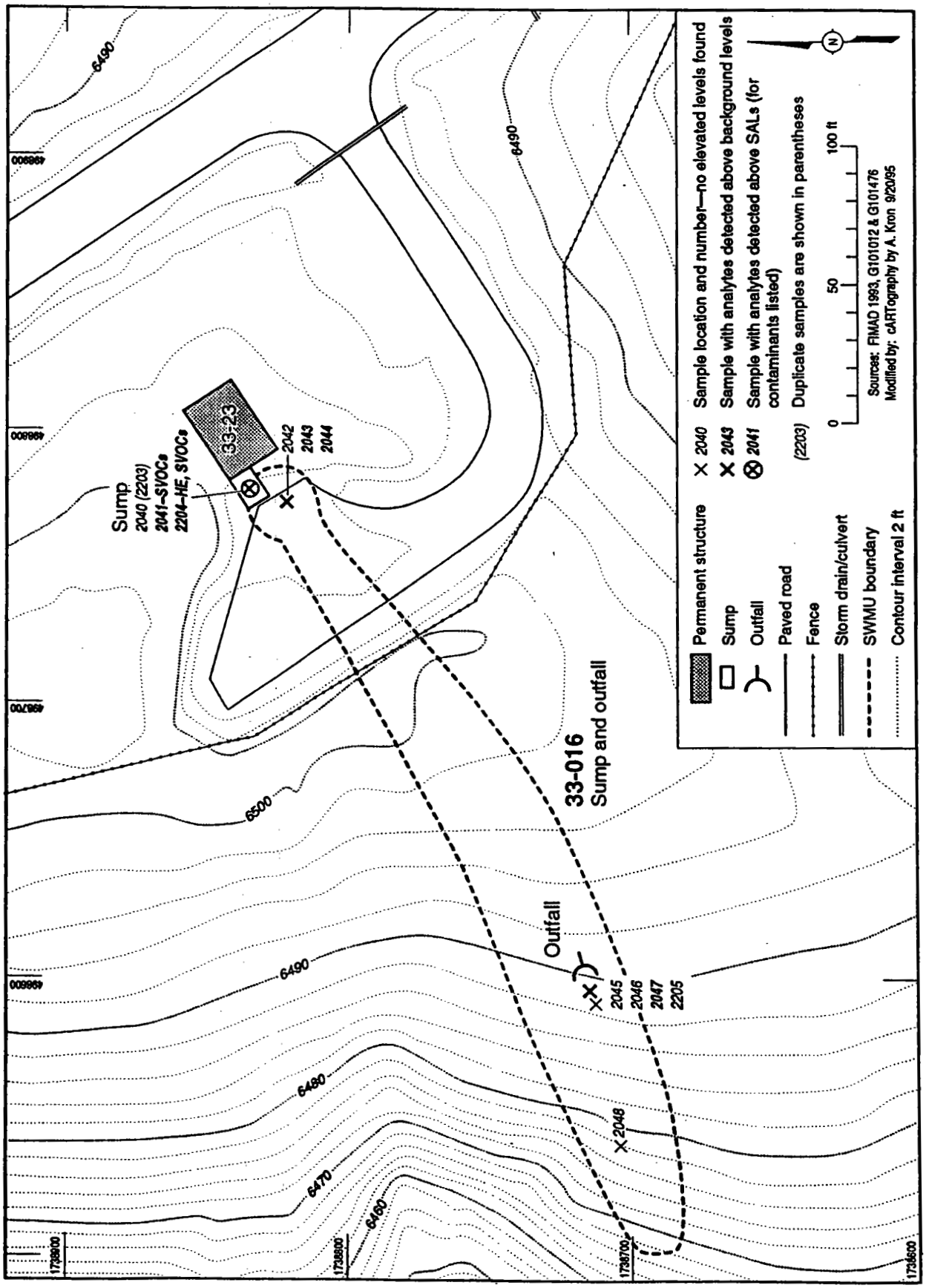


Fig. 4-7. Main Site: SWMU 33-016, sump.

4.7.3.2 Data Interpretation

The sludge at the TA-33-23 sump contains cPAHs above SALs. Analytical results from the borehole beside the sump and at the outfall indicate that contaminants found in the sump are not migrating from the sump.

4.7.3.3 Risk assessment

No risk assessment was performed for this PRS.

4.7.3.4 Ecotoxicological Screening Assessment

A global ecotoxicological assessment is presented in Subsection 3.2.3 of this report.

4.7.4 Conclusion and Recommendation

Sampling and analysis indicated that contamination was confined to the sump. Because the sump is no longer active, it was decommissioned in 1995 under a VCA plan. Approximately 250 gal. of liquid was removed from the sump. Approximately 45 gal. of sludge was vacuumed from the floor of the sump. The sump was filled with 3 yd^3 of sand and gravel, then capped with 1 ft of concrete. No confirmatory samples were taken. The sludge was analyzed for RCRA waste characteristics prior to disposal. Results indicated that 1,1-dichloroethylene and lead were present. A final report was submitted to EPA by October 1, 1995. A copy is attached as Addendum 1.

4.8 SWMU 33-017 Operational Releases/Vehicle Maintenance Area

SWMU 33-017 encompasses the eastern section of the fenced area at Main Site. It is discussed in the RFI Work Plan for OU 1122, Subsections 3.2.2.2 and 4.2.3.1 through 4.2.3.3 (LANL 1992, 0784). Elevated levels of lead and SVOCs are associated with samples from the small area east of shop TA-33-39 known as the vehicle maintenance area. A risk assessment for lead in this area was addressed in Subsection 4.4.4 of RFI Report LA-UR-95-882 (LANL 1995, 1212). The vehicle maintenance area is proposed for Phase II sampling to determine concentrations and extent of SVOC contamination. A sampling and analysis plan is included in Appendix B.

SWMU 33-017 addresses diverse activities at Main Site. Historic operating activities included the fumes from the uranium cut-off shack TA-33-40; air emissions from shop TA-33-39, tritium releases from the high-pressure tritium facility TA-33-86, stack emissions from shop TA-33-119 where uranium was processed, possible atmospheric release of plutonium from the spill in TA-33-21 [SWMUs 33-005(a,b,c)], and any other operations or releases that are not associated

with other known PRSs. One specific site, located east of shop TA-33-39 and used for vehicle maintenance, is included in SWMU 33-017.

The primary potential contaminants were identified as uranium, plutonium, tritium, SVOCs, and inorganics - specifically beryllium, cadmium, and lead. Pesticides, herbicides, and PCBs may also have been used in the area encompassed by this SWMU.

Most of SWMU 33-017 lies within the security fence at Main Site, where laboratory and office buildings are surrounded by asphalt pavement. The area is level with only a slight slope to the east. All runoff from Main Site converges on the east side of the site in a shallow tributary to Chaquehui Canyon. The eastern third of the site is unimproved. Construction of Main Site resulted in a steep bank about 20 ft high at the head of the drainage. Runoff and cooling water blowdown aided vigorous vegetation growth in this area. East of the Main Site fence, native pinyon-juniper woodland covers the drainage and surrounding land.

4.8.1 Previous Investigations

No previous investigations were conducted at this PRS.

4.8.2 Field Investigation

SWMU 33-017 is described as operational releases from Main Site. In the work plan, three separate sets of samples, a total of 82 surface samples, were identified to address SWMU 33-017: vehicle maintenance, airborne operational release, and drainage (LANL 1992, 0784).

- Fifty-six grid samples were taken from a wide area around Main Site and Area 6. Samples locations were selected by random offsets from the nodes of a 100-ft grid overlying Main Site and from four extensions radiating from Main Site as described in the work plan (LANL 1992, 0784).
- Twenty drainage samples were collected.
- Six samples were taken from the vehicle maintenance area east of shop TA-33-39. In addition to these six samples, ten samples were collected from two overlapping SWMUs, SWMU 33-004(i) and SWMU 33-012(a), embedded in the vehicle maintenance area.

All 82 SWMU 33-017 samples were analyzed for inorganics, 80 for radionuclides by gamma spectroscopy and SVOCs, 75 for plutonium, 74 for uranium and tritium, 14 for herbicides, 9 for pesticides, and 4 for PCBs.

4.8.2.1 Results of Field Surveys

All sampling points were surveyed. No other field surveys were associated with SWMU 33-017.

4.8.2.2 Results of Field Screening

The Main Site radiation survey, described in Subsection 4.2.1.3 of the work plan, did not detect any radioactivity (LANL 1992, 0784). No radiation was detected during routine field screening of sampling locations at SWMU 33-017.

4.8.3 Screening Assessment

4.8.3.1 Comparison to Background/SALs

Tritium Because the source of tritium is considered to be the high-pressure tritium facility, a detailed analysis of all surface tritium at Main Site is included in the RFI Report for MDA K (in preparation). In that report, a risk assessment for tritium indicates that levels of activity detected in samples collected at Main site and MDA K present an acceptable risk. Input to the model included an industrial worker exposure unit, an inhalation exposure pathway, a contaminated volume 200 ft by 300 ft by 155 ft deep, and a 1993 activity of 11 900 pCi/g. Calculations indicated that the effective dose equivalent to a worker at the site would be 11.9 mrem/year under these extremely conservative conditions. The DOE allowable effective dose equivalent is 30 mrem/year (LANL 1995, in preparation).

Grid Samples Most grid samples were used to calculate background UTLs specific to TA-33. Results are assessed in detail in Subsection 3.2 of the TA-33 RFI Report LA-UR-95-882 (LANL 1995, 1212). The grid sample set contained some anomalous results. Plutonium-239 (0.174 pCi/g) was detected in sample AAA2089 collected about 50 ft north of the site of TA-33-21 (SWMU 33-005). Inorganic anomalies in grid samples are listed in Table 4-16. Organic analytes above detection limits are listed in Table 4-17. Location of all grid samples are shown in Fig. 4-8.

TABLE 4-16

INORGANIC CONTAMINATION ABOVE LANL AND TA-33 BACKGROUND UTLs IN SWMU 33-017 GRID SAMPLES

ANALYTE	SAMPLE ID	DEPTH (in.)	MEDIUM	CONCENTRATION (mg/kg)	LANL UTL[a] (mg/kg)	TA-33 UTL (mg/kg)	SAL[b] (mg/kg)
Arsenic	AAA2067	0-6	Soil	13.8	11.6	4.36	None
Cadmium	AAA2099	0-6	Soil	5.2	2.7	2.7	80
Chromium	AAA2099	0-6	Soil	35	33.5	20.7	400
Nickel	AAA2061	0-6	Soil	46	26.7	17	1 600
	AAA2075	0-6	Soil	69	26.7	17	1 600
	AAA2077	0-6	Soil	460	26.7	17	1 600
Lead	AAA2067	0-6	Soil	902	39	39	400
	AAA2082	0-6	Soil	90	39	39	400
	AAA2097	0-6	Soil	61	39	39	400
	AAA2105	0-6	Soil	60	39	39	400
	AAA2053	0-6	Soil	98	39	39	400
	AAA2054	0-6	Soil	200	39	39	400
Silver	AAA2092	0-6	Soil	2.3	ND[c]	ND	400
	AAA2099	0-6	Soil	4.6	ND	ND	400
	AAA2053	0-6	Soil	8.8	ND	ND	400
	AAA2054	0-6	Soil	46	ND	ND	400
Uranium	AAA2075	0-6	Soil	41.6	2.8	4.8	95
Zinc	AAA2067	0-6	Soil	217	101	62.3	24 000

[a] Upper tolerance limit.
[b] Screening action level.
[c] Not determined.

TABLE 4-17

ORGANICS DETECTED IN SWMU 33-017 GRID SAMPLES

SVOCS	SAMPLE ID	DEPTH (in.)	MEDIUM	RESULT (mg/kg)	SAL[a] (mg/kg)	EQL[b] (mg/kg)
Acenaphthene	AAA2054	0-6	Soil	0.75	4 800	Not listed
Acenaphthene	AAA2097	0-6	Soil	0.69	4 800	Not listed
Aniline	AAA2123	0-6	Soil	0.41	NC[c]	Not listed
Anthracene	AAA2053	0-6	Soil	0.85	24 000	0.33
Anthracene	AAA2054	0-6	Soil	1.2	24 000	0.33
Anthracene	AAA2077	0-6	Soil	0.36	24 000	0.33
Anthracene	AAA2097	0-6	Soil	0.95	24 000	0.33
Benzo[a]anthracene	AAA2053	0-6	Soil	4.1	1	0.33
Benzo[a]anthracene	AAA2054	0-6	Soil	3.5	1	0.33
Benzo[a]anthracene	AAA2077	0-6	Soil	1.3	1	0.33
Benzo[a]anthracene	AAA2097	0-6	Soil	2.1	1	0.33
Benzo[a]pyrene	AAA2053	0-6	Soil	4.7	0.1	0.33
Benzo[a]pyrene	AAA2054	0-6	Soil	4	0.1	0.33
Benzo[a]pyrene	AAA2077	0-6	Soil	1.4	0.1	0.33
Benzo[b]fluoranthene	AAA2053	0-6	Soil	6.2	1	0.33
Benzo[b]fluoranthene	AAA2054	0-6	Soil	5.2	1	0.33
Benzo[b]fluoranthene	AAA2077	0-6	Soil	1.8	1	0.33
Benzo[b]fluoranthene	AAA2097	0-6	Soil	3.8	1	0.33
Benzo[g,h,i]perylene	AAA2053	0-6	Soil	1.7	44	0.33
Benzo[g,h,i]perylene	AAA2054	0-6	Soil	3.1	44	0.33
Benzo[g,h,i]perylene	AAA2077	0-6	Soil	0.66	44	0.33
Benzo[k]fluoranthene	AAA2053	0-6	Soil	4.3	1	0.33
Benzo[k]fluoranthene	AAA2054	0-6	Soil	3.9	1	0.33
Benzo[k]fluoranthene	AAA2077	0-6	Soil	1.1	1	0.33
Benzo[k]fluoranthene	AAA2097	0-6	Soil	1.9	1	0.33
BHC [beta-]	AAA2070	0-6	Soil	0.0023	4	Not listed
Bis(2-ethylhexyl)phthalate	AAA2053	0-6	Soil	1.1	50	0.33
Bis(2-ethylhexyl)phthalate	AAA2054	0-6	Soil	1.2	50	0.33
Bis(2-ethylhexyl)phthalate	AAA2097	0-6	Soil	1.9	50	0.33
Bis(2-ethylhexyl)phthalate	AAA2110	0-6	Soil	3.2	50	0.33
Chrysene	AAA2053	0-6	Soil	5.5	96	0.33
Chrysene	AAA2054	0-6	Soil	4.6	96	0.33
Chrysene	AAA2077	0-6	Soil	1.6	96	0.33
Chrysene	AAA2097	0-6	Soil	2.4	96	0.33
D [2,4-]	AAA2069	0-6	Soil	1.89	NC	Not listed
DDE [p,p'-]	AAA2071	0-6	Soil	0.0014	NC	0.03
Di-n-butyl phthalate	AAA2075	0-6	Soil	0.5	8 000	0.33
Dibenzofuran	AAA2097	0-6	Soil	0.44	NC	0.33
Dibenzo[a,h]anthracene	AAA2053	0-6	Soil	0.59	0.086	0.33
Dieldrin	AAA2071	0-6	Soil	0.00083	NC	Not listed
Diethylphthalate	AAA2069	0-6	Soil	30	64 000	0.33
Dinoseb	AAA2069	0-6	Soil	0.692	NC	Not listed
Endrin	AAA2070	0-6	Soil	0.0023	NC	Not listed
Endrin	AAA2071	0-6	Soil	0.0027	NC	Not listed

TABLE 4-17

ORGANICS DETECTED IN SWMU 33-017 GRID SAMPLES

SVOCS	SAMPLE ID	DEPTH (In.)	MEDIUM	RESULT (mg/kg)	SAL[a] (mg/kg)	EQL[b] (mg/kg)
Fluoranthene	AAA2053	0-6	Soil	1.6	*3 200*	*0.33*
Fluoranthene	AAA2054	0-6	Soil	5.2	*3 200*	*0.33*
Fluoranthene	AAA2077	0-6	Soil	2.5	*3 200*	*0.33*
Fluoranthene	AAA2097	0-6	Soil	2.8	*3 200*	*0.33*
Fluoranthene	AAA2098	0-6	Soil	0.61	*3 200*	*0.33*
Fluorene	AAA2054	0-6	Soil	0.59	*3 200*	*0.33*
Fluorene	AAA2097	0-6	Soil	0.58	*3 200*	*0.33*
Indeno[1,2,3-cd]pyrene	AAA2053	0-6	Soil	2.2	*1*	*0.33*
Indeno[1,2,3-cd]pyrene	AAA2054	0-6	Soil	3.3	*1*	*0.33*
Indeno[1,2,3-cd]pyrene	AAA2077	0-6	Soil	0.82	*1*	*0.33*
Naphthalene	AAA2054	0-6	Soil	0.39	*3 200*	*0.33*
Naphthalene	AAA2097	0-6	Soil	0.93	*3 200*	*0.33*
Phenanthrene	AAA2053	0-6	Soil	4.7	*NC*	*0.33*
Phenanthrene	AAA2054	0-6	Soil	5.9	*NC*	*0.33*
Phenanthrene	AAA2077	0-6	Soil	1.5	*NC*	*0.33*
Phenanthrene	AAA2097	0-6	Soil	2.8	*NC*	*0.33*
Phenanthrene	AAA2098	0-6	Soil	0.39	*NC*	*0.33*
Pyrene	AAA2053	0-6	Soil	19.6	*2 400*	*0.33*
Pyrene	AAA2054	0-6	Soil	27.4	*2 400*	*0.33*
Pyrene	AAA2068	0-6	Soil	0.49	*2 400*	*0.33*
Pyrene	AAA2070	0-6	Soil	0.38	*2 400*	*0.33*
Pyrene	AAA2077	0-6	Soil	2.6	*2 400*	*0.33*
Pyrene	AAA2097	0-6	Soil	3.3	*2 400*	*0.33*
Pyrene	AAA2098	0-6	Soil	0.53	*2 400*	*0.33*
Pyrene	AAA2221	0-6	Soil	0.69	*2 400*	*0.33*
Pyrene	AAA2222	0-6	Soil	0.44	*2 400*	*0.33*

[a] SAL = Screening action levels.
[b] EQL = Estimated quantitation limits.
[c] NC = Not calculated due to insufficient toxicity data.

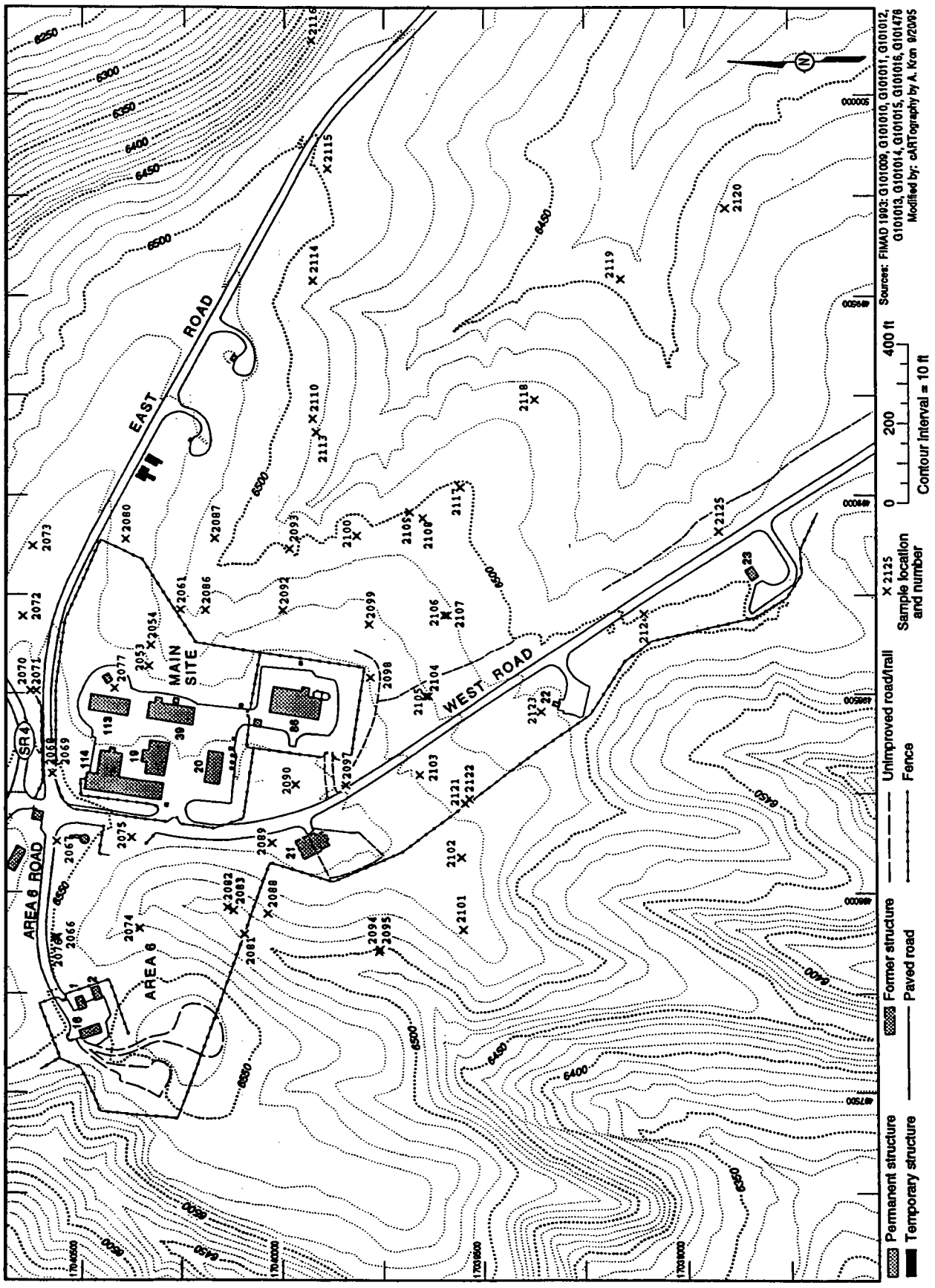


Fig. 4-8. Locations of grid samples assigned to SWMU 33-017.

Drainage Samples Four inorganics from the drainage samples exceeded LANL and TA-33 background UTLs (Table 4-18). Trace amounts of four organics were found above detection limits (Table 4-19). No other analyte concentrations were found above TA-33 and LANL background UTLs. No figure is given for these drainage samples.

TABLE 4-18

INORGANIC ANALYTES ABOVE LANL AND TA-33 BACKGROUND UTLs AT SWMU 33-017 DRAINAGES

ANALYTE	SAMPLE ID	DEPTH (in.)	MEDIUM	CONCENTRATION (mg/kg)	LANL UTL[a] (mg/kg)	TA-33 UTL (mg/kg)	SAL[b] (mg/kg)
Cadmium	AAA2061	0-6	Soil	3.3	2.7	2.7	80
Lead	AAA2055	0-6	Soil	40	39	39	400
	AAA2091	0-6	Soil	98	39	39	400
	AAA2195	0-6	Soil	100	39	39	400
Uranium	AAA2195	0-6	Soil	5.2	2.8	4.8	95
Zinc	AAA2056	0-6	Soil	110	101	62.3	24 000
	AAA2193	0-6	Soil	110	101	62.3	24 000
	AAA2061	0-6	Soil	750	101	62.3	24 000
	AAA2195	0-6	Soil	350	101	62.3	24 000

[a] Upper tolerance limit.
[b] Screening action level.

TABLE 4-19

ORGANIC ANALYTES ABOVE LANL AND TA-33 BACKGROUND UTLs AT SWMU 33-017 DRAINAGES

ANALYTE	SAMPLE ID	DEPTH (in.)	MEDIUM	CONCENTRATION (mg/kg)	EQL[a] (mg/kg)	SAL[b] (mg/kg)
Benzo(b)fluoranthene	AAA2055	0-6	Soil	0.44	0.33	1
Fluoranthene	AAA2056	0-6	Soil	0.41	0.33	3 200
	AAA2064	0-6	Soil	0.72	0.33	3 200
Phenanthrene	AAA2056	0-6	Soil	0.37	0.33	ND[c]
	AAA2064	0-6	Soil	0.59	0.33	ND[c]
Pyrene	AAA2055	0-6	Soil	0.71	0.33	2 400
	AAA2056	0-6	Soil	0.36	0.33	2 400
	AAA2064	0-6	Soil	0.66	0.33	2 400

[a] Estimated quantitation limit.
[b] Screening action level.
[c] Not determined.

Vehicle Maintenance Located within the vehicle maintenance area east of shop TA-33-39 are overlapping SWMUs 33-004(i) and 33-012(a). These SWMUs were discussed in depth in RFI Report LA-UR-95-882, Subsections 4.4 and 4.9 (LANL 1995, 1212). Elevated levels of lead were detected in most samples from the area east of the shop. As a means of dealing with the overlapping PRSs, all inorganic contamination was ascribed to SWMU 33-004(i), outfalls from the shop, because the shop contained a lead melting facility. Fig. 4-9 shows the relationship of these overlapping SWMUs.

Inorganics and SVOCs were detected in 14 of the 16 samples taken in the vehicle maintenance area. Seven samples contained PAHs above SAL. Because SVOCs are logically associated with maintenance activities, this contamination is ascribed to SWMU 33-017. Table 4-20 lists inorganics detected in the vehicle maintenance area. Table 4-21 lists the SVOCs. TICs were detected in all SVOC samples.

4.8.3.2 Data Interpretation

SVOCs, specifically cPAHs, were found in the vehicle maintenance area at levels that exceeded SALs. With the exception of lead, inorganics, radionuclides, herbicides, and pesticides were below SALs. SVOCs and PCBs are discussed in the Appendix B sampling and analysis plan for SWMU 33-017.

The area east of TA-33-39, represented by six samples from SWMU 33-004(i), four samples from SWMU 33-012(a), three samples from the vehicle maintenance area, and four samples from the main drainage, appears to have widespread above-background concentrations of lead and zinc, plus a few above-background observations of nickel and chromium. These analytes are addressed in a separate RFI report LA-UR-95-882 (LANL 1995, 1212). Three samples from SWMU 33-012(a) were analyzed for PCBs. Sample AAA2032 contained 2.3 mg/kg PCBs and sample AAA2034 contained 0.25 mg/kg. PCB migration at Main Site is addressed under area of concern (AOC) C-33-001 in Subsection 5.4 of this RFI report.

4.8.3.3 Risk Assessment

Lead results were included in the SWMU 33-004(i) preliminary risk assessment described in RFI Report LA-UR-95-882, Subsection 4.4. Results indicate that although lead contamination is widespread in the area east of TA-33-39, it would not pose a risk to the most sensitive population, children under seven years (LANL 1995, 1212). Because SWMU 33-004(i) is embedded SWMU 33-017, calculations for this risk assessment are repeated in Appendix D of this RFI report for completeness in dealing with SWMU 33-017. According to EPA, an acceptable risk for lead exposure is less than 5% of the population expected to have blood lead

TABLE 4-20

INORGANICS DETECTED ABOVE LANL AND TA-33 BACKGROUND UTLs AT SWMU 33-017 VEHICLE MAINTENANCE AREA

ANALYTE	SAMPLE ID	DEPTH (in.)	MEDIUM	RESULT (mg/kg)	LANL UTL[a] (mg/kg)	TA-33 UTL (mg/kg)	SAL[b] (mg/kg)
Chromium	AAA2051	0-6	Soil	84	34.2	20.7	400
Chromium	AAA1978	0-6	Soil	60	34.2	20.7	400
Lead	AAA2049	0-6	Soil	64	39	39	1 600
Lead	AAA2050	0-6	Soil	90	39	39	400
Lead	AAA2051	0-6	Soil	170	39	39	400
Lead	AAA2052	0-6	Soil	46	39	39	400
Lead	AAA2053	0-6	Soil	98	39	39	400
Lead	AAA2054	0-6	Soil	200	39	39	400
Lead	AAA1976	0-6	Soil	79	39	39	400
Lead	AAA1977	0-6	Soil	73	39	39	400
Lead	AAA1978	0-6	Soil	800	39	39	400
Lead	AAA1979	0-6	Soil	71	39	39	400
Lead	AAA1980	0-6	Soil	210	39	39	400
Lead	AAA2031	0-6	Soil	104	39	39	400
Lead	AAA2032	0-6	Soil	118	39	39	400
Lead	AAA2033	0-6	Soil	53	39	39	400
Nickel	AAA2051	0-6	Soil	73	26.7	17	1 600
Nickel	AAA2052	0-6	Soil	87	26.7	17	1 600
Nickel	AAA2053	0-6	Soil	35	26.7	17	1 600
Silver	AAA2053	0-6	Soil	8.8	NC[c]	NC	400
Silver	AAA2054	0-6	Soil	46	NC	NC	400
Uranium	AAA2052	0-6	Soil	3.6	2.82	4.84	95
Uranium	AAA2053	0-6	Soil	3.5	2.82	4.84	95
Uranium	AAA2054	0-6	Soil	4.2	2.82	4.84	95
Uranium	AAA1976	0-6	Soil	3.1	2.82	4.84	95
Uranium	AAA1977	0-6	Soil	3.9	2.82	4.84	95
Zinc	AAA2049	0-6	Soil	730	101	62.3	24 000
Zinc	AAA2050	0-6	Soil	530	101	62.3	24 000
Zinc	AAA2051	0-6	Soil	1 700	101	62.3	24 000
Zinc	AAA2053	0-6	Soil	330	101	62.3	24 000
Zinc	AAA2054	0-6	Soil	350	101	62.3	24 000
Zinc	AAA1976	0-6	Soil	210	101	62.3	24 000
Zinc	AAA1977	0-6	Soil	120	101	62.3	24 000
Zinc	AAA1980	0-6	Soil	130	101	62.3	24 000
Zinc	AAA2031	0-6	Soil	820	101	62.3	24 000
Zinc	AAA2032	0-6	Soil	610	101	62.3	24 000
Zinc	AAA2033	0-6	Soil	210	101	62.3	24 000

[a] UTL = Upper tolerance limit.
[b] SAL = Screening action level.
[c] NC = Not calculated due to insufficient data above detection limit.

TABLE 4-21

ORGANICS DETECTED AT SWMU 33-017 VEHICLE MAINTENANCE AREA

ANALYTE	SAMPLE ID	DEPTH (in.)	MEDIUM	RESULT (mg/kg)	SAL[a] (mg/kg)	EQL[b] (mg/kg)
Acenaphthene	AAA2051	0-6	Soil	0.47	4 800	Not listed
Acenaphthene	AAA2054	0-6	Soil	0.75	4 800	Not listed
Acenaphthene	AAA1976	0-6	Soil	0.63	4 800	Not listed
Acenaphthene	AAA1979	0-6	Soil	0.47	4 800	Not listed
Anthracene	AAA2051	0-6	Soil	2.3	24 000	0.33
Anthracene	AAA2053	0-6	Soil	0.85	24 000	0.33
Anthracene	AAA2054	0-6	Soil	1.2	24 000	0.33
Anthracene	AAA1976	0-6	Soil	0.94	24 000	0.33
Anthracene	AAA1978	0-6	Soil	0.69	24 000	0.33
Anthracene	AAA1979	0-6	Soil	0.92	24 000	0.33
Benzo[a]anthracene	AAA2051	0-6	Soil	8.2	1	0.33
Benzo[a]anthracene	AAA2053	0-6	Soil	4.1	1	0.33
Benzo[a]anthracene	AAA2054	0-6	Soil	3.5	1	0.33
Benzo[a]anthracene	AAA2032	0-6	Soil	0.51	1	0.33
Benzo[a]anthracene	AAA1976	0-6	Soil	1.8	1	0.33
Benzo[a]anthracene	AAA1977	0-6	Soil	0.39	1	0.33
Benzo[a]anthracene	AAA1978	0-6	Soil	1.3	1	0.33
Benzo[a]anthracene	AAA1979	0-6	Soil	1.6	1	0.33
Benzo[a]anthracene	AAA1980	0-6	Soil	0.6	1	0.33
Benzo[a]pyrene	AAA2051	0-6	Soil	7.5	0.1	0.33
Benzo[a]pyrene	AAA2053	0-6	Soil	4.7	0.1	0.33
Benzo[a]pyrene	AAA2054	0-6	Soil	4	0.1	0.33
Benzo[a]pyrene	AAA1976	0-6	Soil	0.64	0.1	0.33
Benzo[a]pyrene	AAA1978	0-6	Soil	0.86	0.1	0.33
Benzo[a]pyrene	AAA1979	0-6	Soil	1.3	0.1	0.33
Benzo[a]pyrene	AAA1980	0-6	Soil	0.62	0.1	0.33
Benzo[b]fluoranthene	AAA2049	0-6	Soil	0.34	0.7	0.33
Benzo[b]fluoranthene	AAA2051	0-6	Soil	9.8	1	0.33
Benzo[b]fluoranthene	AAA2053	0-6	Soil	6.2	1	0.33
Benzo[b]fluoranthene	AAA2054	0-6	Soil	5.2	1	0.33
Benzo[b]fluoranthene	AAA2032	0-6	Soil	0.43	1	0.33
Benzo[b]fluoranthene	AAA1976	0-6	Soil	1.1	1	0.33
Benzo[b]fluoranthene	AAA1977	0-6	Soil	0.45	1	0.33
Benzo[b]fluoranthene	AAA1978	0-6	Soil	1.5	1	0.33
Benzo[b]fluoranthene	AAA1979	0-6	Soil	3.1	1	0.33
Benzo[b]fluoranthene	AAA1980	0-6	Soil	0.8	1	0.33
Benzo[g,h,i]perylene	AAA2051	0-6	Soil	3.1	NC[c]	0.33
Benzo[g,h,i]perylene	AAA2053	0-6	Soil	1.7	NC	0.33
Benzo[g,h,i]perylene	AAA2054	0-6	Soil	3.1	NC	0.33
Benzo[k]fluoranthene	AAA2049	0-6	Soil	0.34	1	0.33
Benzo[k]fluoranthene	AAA2051	0-6	Soil	7.1	1	0.33
Benzo[k]fluoranthene	AAA2053	0-6	Soil	4.3	1	0.33

TABLE 4-21 (CONTINUED)

ORGANICS DETECTED AT SWMU 33-017 VEHICLE MAINTENANCE AREA

ANALYTE	SAMPLE ID	DEPTH (in.)	MEDIUM	RESULT (mg/kg)	SAL[a] (mg/kg)	EQL[b] (mg/kg)
Benzo[k]fluoranthene	AAA2054	0-6	Soil	*3.9*	*1*	*0.33*
Benzo[k]fluoranthene	AAA2032	0-6	Soil	0.52	*1*	*0.33*
Benzo[k]fluoranthene	AAA1978	0-6	Soil	0.36	*1*	*0.33*
Benzo[k]fluoranthene	AAA1980	0-6	Soil	0.57	*1*	*0.33*
Bis(2-ethylhexyl)phthalate	AAA2049	0-6	Soil	1.4	*50*	*0.33*
Bis(2-ethylhexyl)phthalate	AAA2051	0-6	Soil	0.92	*50*	*0.33*
Bis(2-ethylhexyl)phthalate	AAA2053	0-6	Soil	1.1	*50*	*0.33*
Bis(2-ethylhexyl)phthalate	AAA2054	0-6	Soil	1.2	*50*	*0.33*
Bis(2-ethylhexyl)phthalate	AAA2031	0-6	Soil	1.1	*50*	*0.33*
Bis(2-ethylhexyl)phthalate	AAA2032	0-6	Soil	1.3	*50*	*0.33*
Chrysene	AAA2049	0-6	Soil	0.35	*96*	*0.33*
Chrysene	AAA2051	0-6	Soil	9.2	*96*	*0.33*
Chrysene	AAA2053	0-6	Soil	5.5	*96*	*0.33*
Chrysene	AAA2054	0-6	Soil	4.6	*96*	*0.33*
Chrysene	AAA2032	0-6	Soil	0.54	*96*	*0.33*
Chrysene	AAA1976	0-6	Soil	2	*96*	*0.33*
Chrysene	AAA1977	0-6	Soil	0.54	*96*	*0.33*
Chrysene	AAA1978	0-6	Soil	1.5	*96*	*0.33*
Chrysene	AAA1979	0-6	Soil	1.5	*96*	*0.33*
Chrysene	AAA1980	0-6	Soil	0.64	*96*	*0.33*
Dibenzo[a,h]anthracene	AAA2053	0-6	Soil	*0.59*	*0.1*	*0.33*
Fluoranthene	AAA2049	0-6	Soil	0.65	*3 200*	*0.33*
Fluoranthene	AAA2051	0-6	Soil	20.1	*3 200*	*0.33*
Fluoranthene	AAA2053	0-6	Soil	1.6	*3 200*	*0.33*
Fluoranthene	AAA2054	0-6	Soil	5.2	*3 200*	*0.33*
Fluoranthene	AAA2032	0-6	Soil	0.68	*3 200*	*0.33*
Fluoranthene	AAA1975	0-6	Soil	0.44	*3 200*	*0.33*
Fluoranthene	AAA1976	0-6	Soil	2.7	*3 200*	*0.33*
Fluoranthene	AAA1977	0-6	Soil	0.54	*3 200*	*0.33*
Fluoranthene	AAA1978	0-6	Soil	1.4	*3 200*	*0.33*
Fluoranthene	AAA1980	0-6	Soil	1.3	*3 200*	*0.33*
Fluorene	AAA2054	0-6	Soil	0.59	*3 200*	*0.33*
Fluorene	AAA1976	0-6	Soil	0.38	*3 200*	*0.33*
Fluorene	AAA1979	0-6	Soil	0.33	*3 200*	*0.33*
Indeno[1,2,3-cd]pyrene	AAA2051	0-6	Soil	*4.2*	*1*	*0.33*
Indeno[1,2,3-cd]pyrene	AAA2053	0-6	Soil	*2.2*	*1*	*0.33*
Indeno[1,2,3-cd]pyrene	AAA2054	0-6	Soil	*3.3*	*1*	*0.33*
Naphthalene	AAA2054	0-6	Soil	0.39	*3 200*	*0.33*
Phenanthrene	AAA2051	0-6	Soil	12.6	*None*	*0.33*
Phenanthrene	AAA2052	0-6	Soil	0.34	*None*	*0.33*
Phenanthrene	AAA2053	0-6	Soil	4.7	*None*	*0.33*
Phenanthrene	AAA2054	0-6	Soil	5.9	*None*	*0.33*
Phenanthrene	AAA2032	0-6	Soil	0.96	*None*	*0.33*

TABLE 4-21 (CONTINUED)

ORGANICS DETECTED AT SWMU 33-017 VEHICLE MAINTENANCE AREA

ANALYTE	SAMPLE ID	DEPTH (in.)	MEDIUM	RESULT (mg/kg)	SAL[a] (mg/kg)	EQL[b] (mg/kg)
Phenanthrene	AAA1976	0-6	Soil	3.8	*None*	*0.33*
Phenanthrene	AAA1977	0-6	Soil	0.5	*None*	*0.33*
Phenanthrene	AAA1978	0-6	Soil	2.5	*None*	*0.33*
Phenanthrene	AAA1979	0-6	Soil	2.9	*None*	*0.33*
Phenanthrene	AAA1980	0-6	Soil	1.2	*None*	*0.33*
Pyrene	AAA2049	0-6	Soil	0.92	*2 400*	*0.33*
Pyrene	AAA2050	0-6	Soil	0.35	*2 400*	*0.33*
Pyrene	AAA2051	0-6	Soil	26.7	*2 400*	*0.33*
Pyrene	AAA2052	0-6	Soil	1.7	*2 400*	*0.33*
Pyrene	AAA2053	0-6	Soil	19.6	*2 400*	*0.33*
Pyrene	AAA2054	0-6	Soil	27.4	*2 400*	*0.33*
Pyrene	AAA2032	0-6	Soil	2.1	*2 400*	*0.33*
Pyrene	AAA1975	0-6	Soil	0.51	*2 400*	*0.33*
Pyrene	AAA1976	0-6	Soil	4.5	*2 400*	*0.33*
Pyrene	AAA1977	0-6	Soil	1.4	*2 400*	*0.33*
Pyrene	AAA1978	0-6	Soil	4.2	*2 400*	*0.33*
Pyrene	AAA1979	0-6	Soil	2.3	*2 400*	*0.33*
Pyrene	AAA1980	0-6	Soil	1.6	*2 400*	*0.33*

[a] SAL = Screening action level.
[b] EQL = Estimated quantitation limit.
[c] NC = Not calculated due to insufficient toxicity data.

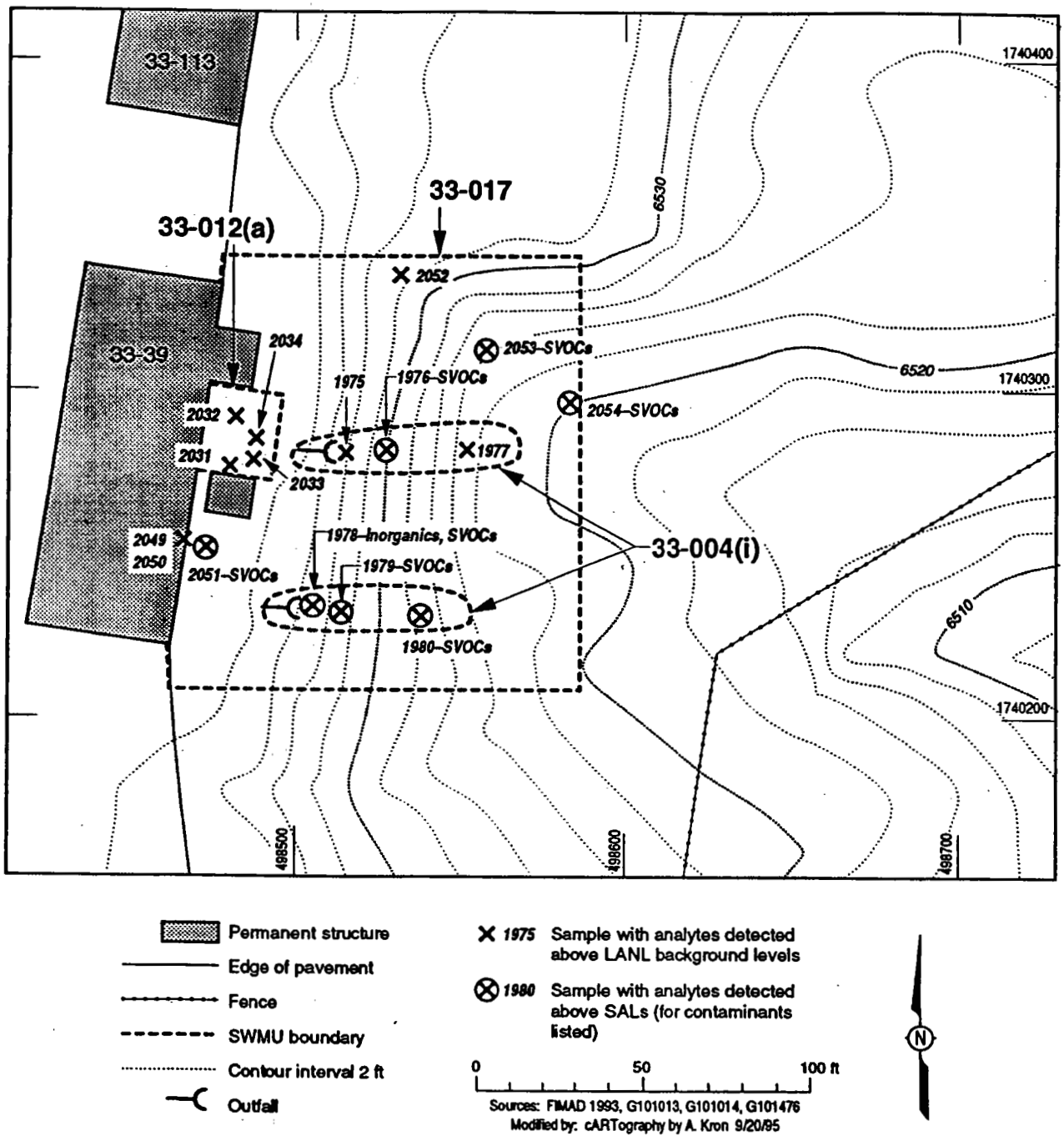


Fig. 4-9. Main Site: SWMU 33-017, vehicle maintenance area risk assessment exposure area showing overlapping SWMUs 33-004(i) and 33-012(a).

levels of greater than 10 µg/dL. Results of the modeling effort for TA-33 reveal that 1.66% of a hypothetical population of children exposed to 416.3 mg/kg of lead would exceed the standard value of 10 µg/dL, indicating that adverse health effects from lead exposure are unlikely at this site.

The same exposure unit used for lead, approximately 0.15 acres east of TA-33-39, was used for a preliminary risk assessment for the PAHs (Fig. 4-9). Risk assessment calculations for SWMU 33-017 are presented in Appendix D of this RFI report. Results show that the estimated carcinogenic risk to construction workers is low at both the mean and the 95% UCL concentrations: 2.7E-07 and 5.6E-07, respectively. Estimated risk to future residents based on the mean PAH concentration is 3.1E-06 and when based on all seven 95% UCLs, estimated risk rises to 2.1E-05.

4.8.3.4 Ecotoxicological Screening Assessment

A global ecotoxicological assessment is presented in Subsection 3.2.3 of this RFI report.

4.8.4 Conclusion and Recommendation

Based on results of this preliminary risk assessment for SVOCs, further study will be taken in this exposure unit, which includes the area extending approximately 130 ft east of shop TA-33-39. Phase II sampling will collect additional samples in the vicinity of the elevated SVOCs to refine level and extent of contamination (Appendix B).

5.0 REVISED PHASE I SAMPLING AND ANALYSIS PLANS

Information gathered since the RFI work plan LA-UR-92-925 was submitted in May 1992 indicates that six sampling plans are inadequate or inappropriate. Therefore, revised sampling plans for the PRSs listed in Table 5-1 are submitted in Section 5.0.

5.1 SWMU 33-003(b) MDA-D, East Site

SWMU 33-003(b) is underground experimental chamber TA-33-6 at MDA D. It is discussed in the RFI Work Plan for OU 1122, Subsections 3.5.2.1 and 4.5.3.1 (LANL 1992, 0784). No action is proposed for the chamber based on an assessment of exposure pathways. A Phase II sampling plan is presented for the surface and subsurface soil component of SWMU 33-003(b).

TABLE 5-1

PRSs WITH REVISED SAMPLING PLANS

PRS[a]	DESCRIPTION	REASON FOR REVISION
33-003(b)	MDA D subsurface	Possible PCB[b] contamination
33-004(k)	Outfall from TA-33-87	Outfall not located in 1994 campaign.
33-008(a)	Landfill at East Site	New information on contents
33-008(b)	Landfill at South Site	New information on contents
C-33-001	Transformer at Main Site	Phase I sampling plan for PCBs
C-33-002	Transformer at East Site	Phase I sampling plan for PCBs

[a] PRS = Potential release site.
[b] PCB = Polychlorinated biphenyl.

The chamber was constructed in 1948. It is an 18 ft by 18 ft octagonal, vault-like structure 11 ft high, buried with the roof approximately 30 ft below grade. Access was through a 4 ft by 6 ft elevator shaft at the side of the chamber. The elevator shaft, now filled, was approximately 46 ft deep. Remaining surface indications of the chamber include only an 8 ft by 12 ft concrete pad broken at the east end where the shaft was located. A 6 ft by 10 ft depression remains in the area of the shaft.

The chamber was used for initiator tests involving milligram quantities of beryllium. Polonium-210 (half-life 138 days) was used as a source of alpha particles. Chamber TA-33-6 was used twice, once in December 1948 and again in April 1952. The second test destroyed the chamber. Debris from the test was ejected through the elevator shaft and spread over the mesa. A 10-ft deep crater formed around the chamber (Blackwell 1952, 02-034). The crater was later filled with the ejected debris and covered with uncontaminated soil (Blackwell 1953, 02-035). In 1963 the depression was refilled (Zia Company 1963, 02-030).

MDA D is located at East Site. The mesa is level enough so that drainage patterns are not evident. The area is covered with weeds interspersed with a few chamisa shrubs. The chamber TA-33-6 concrete pad lies approximately 50 ft north of the East Site Road near septic tank TA-33-96 and approximately 350 ft south of the rim of Ancho Canyon.

5.1.1 Previous Investigation

Existing surface data for SWMU 33-003(b) at East Site includes 16 surface soil samples collected by LANL's Environmental Surveillance Program in 1977. The surveillance samples were analyzed for tritium, uranium, and cesium-137; all results were within background ranges. These data are summarized in the RFI Work Plan for OU 1122 (LANL 1992, 0784).

In 1989 Weston personnel conducted sampling at three boreholes at TA-33-6. Nine subsurface samples were collected. Seven were analyzed for uranium, six for inorganics, and seven for HE. Three samples were analyzed for VOCs. Results are discussed in Subsection 5.1.3.1 of this RFI report. Weston borehole logs indicate the following subsurface materials were encountered:

- LAN33-0023: This borehole was drilled into the elevator shaft to a total depth of 47 ft. Matrix consisted of fill material with gravel, sand, and tuff fragments. Wood was encountered between 8 and 23 ft. Gravel persisted to 28 ft. Rusty wire, metal clips, and chain fragments were encountered at 43 ft. Three samples were taken from the shaft.

- LAN33-0024: This borehole was drilled atop the chamber to a depth of 29 ft. Matrix consisted of tuff fill. The surface sample had numerous small, glass fragments. At 18 ft, the drill encountered a void. Below the void, sand and gravel were intermixed with tuff material. The concrete roof of the chamber was encountered at 29 ft. Two samples were taken from the borehole.

- LAN33-0025: This borehole was drilled adjacent to the chamber to a depth of 58 ft. The matrix consisted of fill material (sand and gravel) mixed with tuff. The upper 1.5 ft consisted of native soil. Four samples were taken from the borehole.

5.1.2 Field Investigation

In 1994 LANL ER Project sampling at East Site included five surface samples taken north of the chamber. Additional surface samples were taken in the drain field of SWMU 33-004(c). All samples were analyzed for inorganics, gamma emitters, and HE.

In 1994 an archival search was conducted to determine the probable contents of the chambers, with emphasis on the composition of the neutron counters. The search revealed the following: steel, copper, and aluminum were present in kilogram amounts; lead from solder was probably present in gram amounts. Capacitors used in the chamber may have contained less than 5 lb total of PCBs. No shielding material (lead, cadmium, paraffin) was used, nor were scintillation fluids or uranium (Morgan 1994, 02-088). Beryllium was present in milligram amounts. Polonium-210 (half-life 138 days) has decayed to undetectable levels.

5.1.2.1 Results of Field Surveys

All sampling points were surveyed. No other field surveys were associated with SWMU 33-003(b).

5.1.2.2 Results of Field Screening

No radiation was detected during routine field screening of sampling locations at SWMU 33-003(b).

5.1.3 Screening Assessment

5.1.3.1 Comparison to Background/SALs

Chamber Analytes above background UTLs were detected only in Weston samples from the LAN33-0023 borehole drilled into the elevator shaft. No analytes were detected above background UTLs in Weston boreholes LAN33-0024 and LAN33-0025. Results from borehole LAN33-0023 are presented in Table 5-2. Weston results have not received LANL ER QA/QC data validation and are presented for information purposes only.

TABLE 5-2

ANALYTES DETECTED ABOVE LANL AND TA-33 BACKGROUND UTLS IN THE TA-33-6 ELEVATOR SHAFT

ANALYTE	SAMPLE ID	DEPTH (ft)	MEDIUM	CONCENTRATION (mg/kg)	LANL UTL[a] (mg/kg)	TA-33 UTL (mg/kg)	SAL[b] (mg/kg)
Cadmium	33-0023-2	38-43	Fill	7.1	2.7	2.7	80
	33-0023-3	43-47	Fill	4.9	2.7	2.7	80
Mercury	33-0023-2	38-43	Fill	2.1	0.1	NA[c]	24
	33-0023-3	43-47	Fill	1.1	0.1	NA	24
Lead	33-0023-2	38-43	Fill	79	39	39	400
Zinc	33-0023-2	38-43	Fill	852	101	62.3	24 000
	33-0023-3	43-47	Fill	652	101	62.3	24 000

[a] Upper tolerance limit.
[b] Screening action level.

Surface Area In 1994 LANL ER personnel conducted surface sampling in the vicinity of the chamber. Analyses for gamma emitters and inorganics did not detect concentrations above LANL and TA-33 background UTLs, with the exception of a possibly anomalous mercury concentration of 0.02 mg/kg in sample AAA9608. A laboratory reanalysis of sample AAA9608 did not detect mercury. Location of Weston and ER sampling points is shown in Fig. 5-1.

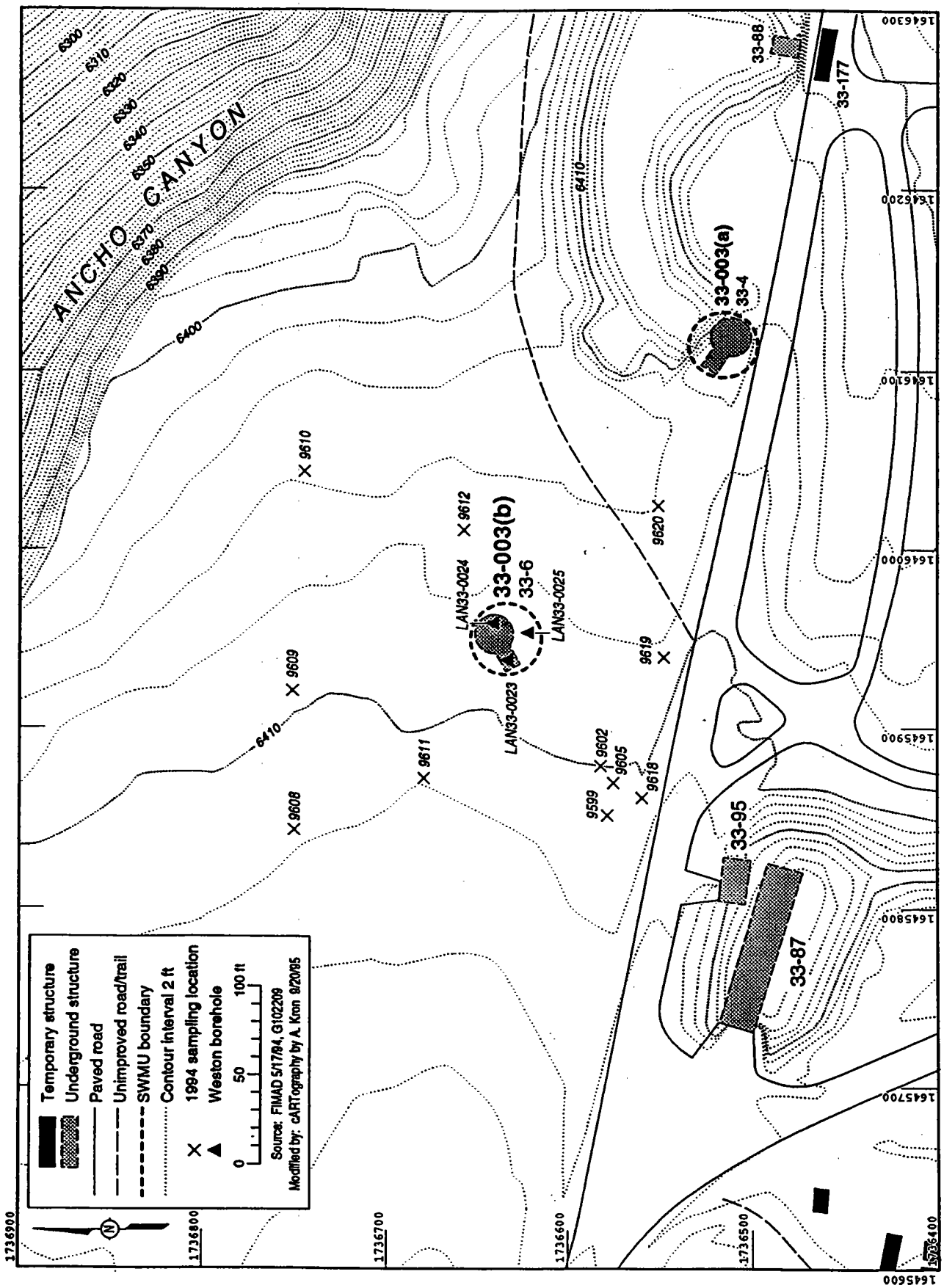


Fig. 5-1. East Site: SWMU 33-003(b) Weston boreholes and ER 1994 sampling campaign.

5.1.3.2 Data Interpretation

Results of sampling and analysis indicate that no inorganics or radionuclides are present at hazardous levels in the area surrounding the chamber. At the time of sampling, PCBs were not recognized as a potential contaminant.

5.1.3.3 Risk Assessment

No risk assessment was performed for SWMU 33-003(b). The following is a discussion of the pathway from the chamber to receptors. It does not address surface or subsurface contamination.

No remediation is recommended for chamber TA-33-6. This chamber is identical to chamber TA-33-4, described in Subsection 4.1. The rationale against further action is described in detail in Subsection 4.1.3.3 of this RFI report and is summarized here.

The source of contamination at the MDA D chambers is material within the underground chambers and possibly the elevator shafts. Based upon documentation of experiments conducted at MDA D, materials that may be present in the underground chambers include steel, copper, aluminum, PCBs, zinc, and milligram or gram amounts of beryllium and lead. The HE trinitrotoluene and its detonation products may also be present. Some electrical components of the tests may have contained PCBs and the chambers may contain PCBs in amounts estimated to be less than 5 lb (Morgan 1994, 02-088). No research data on the fate of PCBs under explosive conditions similar to those within the chamber can be found. It is not known what percentage of the PCBs remained intact and what percentage are present as combustion products.

For chamber TA-33-6, SWMU 33-003(b), the immediate transport mechanism was atmospheric dispersion. This mechanism potentially brought contaminants to the surface. This mechanism will be investigated in accordance with the sampling plan presented in Subsection 5.1.5 of this RFI report. The only current transport medium for any contaminants that remained in the chamber after detonation would be through soil sifting through cracks in the chamber or through the material used to backfill the elevator shaft. Migration is unlikely because these contaminants are most likely to bind to the subsurface fill material, the tuff walls of the shaft, and the concrete walls of the chamber. Any remaining PCBs, especially the more heavily chlorinated PCBs, will bind to organic material in the soil or to tuff rubble that may have entered the chamber.

The potential for future migration of PCBs and other contaminants from the chamber is negligible because of the minimum potential for migration discussed in the preceding paragraph and the inaccessibility of contaminated material in the chamber to potential receptors. Because the floor of the chamber is approximately 50 ft below grade, contaminants are not accessible to LANL workers or visitors. A potential future construction scenario is unlikely to expose workers to chamber contamination because a typical excavation would not occur at depths greater than 12 ft, the average depth of a basement. A residential scenario would not expose homeowners to contamination. For these reasons no remediation is recommended for the chamber.

The risk to groundwater is considered negligible. MDA D is located 660 ft above the nearest spring on the floor of Ancho Canyon. No springs have been located on the side of the canyon. No driving force exists in the chambers to force contaminants through cracks in both tuff and basalt layers to groundwater.

5.1.4 Conclusion and Recommendation

Based on the argument in Subsection 5.1.3.2 that no pathway exists for contamination to reach a receptor, no further investigation of chamber TA-33-6 will be carried out. However, sampling prescribed by the RFI work plan was not sufficient to characterize material bulldozed into the crater created by the 1952 test, nor were PCBs considered a potential contaminant. Therefore, additional Phase I surface and subsurface sampling are proposed for SWMU 33-003(b).

5.1.5 Phase I Revised Sampling and Analysis Plan

5.1.5.1 Phase I Sampling Objectives

Existing surface data for SWMU 33-003(b) at East Site includes 16 surface soil samples collected by LANL's Environmental Surveillance program, and 9 samples collected from 3 boreholes for the 1989 Weston investigation. The surveillance samples were analyzed for tritium, uranium, and cesium-137, and all results were within background ranges. The Weston borehole samples were analyzed for inorganics, HE, and radionuclides. Results were below detection limits or background UTLs. Surface sampling in 1994 did not detect inorganics above background UTLs.

Concerns that are inadequately addressed by the existing data are:

- Previous surface data are primarily from locations within approximately 50 ft of TA-33-6. However, following destruction of the chamber by a large experiment that ejected debris from the shaft, debris and soil were bulldozed back into the crater. It is possible that the area sampled in 1977 either had been scraped off, or consisted of uncontaminated soil used to cover the bulldozed material, while contaminants above background and possibly even above levels of concern may remain at greater distances from the elevator shaft.

- The Weston survey provided two samples from the refilled volume of the crater; that is, the debris and material for which above background field radioactivity measurements were reported in 1953.

Phase I sampling at PRS 33-003(b) is intended to address these concerns, to provide data for risk assessment, and (if appropriate) to provide information on the mobility of buried contaminants (Fig 5-2).

- **Surface samples** A 100 ft by 100 ft grid-stratified random sampling scheme will provide 9 surface samples out to a distance of 150 to 200 ft from the elevator shaft. One sample will be taken from each square, with the sample location randomly selected within each square. Sampling will be conducted north of the East Site road and will avoid other SWMUs when possible.

- **Subsurface samples** Two holes drilled near the shaft will provide six samples from depths of 2 ft to a minimum of 15 ft within the bulldozed debris.

All 15 samples will be field screened for PCBs using the PCB D TECH™ kit. PCB-screened samples exceeding 1 mg/kg will be submitted for fixed laboratory analysis. Subsurface samples will also be analyzed for inorganics. Results of inorganic analyses from the ER 1994 surface sampling points are adequate to address surface inorganic concerns. Toxicity characteristic leaching procedure (TCLP) analyses will be performed on subsurface samples if the total inorganics results (in mg/kg) exceed twenty times the TCLP limit (in mg/L).TCLP analyses will determine if buried constituents are leachable.

5.1.5.2 Sampling and Analysis

Phase I sampling will focus on determining the presence of inorganics and PCBs at SWMU 33-003(b). All samples will be field screened for radioactivity to identify gross concentrations of contaminants. Appropriate health and safety precautions will be undertaken according to the site-specific health and safety plan.

Sampling Techniques Surface soil samples will be collected with the spade and scoop technique (LANL-ER-SOP-06.09) to a depth of 6 in. Subsurface samples will be collected with a hollow-stem auger drill rig outfitted with a continuous sample collection system (LANL-ER-SOP-04.01) and will be advanced to a depth of 15 ft. The 15 ft depth is designed to ensure detection of contamination below the clean fill and/or scraped surface horizon.

The SWMU includes two target areas

- **Elevator shaft** Nine surface soil samples (0 to 6 in.) will be collected. The 9 grid-stratified random samples taken from a 100 ft by 100 ft grid will result in sampling to a distance of approximately 150 to 200 ft from the shaft (Fig. 5-2). These random samples will be field screened for PCBs.

- **Borehole samples** Two hollow-stem auger boreholes adjacent to the shaft will be drilled to a nominal depth of 15 ft. If soil texture or color indicates that the boreholes are not below the bottom of the former depression , the boreholes will be advanced below 15 ft until that interface is reached. These boreholes will be located within 8 ft of the shaft and will provide 3 analytical samples each. Analytical samples will be collected below the cover fill layer and above the bottom of the former depression. Selection of analytical sample intervals will be based upon observed changes in soil color and texture. Analytical samples will be a minimum depth interval of 6 in. each. See Fig. 5-2 for planned sample locations.

Laboratory Analysis Subsurface analytical samples will be field screened by X-ray fluorescence (XRF) or laser-induced breakdown spectroscopy (LIBS) for inorganics. All samples for which the inorganic concentration exceeds 20 times the TCLP limits will be submitted to the laboratory for TCLP analyses. Any sample measuring 1 mg/kg PCBs or above by field screening will be submitted for fixed-laboratory analysis.

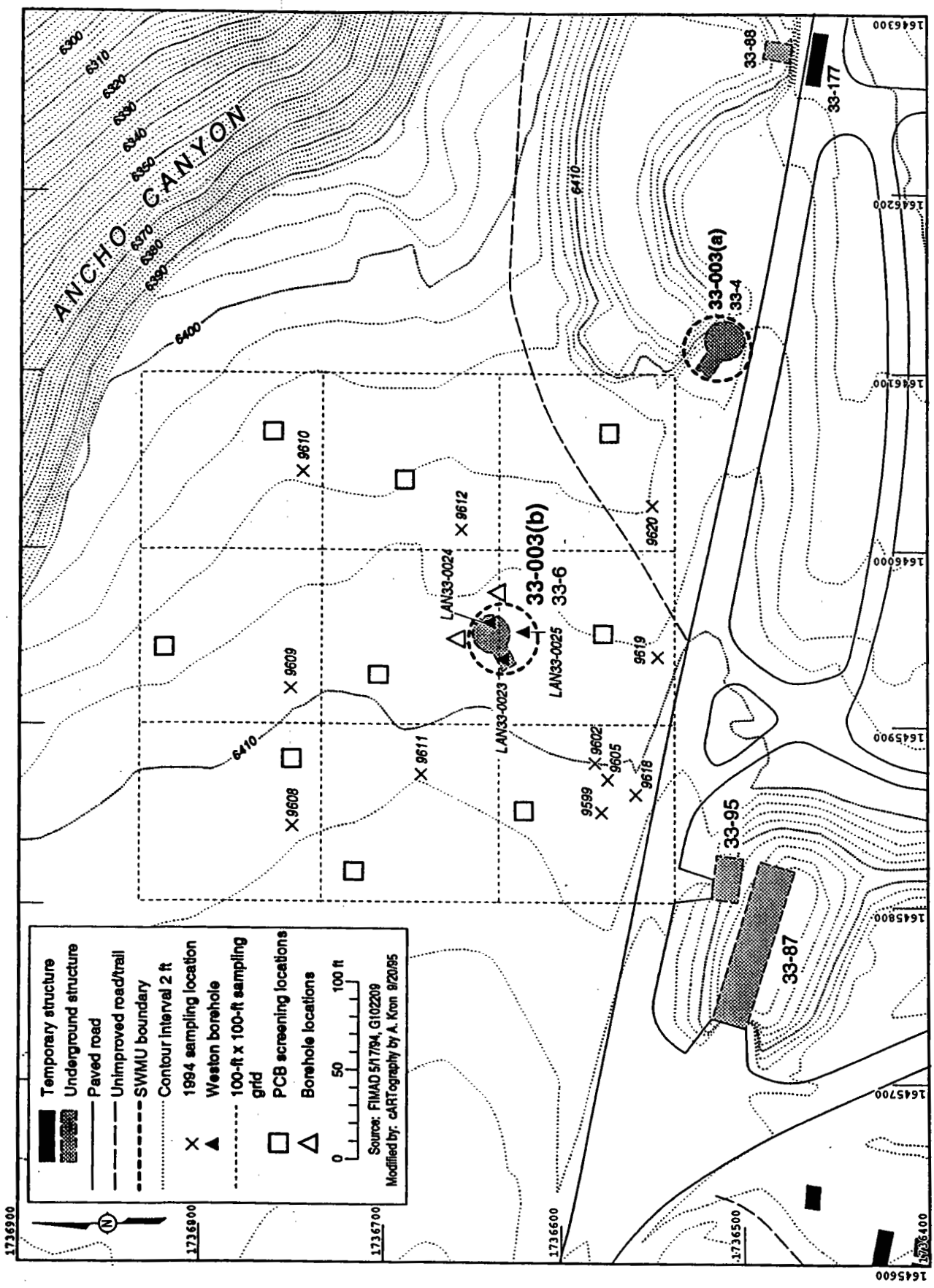


Fig. 5-2. East Site: SWMU 33-003(b) sampling locations.

5.2 SWMU 33-004(k) Outfall from TA-33-87, East Site

SWMU 33-004(k) is the outfall of a drain line from bunker TA-33-87. It is discussed in the RFI Work Plan for OU 1122, Subsection 3.5.2.3 and 4.5.3.2 (LANL 1992, 0784). Sampling during the 1994 campaign was inadequate to assess contamination from this SWMU because neither the outfall or the drain line was located.

SWMU 33-004(k) is the alleged outfall of a drain line from control bunker TA-33-87 at East Site. LANL engineering drawing C-3304 shows an 8-in cast iron. pipe extending 54 ft southeast of the building, then an 8-in. vitrified-clay pipe extending another 71 ft to an outfall. During the 1994 field campaign, neither pipe nor outfall was found. The outfall point of the clay pipe may be in the area excavated in 1984 for the SWMU 33-008(b) landfill. The point of discharge may have been destroyed during creation of the landfill.

Bunker TA-33-87 was completed in June 1955 to support shot tests at East Site. There is no record of radioactive materials being used or stored in the building. However, photoprocessing may have occurred.

TA-33-87 is covered by a berm and part of the alleged pipe is covered by this berm. The terrain southeast of the berm is level and covered with chamisa.

5.2.1 Previous Investigation

No previous investigations have been performed for this SWMU.

5.2.2 Field Investigation

Because the pipe was never found, no ER samples were collected during the 1994 field campaign that can be directly attributed to this outfall.

5.2.2.1 Results of Field Surveys

Magnetic and electromagnetic surveys failed to detect anomalies at the expected location of the pipe. Most of the area is buried under the berm covering bunker TA-33-87.

5.2.2.2 Results of Field Screening

No radiation screening was performed at SWMU 33-004(k).

5.2.3 Screening Assessment

No screening assessment can be performed for this SWMU.

5.2.4 Conclusion and Recommendation

To adequately assess release of potential contamination by this outfall, a second try at Phase I sampling is proposed in conjunction with sampling in landfill SWMU 33-008(b).

5.2.5 Sampling and Analysis Plan

During the Phase I sampling of landfill SWMU 33-008(b), described in Subsection 5.3 of this RFI report, an attempt will be made to locate the pipe. If the pipe is located, samples will be collected as follows: if the outfall lies within the boundaries of the landfill, a sample will be taken at the soil/tuff interface in the landfill at the point indicated on the engineering drawing as the location of the outfall (Fig. 5-3). If the outfall is located outside the boundaries of the landfill, a sample will be taken at that point. This sampling will be considered Phase I reconnaissance sampling. The sample will be analyzed in the laboratory for inorganics, VOCs, and SVOCs.

5.3 SWMU 33-008(a,b) Landfills at South Site and East Site

SWMUs 33-008(a,b) are landfills created at TA-33 during a 1984 cleanup of South and East Sites. SWMU 33-008(a) is discussed in the RFI Work Plan for OU 1122, Subsections 3.4.2.10 and 4.4.7 (LANL 1992, 0784). SWMU 33-008(b) is discussed in work plan Subsections 3.5.2.6 and 4.5.6. After the RFI work plan was submitted, evidence was discovered that the contents of the landfill made the proposed trenching sampling plan inappropriate to perform. A revised plan is presented here.

The SWMU 33-008(a) landfill was created in 1984 at South Site when many structures and experimental objects were dismantled. The cleanup was intended as an interim action pending stricter regulation of LANL cleanup activities. During cleanup, radioactive and salvageable material were removed; however, no sampling was done to identify RCRA hazardous wastes. Remaining material was buried in the landfill (Buhl 1984, 02-038).

The SWMU 33-008(b) landfill was created at East Site during the 1984 cleanup. Radioactive and salvageable material were removed. Remaining material was buried. The surface was leveled and the corners of the landfill marked with metal posts.

The RFI work plan for OU 1122, approved by EPA in 1993, proposed trenching through each landfill to determine if the contents include hazardous material (LANL 1992, 0784). Subsequent to submittal of the work plan, photos were discovered that were taken during the cleanup. Photos indicate that the buried debris included massive items such as telephone poles and railroad ties and that the material is tightly packed within the landfill. It became clear that trenching with a backhoe as described in the work plan could not produce the desired samples. This section presents an alternate sampling plan.

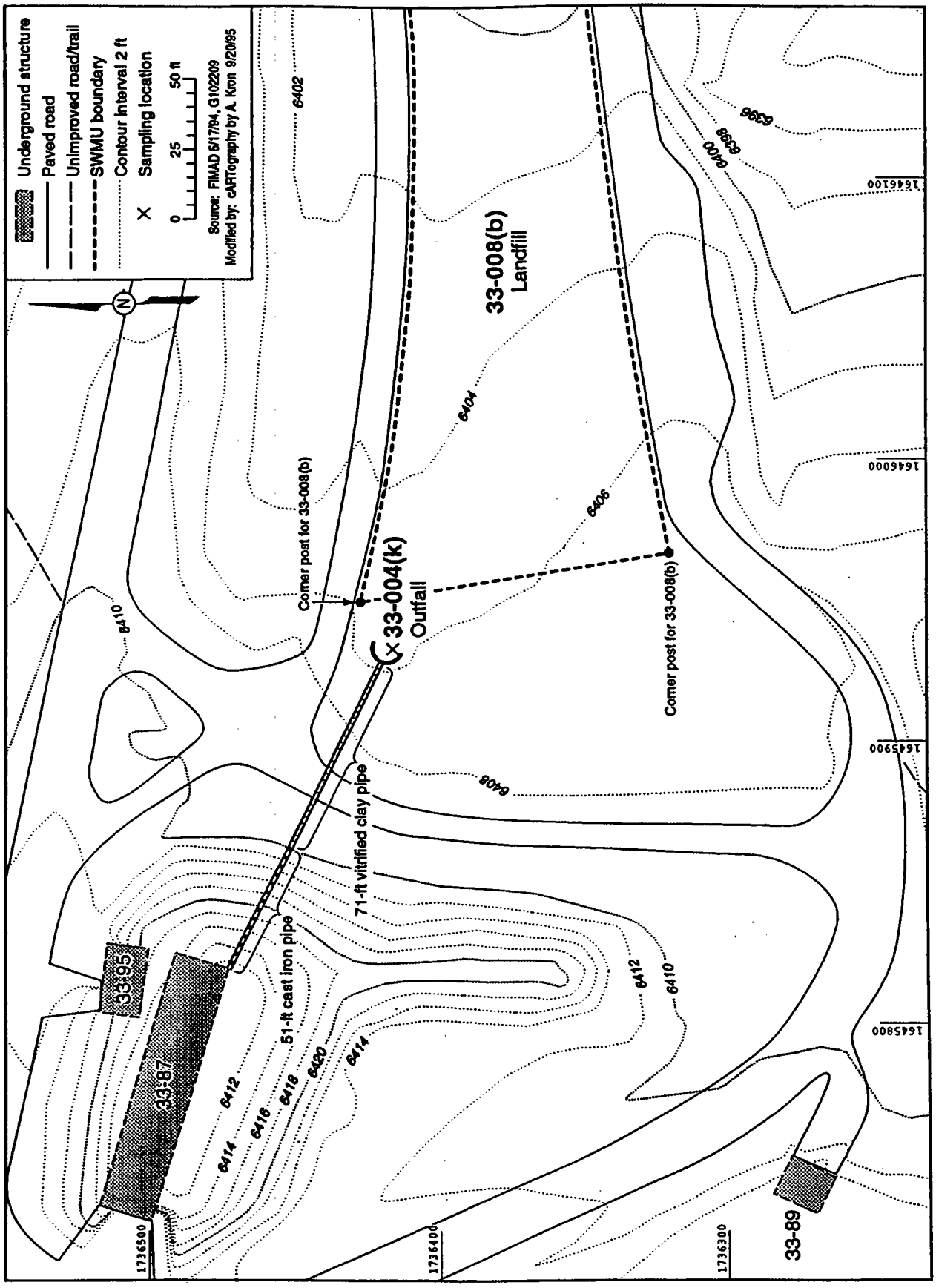


Fig. 5-3. East Site: SWMU 33-004(k), outfall from TA-33-87, shown in relation to SWMU 33-008(b), landfill.

SWMU 33-008(a) This landfill lies within a horseshoe-shaped berm, TA-33-43, at South Site. The floor of the berm appears to be on bedrock. At its highest point, the berm is about 15 ft high. The landfill grades from the floor to the inside curve of the berm and may be 8 ft at its deepest point. The four corners of the landfill are marked with metal pipe. Over the years, a thick stand of chamisa has grown on the landfill. Some of the buried material has been exposed through erosion.

SWMU 33-008(b) The landfill at East Site occupies the space between the firing pads east of bunker TA-33-87 and shack TA-33-151. According to LANL engineering drawing ENG-C 3304, this area may have originally been excavated to provide material for the nearby berms. The fill is well compacted and covered; there is no longer any surface indication of its existence. The four corners are marked with metal poles. The surface is level and covered with a sparse growth of weeds and grasses. Thick stands of chamisa grow along most of the perimeter.

5.3.1 Previous Investigations

Prior to 1994 ER sampling, no investigations had been performed for these landfills.

5.3.2 Field Investigations

SWMU 33-008(a) During the 1994 sampling campaign, four surface samples were collected at the South Site landfill. Three were taken at the lower edge of the landfill. The fourth was taken in the drainage leading from the bermed area (Fig. 5-4). All four samples were analyzed for inorganics, uranium, gamma emitters and HE. Two samples were analyzed for uranium.

SWMU 33-008(b) No samples were taken within the East Site landfill boundaries during the 1994 sampling campaign. Fig. 5-5 shows the extent of the landfill.

5.3.2.1 Results of Field Surveys

No field surveys were associated with SWMUs 33-008(a) or 33-008(b).

5.3.2.2 Results of Field Screening

No radiation was detected during routine field screening of sampling locations at SWMU 33-008(a).

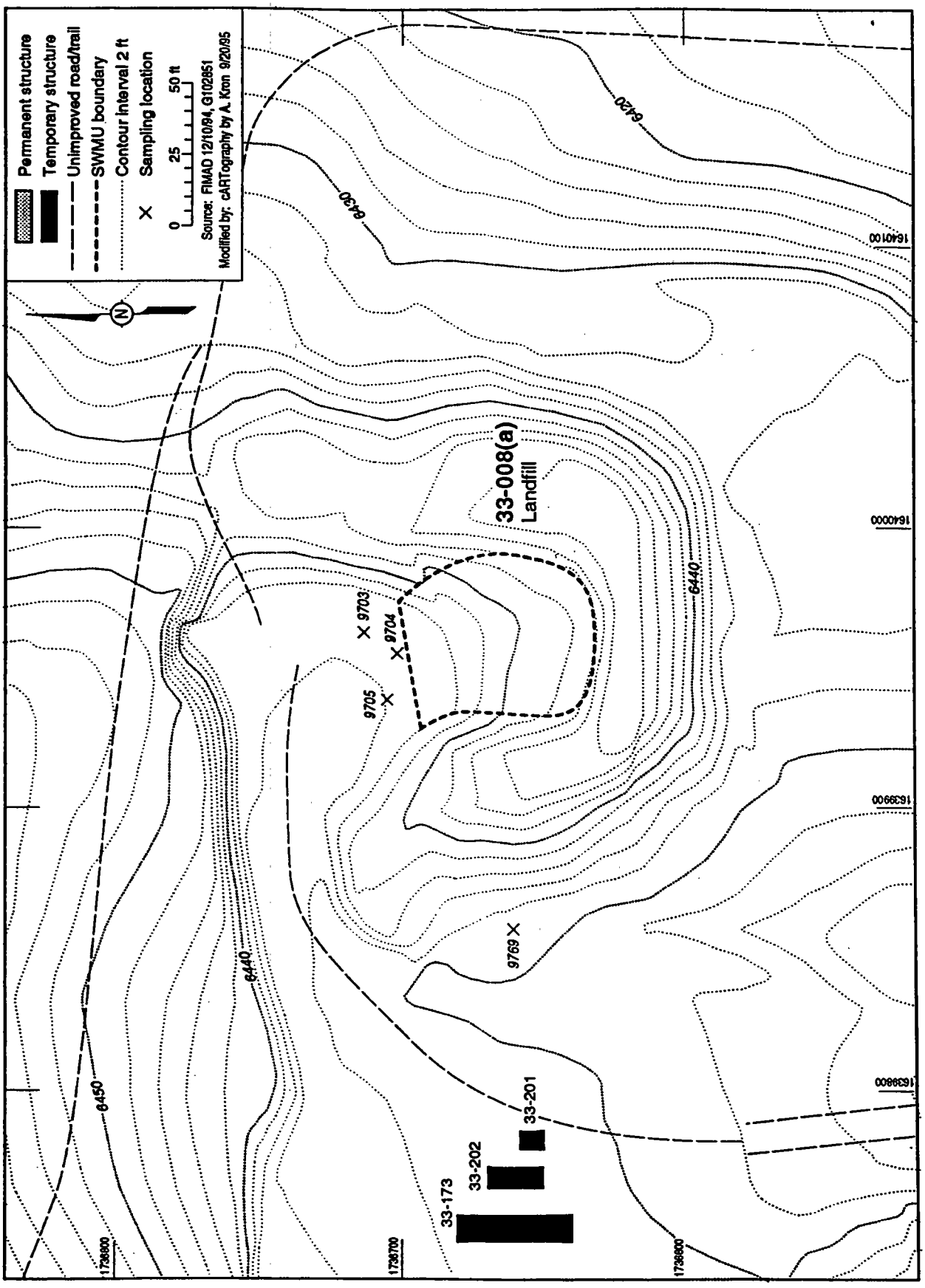


Fig. 5-4. South Site: SWMU 33-008(a), landfill, 1994 sampling campaign.

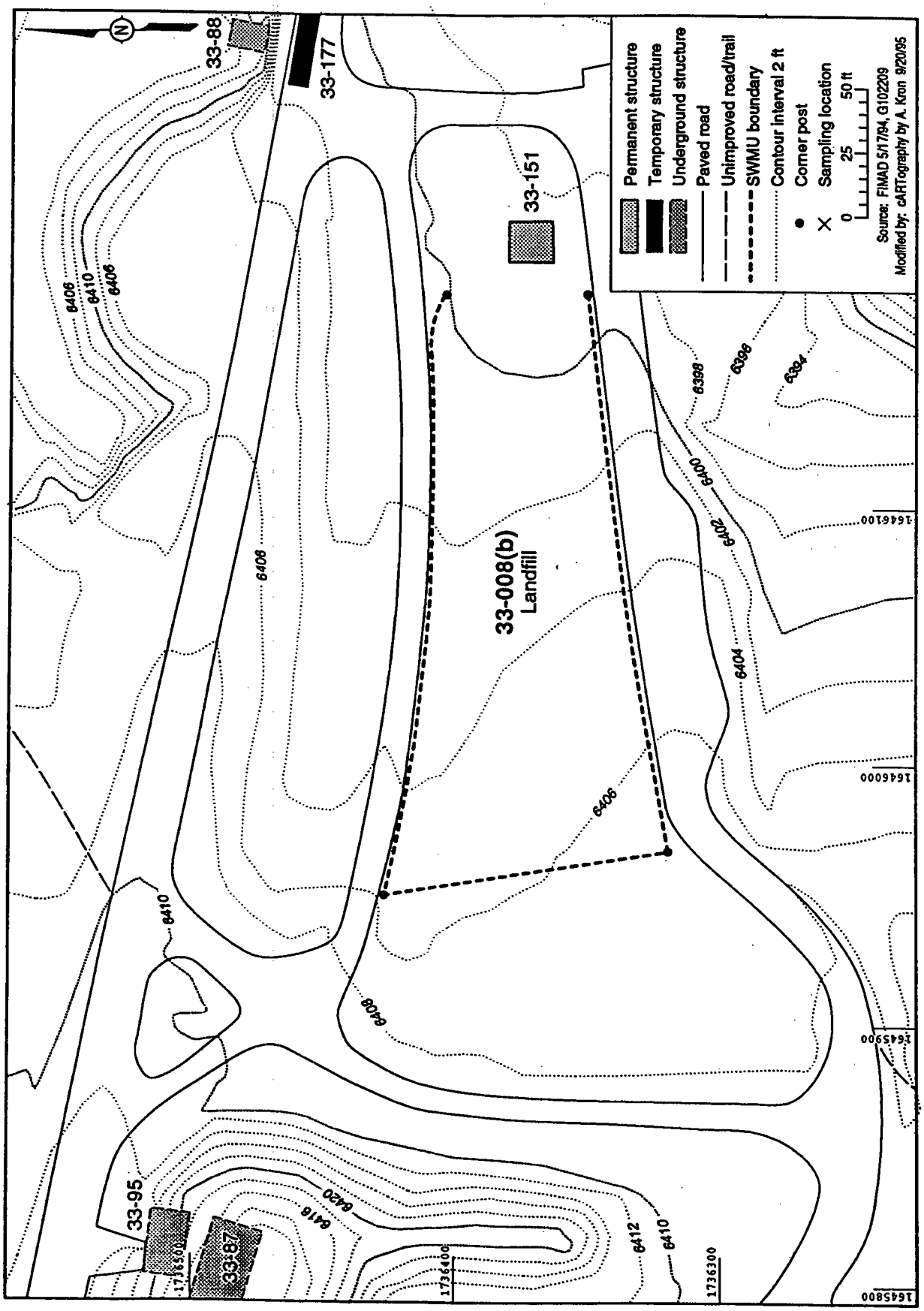


Fig. 5-5. East Site: SWMU 33-008(b), landfill.

5.3.3 Screening Assessment

5.3.3.1 Comparison to Background/SALs

SWMU 33-008(a) Two SVOCs were detected in one sample (Table 5-3). No inorganics, gamma emitters, or uranium were detected above LANL and TA-33 background UTLs.

TABLE 5-3

SVOCs DETECTED AT LANDFILL SWMU 33-008(a)

ANALYTE	SAMPLE ID	DEPTH (in.)	MEDIUM	CONCENTRATION (mg/kg)	SAL[a] (mg/kg)
Di-n-butylphthalate	AAA9675	0-6	Soil	4.1	8 000
Dinitrotoluene	AAA9675	0-6	Soil	2	1

[a] SAL = Screening action level.

5.3.3.2 Data Interpretation

The question of contamination within the landfills has not been addressed. Di-n-butylphthalate, a plasticizer, is a common analytical laboratory contaminant and may not be present. Dinitrotoluene is a propellant plasticizer.

5.3.4 Conclusions and Recommendations

Additional Phase I sampling is recommended for these landfills to assess the possibility of contamination. Based on sampling and analyses, recommendations will be developed for the disposition of the landfills.

5.3.5 Further Investigations

5.3.5.1 Sampling Objectives for SWMU 33-008(a,b)

Based on anecdotal evidence and reports of the 1984 activities that created these landfills, uranium, beryllium, and lead are likely to be present in small quantities in both landfills. HE or their byproducts may be present at the South Site landfill, SWMU 33-008(a). Field and/or laboratory analysis will characterize levels of radioactivity, inorganic hazardous constituents (both total and recoverable by TCLP), and HE.

The landfills are expected to be heterogeneous. Field information will provide information about this heterogeneity, including estimates of the volumes of metallic material such as cables, of wood material such as telephone poles and railroad ties, and of fill material, as well

as identify other types of buried material. Field investigations of the two shallow landfills will provide estimates of several parameters associated with these sites: the volumes of each landfill, the nature of the landfill contents, levels of radioactive and hazardous constituents, and whether or not such constituents, if present, are migrating into the underlying tuff. The depth of the fill/tuff interface will be observed in each borehole placed during Phase I sampling. The lateral extent of the landfills is known, and the depth will provide sufficient information to establish the total volume of the landfills.

Field crews will categorize all excavated material into at least three categories (metal, wood, soil/tuff fill), and more if desirable. Additional categories might be established for glass, rubber, or other materials if they are encountered. The volume of each type of material in the landfill will be estimated based on the relative amounts of each category encountered during drilling. This information will also be used to stratify the collection of samples for analysis.

Samples will be collected from the cored material, both within the landfill (i.e., above the fill/tuff interface), at the interface, and in undisturbed tuff or material beneath the landfill. Analysis will determine whether hazardous constituents are present in any stratum at each landfill. The TCLP will be performed on one-half the randomly selected soil samples in preparation for possible removal of landfilled materials.

5.3.5.2 Phase I Sampling and Analysis

Phase I sampling will focus on determining: the volume of the landfills, the nature of the landfill contents, the levels of hazardous constituents within the landfills, and possible migration of hazardous constituents into underlying soil/tuff.

All samples will be field screened for radioactivity and organic vapors to identify gross concentrations of contaminants. Appropriate health and safety precautions will be undertaken according to the site-specific health and safety plan.

Sampling Techniques Subsurface core samples will be collected with an auger drill rig outfitted with a tungsten-carbide tipped core barrel. Although this drill rig would normally drive a hollow-stem auger drill string, in this case no augers will be used, only a specially-built tungsten carbide-tipped core barrel. This drill string will be cooled and lubricated with compressed air and is designed to slowly mill through the various types of landfill debris expected to be encountered. The boreholes will be advanced 2-ft into the underlying tuff to a nominal depth of 10 ft to ensure the detection of contaminants that may have leached from the landfill and migrated to the fill/tuff interface or below.

Sampling Summary, SWMU 33-008(a) Four cored boreholes will be drilled at the South Site landfill at random locations within a stratified 2 by 2 grid (four cells approximately 30 ft by 35 ft each) laid over the site as defined by the four posts. Alternate borehole locations will be selected within the same grid square if drilling into the underlying tuff is not possible because of bit refusal.

The boreholes will be cored through the landfill surface cover layer, the debris layer, and 2 ft into the tuff below. Four analytical samples will be collected from each borehole. Two borehole samples will consist of actual debris material, one soil sample at the bottom of the landfill material immediately above the tuff, and one tuff sample from between 12 in. to 24 in. beneath the fill/tuff interface. Debris samples will be selected from the entire landfill in the following proportions; one-third fill, one-third wood, one-third other material. Depth intervals of analytical samples will be 6 in. the case of tuff or soil and the thickness of the debris when the debris samples are being collected.

Sampling Summary, SWMU 33-008(b) Six cored boreholes will be drilled at the East Site landfill at random within a stratified grid of 2 by 3 (six cells approximately 40 ft by 60 ft each) laid over the site within the four corner posts. Alternate borehole locations will be selected within the same grid square if drilling into the underlying tuff is not possible because of bit refusal.

The boreholes will be cored through the landfill surface cover layer, the debris layer, and 2 ft into the tuff below. Four analytical samples will be collected from each borehole. Two samples will consist of actual debris materials, one soil sample at the bottom of the landfill material immediately above the tuff, and one tuff sample from between 12 in. to 24 in. beneath the fill/ tuff interface. Debris samples will be selected from the entire landfill in the following proportions; one-third fill, one-third wood, one-third other material. Depth intervals of analytical samples will be 6 in. the case of tuff or soil and the thickness of the debris when the debris samples are being collected.

Laboratory Analysis Debris samples of landfill material will be field screened for inorganics using XRF or LIBS. All soil samples will be analyzed in the laboratory for total inorganics and total uranium. TCLP analyses will be performed on samples exceeding 20 times SAL. HE analyses will be performed on all samples collected from the South Site landfill. Analysis for SVOCs will be performed on all fill samples, tuff/fill interface samples, and the samples taken 12 to 24 in. beneath the tuff/fill interface.

5.4 C-33-001, C-33-002 Power transformers

AOCs C-33-001 and C-33-002 are power transformers. C-33-001 is discussed in Subsection 3.2.2.15 and C-33-002 is discussed in Subsection 3.5.2.7 of the RFI Work Plan for OU 1122 (LANL 1992, 0784). Sampling is proposed to detect PCBs.

Two power transformers were installed at TA-33 in the 1950s. C-33-001, transformer TA-33-124, is located at Main Site on the east side of building TA-33-114. C-33-002, transformer TA-33-95, is in a vault at the TA-33-87 complex at East Site. Transformer oil in these transformers may have contained PCBs. When the RFI work plan was written, both transformers were scheduled for replacement. The transformers were replaced in 1992 under the Toxic Substances Control Act (EPA 1993, 1244). However, sampling after replacement was not adequate for ER objectives. This subsection proposes sampling and analysis to detect any PCB contamination and migration that may have resulted from historic operation of the transformers.

5.4.1 Objectives

The OU 1122 work plan depended upon sampling and cleaning to be performed during replacement of the transformers in 1992. Subsequent inquiry into the replacement operations at TA-33 indicate that the replacement crew only sampled where they had temporarily set down the old transformer. No site-wide sampling was performed to detect historic PCB releases. No cleanup was performed at either site.

The principal questions are:

- Were there historic releases of PCBs from either transformer?
- Have PCBs been released to the environment at either site?
- If PCBs are present, are they migrating to the environment?

Objectives for field screening at each site include:

- an estimate of the distribution of PCB contamination, if present,
- an estimate of the PCB concentration, and
- an indication of PCB migration and the direction of the plume.

Information expected from field screening includes:

- an estimate of PCB presence and extent,
- an estimate of potential and possible direction for migration,
- laboratory analysis, if field results warrant sampling.

C-33-001 Boundary of the Main Site transformer will be a 3-ft. radius around the perimeter of the fenced area (Fig. 5-6). If field screening locates PCBs at the perimeter, then screening will proceed outward until PCBs are no longer found. PCB sampling in the drainage at the vehicle maintenance area of SWMU 33-017 (Subsection 4.8 of this RFI report) will be considered when evaluating this AOC. In addition, field screening will be performed in the drain field at the points where PCBs were identified as TICs.

C-33-002 At East Site the boundary will be the concrete pad outside the vault door, an area approximately 10 ft by 20 ft, and 2 ft down the adjacent drainage (Fig. 5-7). The floor of the vault will not be sampled. The tolerable uncertainty is a 15% chance of missing contamination altogether even if half of the area is contaminated. Three samples will provide this margin of certainty.

5.4.2 Sampling Plan

Field screening will consist of D TECH™ immunoassay testing with a detection limit of 0.5 mg/kg of PCBs in soil (Appendix C). Because PCBs tend to absorb into asphalt or concrete, stained areas will be screened if present. If PCBs are detected, further testing will determine if a plume exists. If soil near either area appears stained, that soil will also be tested. If field screening indicates that PCBs may be present above 1 mg/kg, samples will be submitted for laboratory analysis.

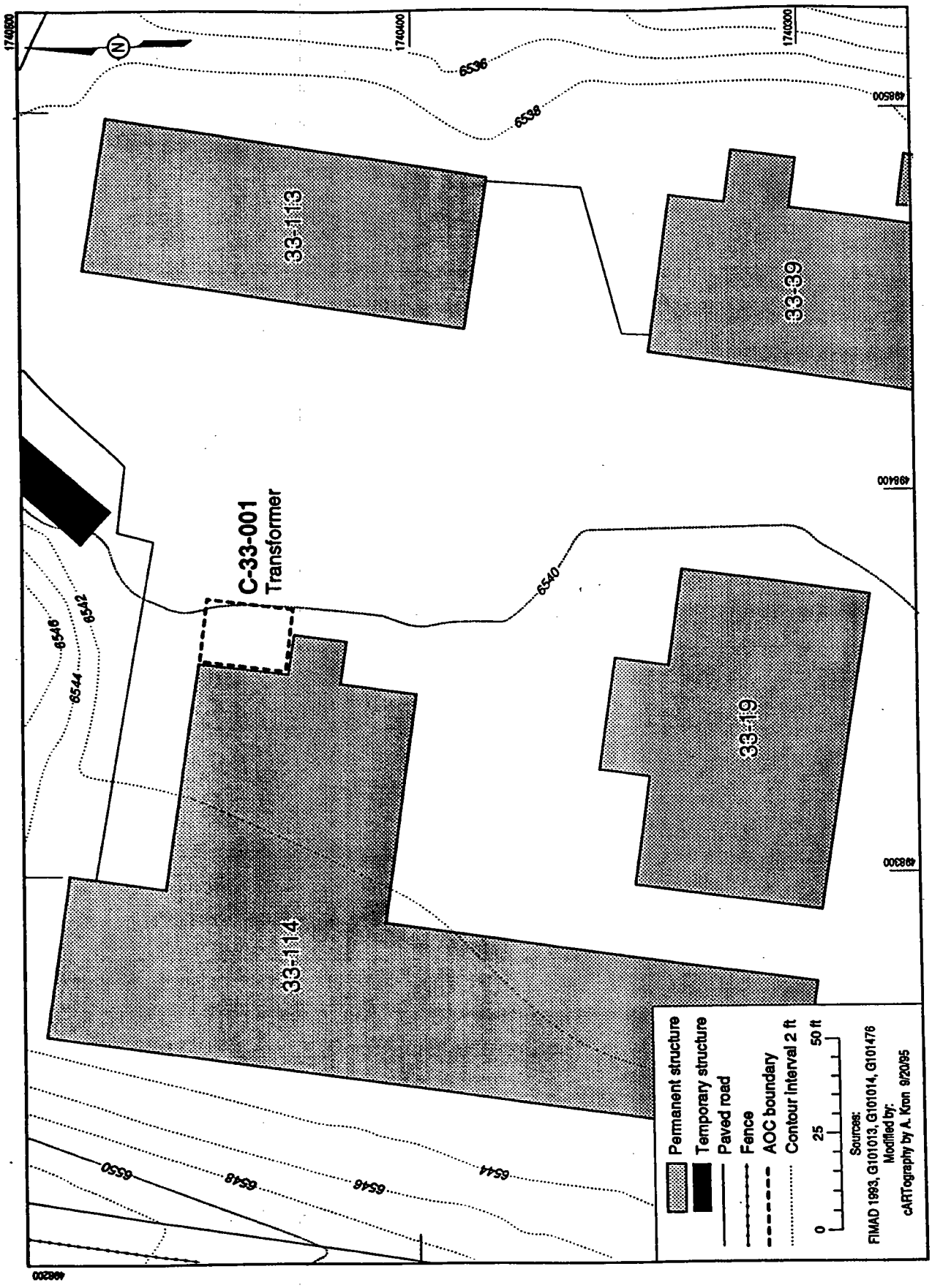


Fig. 5-6. Main Site: Area of concern (AOC) C-33-001, transformer.

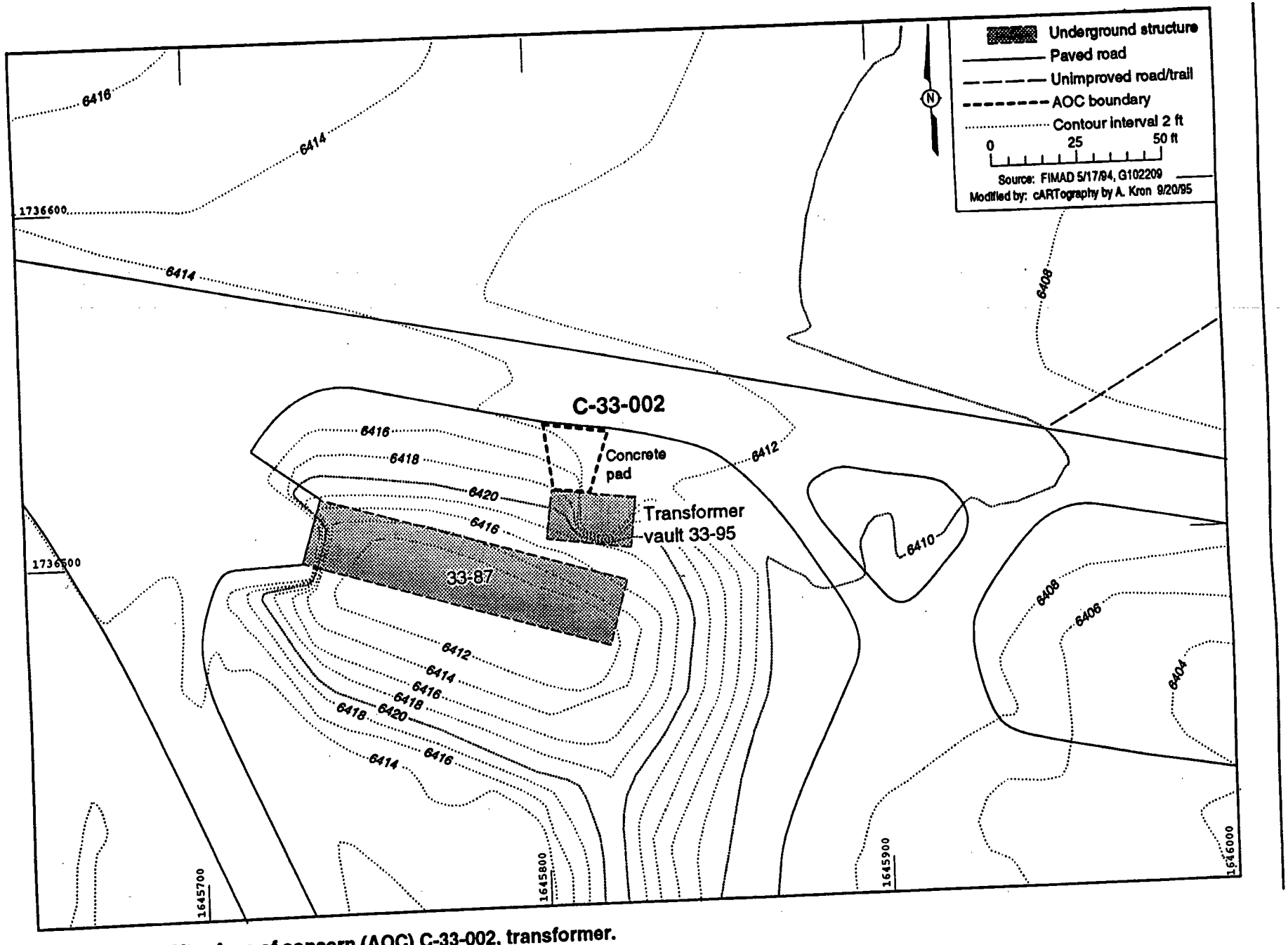


Fig. 5-7. East Site: Area of concern (AOC) C-33-002, transformer.

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APPENDIX A

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

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APPENDIX B PHASE II SAMPLING AND ANALYSIS PLANS

Table B-1 list the four sampling plans presented in Appendix B of this RFI report.

TABLE B-1

PHASE II SAMPLING AND ANALYSIS PLANS

SECTION	PRS[a]	OBJECTIVE
1.0	33-009	Determine levels and extent of PCBs[b]
2.0	33-011(d)	Locate and remove uranium contamination Determine levels and extent of lead
3.0	33-013	Investigate inorganic contamination
4.0	33-017	Determine levels and extent of PAHs[c]

a PRS = Potential release site.
b PCBs = Polychlorinated biphenyls.
c PAHs = Polycyclic aeromatic hydrocarbon.

1.0 PHASE II SAMPLING AND ANALYSIS PLAN FOR SWMU 33-009

1.1 Phase II Sampling Objectives

Phase II sampling is proposed for solid waste management unit (SWMU)-33-009. The objective of Phase II sampling is to determine the levels and extent of polychlorinated biphenyls (PCB) releases within and around the suspected storage site. In particular, it will seek to determine;

- whether PCBs are present at concentrations that could trigger cleanup,
- if so, the approximate lateral and vertical extent of volumes requiring cleanup, and
- the extent of PCB migration down the channel below the SWMU 33-004(g) outfall.

The study will be conducted primarily by means of field immunoassay measurements. Confirmatory laboratory analyses will be used to evaluate the method in the critical range (1 to 50 mg/kg) and to estimate the false negative rate, defined as reporting less than 1 mg/kg for samples greater than 5 mg/kg. If high field observations are made, waste characterization analyses will also be requested in anticipation of corrective action.

Four areas are targeted for the Phase II investigation.

- **Area most likely** The area most likely to have been used for storage of defective capacitors is the rim of Area 6 extending from north of TA-33-16 south to the west end of the excavated cinder cone. Ten augered boreholes about 25 ft apart (shown as circles in Fig. B-1) will provide two samples each, a surface sample and a sample from 12 to 18 in.

  Field immunoassays will be performed on all samples. If field results above 1 mg/kg are reported, an additional three augered boreholes will be placed around the location within a 4- to 10-ft radius to provide information for evaluating the extent of release. These conditional samples are not shown on Fig. B-1. Field observations above 1 mg/kg in 18 to 24 in. samples will also trigger the collection of deeper samples at those locations.

  A minimum of 10% of the field samples will be submitted for confirmatory laboratory analysis. Preference will be given to samples, if any, with immunoassay results in the range of 1 to 50 mg/kg. Some samples from below this range will also be included to provide data for evaluating the rate of false negatives produced by the field method. If there are samples with immunoassay results above 15 mg/kg, 5 samples from those locations and those in the 1 to 15 mg/kg range will be submitted for waste characterization analyses for toxicity characteristic leaching procedure (TCLP) inorganics, TCLP organics, and isotopic uranium.

- **Slope below** For the slope below the suspected capacitor storage area, Fig. B-1 indicates four augered boreholes (squares) that will provide both surface and subsurface samples to supplement information from Phase I samples AAA2150, AAA2152 and AAA2168. However, if any releases are located by sampling in the capacitor storage area, these augered boreholes may be moved or supplemented by other boreholes in order to sample downslope areas. As in the preceding paragraph, these holes will provide 0 to 6 in. and 18 to 24 in. samples, and immunoassay results above 1 mg/kg will trigger additional sampling. Samples will be selected for confirmatory laboratory PCB analysis as above, and three samples will be submitted for waste characterization if there are immunoassay results above 15 mg/kg.

- **Drainage** For the SWMU 33-004(g) drainage, at least five 0 to 6 in. sediment samples will be collected in the drainage to confirm results for AAA2145 and determine the extent of contamination in this drainage.

Sampling will begin at the location of AAA2145 and continue at 20-ft intervals at least 20 ft below the culvert (the location of AAA2149), and farther if the immunoassay results at that point exceed 1 mg/kg. The first five samples are shown as triangles in Fig. B-1.

- **Filled areas** Finally, Fig. B-1 indicates the maximum extent of the area that may have been covered by material excavated from the cinder cone. This area will be surveyed using metal-detecting instruments. Samples will be collected only if capacitors are found and after they are removed. Visibly stained soil will be removed together with the capacitor, as described in Subsection 1.2 of this appendix, and two samples will then be collected from 0 to 6 in. in the exposed surface. Further excavation and sampling will be required if an immunoassay result exceeds 1 mg/kg. One confirmatory sample will be submitted for laboratory analysis if all immunoassay results are below 1 mg/kg.

1.2 Geophysical Survey and Removal of Capacitors

A cleanup plan has been written to locate and remove any capacitors that may have been buried in the basaltic cinder groundmass. The plan specifies geophysical techniques to locate metallic objects followed by removal with hand digging. If capacitors are found, cleanup will follow appropriate guidance for removal, verification sampling, and disposal. Investigation will be coordinated with the LANL Toxic Substances Control Act (TSCA) Compliance Program (ICF Kaiser 1995, 02-105).

1.3 Sampling and Analysis at SWMU 33-009

Phase II sampling will focus on determining the levels and extent of PCBs at SWMU 33-009. All samples will be field screened for PCBs by means of the D TECH™ field PCB immunoassay screening. Appendix C contains a discussion of the use of a the field PCB immunoassay kit. Appropriate health and safety precautions will be undertaken according to the site-specific health and safety plans.

Sampling Techniques Because the groundmass contains basaltic cinders, samples will be collected by the spade and scoop technique (LANL-ER-SOP-06.09). Surface soil samples will be gathered to a depth of 6 in. The specific technique will be determined by the field team leader. Subsurface samples will be taken at a depth of 24 in. The 24 in. depth is designed to ensure detection of PCBs that may have migrated below the immediate surface through

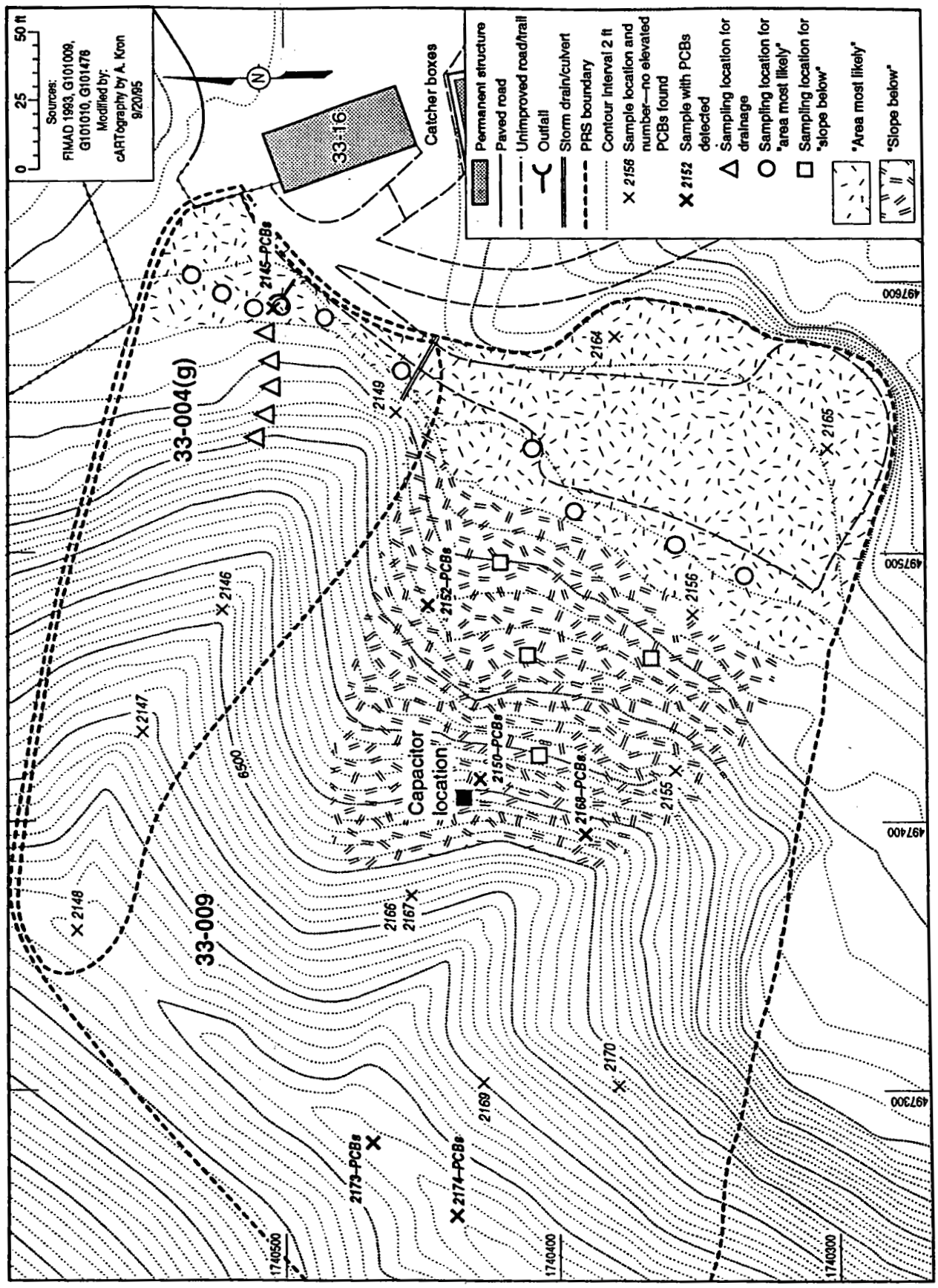


Fig. B-1. Area 6: SWMU 33-009 Phase II PCB sampling plan.

weathering. See Fig. B-1 for planned sample locations. Sampling locations may be moved at the discretion of the field team leader. Reasons for relocating samples will be documented in the field logs.

Sampling will proceed at the four target areas that will undergo Phase II sampling as described in Subsection 1.1 of this appendix.

- **Storage area** At the possible storage area for defective capacitors, sampling will consist of boring 10 hand-augered holes. The augered sample holes will be located on the north rim of Area 6 from north of TA-33-16 to the west end of the excavated cinder cone. Analytical samples will be removed at the surface (0 to 6 in.) and at the bottom of the hole (18 to 24 in.). If PCB field results above 1 mg/kg are detected, these 24-in.-deep augered boreholes will be advanced an additional 24 in. and tested for PCBs. The augered boreholes will be advanced in 24 in. increments until field testing indicates that PCBs are less than 1 mg/kg.

  In addition to deepening the original hand augered boreholes, where PCB readings are in excess of 1 mg/kg, three additional augered boreholes will be placed around the sample location at a 4- to 10-ft radius. As with the first augered boreholes, these will be advanced to a depth of 24 in. Analytical samples will be collected at the surface and bottom of the borehole.

- **Slope below** On the slope below the suspected capacitor storage area, sampling will consist of boring four augered boreholes below the suspected storage area and across the downslope area (Fig. B-1). Analytical sample intervals will be the same as for the first target area. Field screening results above 1 mg/kg will result in advancing the boreholes and possibly added new holes. The locations of these boreholes will also depend upon the upslope results in the suspect capacitor storage area .

- **Drainage** A minimum of five surface soil samples (0 to 6 in.) will be collected to determine the extent of contamination in the drainage. Sampling will began at AAA2145 and continue in 20 ft intervals at least 100 ft (Fig. B-1).

- **Filled Areas** Sampling will be performed only if capacitors are found and after they are removed. Two surface soil samples will be collected at the location of any removed capacitor. Additional sampling will be performed if field results indicate PCBs above 4 mg/kg.

Laboratory Analysis A minimum of 10% of field samples will be submitted for confirmatory laboratory analysis for PCBs. Preference will be given to samples with field PCB results in the 1 to 50 mg/kg range but some samples below this level may also be sent to the laboratory. Five samples with PCB levels of 1 to 15 mg/kg and five samples above 15 mg/kg, if found, will be submitted for waste characterization analyses (TCLP analyses and isotopic uranium).

2.0 PHASE II SAMPLING AND ANALYSIS PLAN FOR SWMU 33-011(d) STORAGE AT TA-33-20

2.1 Phase II Sampling Objectives

Phase I sampling results indicate that remediation may be required to remove high, but localized, levels of uranium contamination. Phase II investigations are proposed to locate radioactive spots for remediation. Continuous gamma scanning will be used to identify areas with elevated radioactivity within the survey area. The lateral and vertical extent of any hot spots thus identified, including the Phase I sampling location 33-1081, will be determined from field screening results. Vertical extent will be determined by gamma counting and by direct alpha and beta/gamma measurements.

Phase 1 sampling found lead above SAL in pavement sample AAA6866. Phase II sampling will enlarge the data set sufficiently to complete a risk assessment for lead. Pavement and soil/tuff samples will be collected from cores at all radioactive spots located and from six additional randomly selected sites. All samples will be analyzed for inorganics and total uranium. A fraction of the samples from radioactive spots will be analyzed for isotopic uranium.

2.2 Phase II Sampling and Analysis Plan for SWMU 33-011(d)

All samples will be field screened for radioactivity and organic vapors to identify gross concentrations of contaminants. Appropriate health and safety precautions will be undertaken according to the site-specific health and safety plans.

A field radioactivity survey will be performed to identify radioactive spots around building TA-33-20. The survey will extend to the fence that bounds the paved area south and west of the building and to a distance of 25 ft north and east of the building (Fig. B-2). The survey will also extend 10 ft beyond any radioactive spots detected. Gamma scanning will be performed by swinging a sodium-iodide detector in a pendulum manner as close to the paved surface as possible while progressing at the speed of a slow walk. The surveyor will be equipped with headphones.

Areas with count rates that are more than two times above the locally determined background level will be marked. One-minute alpha and beta/gamma direct measurements of the surface from each of these locations identified by gamma scanning will be recorded. Core samples will be taken at each location. The lateral dimensions of areas with above-background activity will be mapped, and the vertical extent of areas with above-background activity will be determined by making direct measurements along core samples collected at each area.

Sampling Techniques The pavement surface samples will be collected with a portable gasoline-powered impact drill outfitted with a continuous sampler. Subsurface samples will be collected according to the hand-auger and thin-walled tube sampler method (LANL-ER-SOP-06.10). All analytical samples will be a minimum depth interval of 6 in.

Sampling Summary The field radioactivity survey will identify any radioactive points in addition to the Phase I sampling location 33-1081 (samples AAA6866 and AAA6867). Cores will be taken from the center of each radioactive spot. The surface pavement sample will be collected with the portable impact drill. The hand auger will then be advanced 2 ft below the point at which field screening indicates a drop below background readings. Analytical samples will be collected at the surface and at each 18 in. interval until one sample is collected beneath the last field screening result that exceeds background.

In addition to the radioactive spots identified by field survey, six additional randomly selected hand-auger locations will be placed within the survey area. The hand-augered core will have analytical samples collected at the surface (a pavement sample) and at 2 ft 6 in. beneath the bottom of the pavement.

Laboratory Analysis All analytical samples will be analyzed for inorganics and total uranium. Three analytical samples from radioactive spots or 25% of radioactive samples, which ever is larger, will be analyzed for isotopic uranium. If the concentration of any analyte exceeds 20 times the TCLP limit, that analytical sample will be submitted to the laboratory for TCLP analyses.

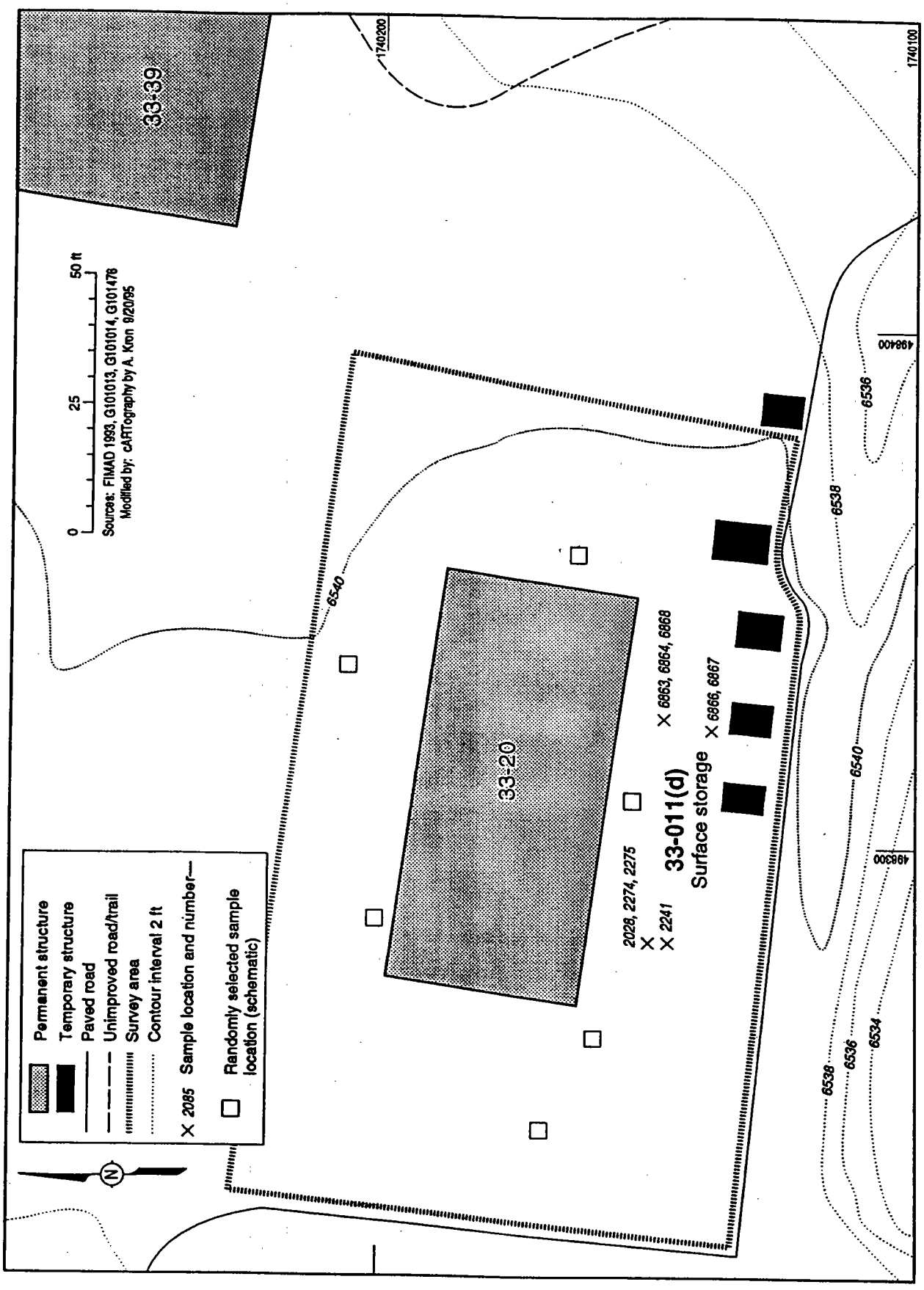


Fig. B-2. SWMU 33-011(d) sampling plan.

3.0 PHASE II SAMPLING AND ANALYSIS PLAN FOR SWMU 33-013 LIQUID WASTE STORAGE AT THE TRITIUM FACILITY

3.1 Phase II Objectives

The objective of resampling at PRS 33-013 is to determine whether the level and extent of inorganic contamination at this site warrants remediation. In particular, resampling will attempt to replicate the Phase I observations and to determine the horizontal and vertical extent of contamination within the storage area. Based on Phase I sampling results, the analytes of interest are inorganics, particularly chromium and cadmium but also silver, beryllium, and nickel. Uranium will be added to the analytical suite. Volatile organic compound (VOC) analyses will be performed on subsurface samples.

Resampling at 33-013 will be biased with field screening using x-ray fluorescence (XRF) or laser-induced breakdown spectroscopy (LIBS). XRF and LIBS detection limits for elements of interest are shown in Table B-2. Beryllium cannot be detected by XRF. Cadmium would easily be detected at the level at which it was reported in sample AAA2035 (620 mg/kg), but the XRF detection level is slightly above the SAL of 80 mg/kg. For the remaining analytes shown in Table B-2, the XRF detection limit is well below the SAL.

TABLE B-2

LOWER LIMITS OF DETECTION FOR THE SPECTRACE 9000™ X-RAY FLUORESCENCE ANALYZER AND LIBS FIELD INSTRUMENT

ANALYTE	XRF[a] (mg/kg)	LIBS[b] (mg/kg)	SAL[c] (mg/kg)
Beryllium	Not detectable	2	None
Cadmium	90	200	80
Chromium	78	10	400
Lead	15	30	400
Nickel	60	Not determined	1 600
Silver	55	20	400
Zinc	34	20	24 000

[a] X-ray fluorescence.
[b] Laser-induced breakdown spectroscopy.
[c] Screening action level.

The area targeted for resampling is shown in Fig. B-3. A 20-ft grid on a 60-ft by 60-ft area, measured south and west from the fence, will provide nine sampling locations. *In situ* field inorganic measurements will be made at each point selected within each grid square and also at the three Phase I sampling locations. If beryllium is found above background or if above-detection level observations of cadmium, chromium, nickel, or silver are found, an additional three locations will be randomly selected within a 4-ft to 10-ft radius and *in situ* measurements will be made.

Two samples will be collected for laboratory analysis from the location of sample AAA2035, and one sample collected from each location with high field measurements (i.e., above field instrument detection levels for analytes of interest or above 50 pCi/g tritium), if any such locations are identified. These will be surface (0 to 6 in.) samples if the location is unpaved, or soil samples within 2 ft beneath the pavement, if paved. If fewer than four samples are selected as a result of field measurements, the total number of samples submitted for laboratory analysis will be increased to four by random selection from the surveyed grid points.

3.2 Sampling and Analysis of SWMU 33-013 Liquid Waste Storage

All samples will be initially analyzed in the field for inorganics by means of XRF or LIBS. Appropriate health and safety precautions will be undertaken according to current versions of the site-specific health and safety plans.

Sampling Techniques Surface soil samples will be collected with either the spade and scoop or ring sampler technique (LANL-ER-SOP-06.09) to a depth of 6 in. The specific technique will be determined by the field team leader. Subsurface samples will be collected with the hand-auger and thin-walled tube sampler method (LANL-ER-SOP-06.10). See Fig. B-3 for planned sample locations.

Nine samples at the storage area will be collected randomly, one from within each 20-ft square of a 20 ft x 20 ft grid within the 60 ft x 60 ft area (Fig. B-3). *In situ* field measurements will be made with the XRF and LIBS at each grid point and also at the three Phase I sampling locations. An additional three sample locations will be selected if above-detection level field observations are made of cadmium, chromium, nickel, or silver. These three samples will be located at random within a 4-ft to 10-ft radius of the elevated readings.

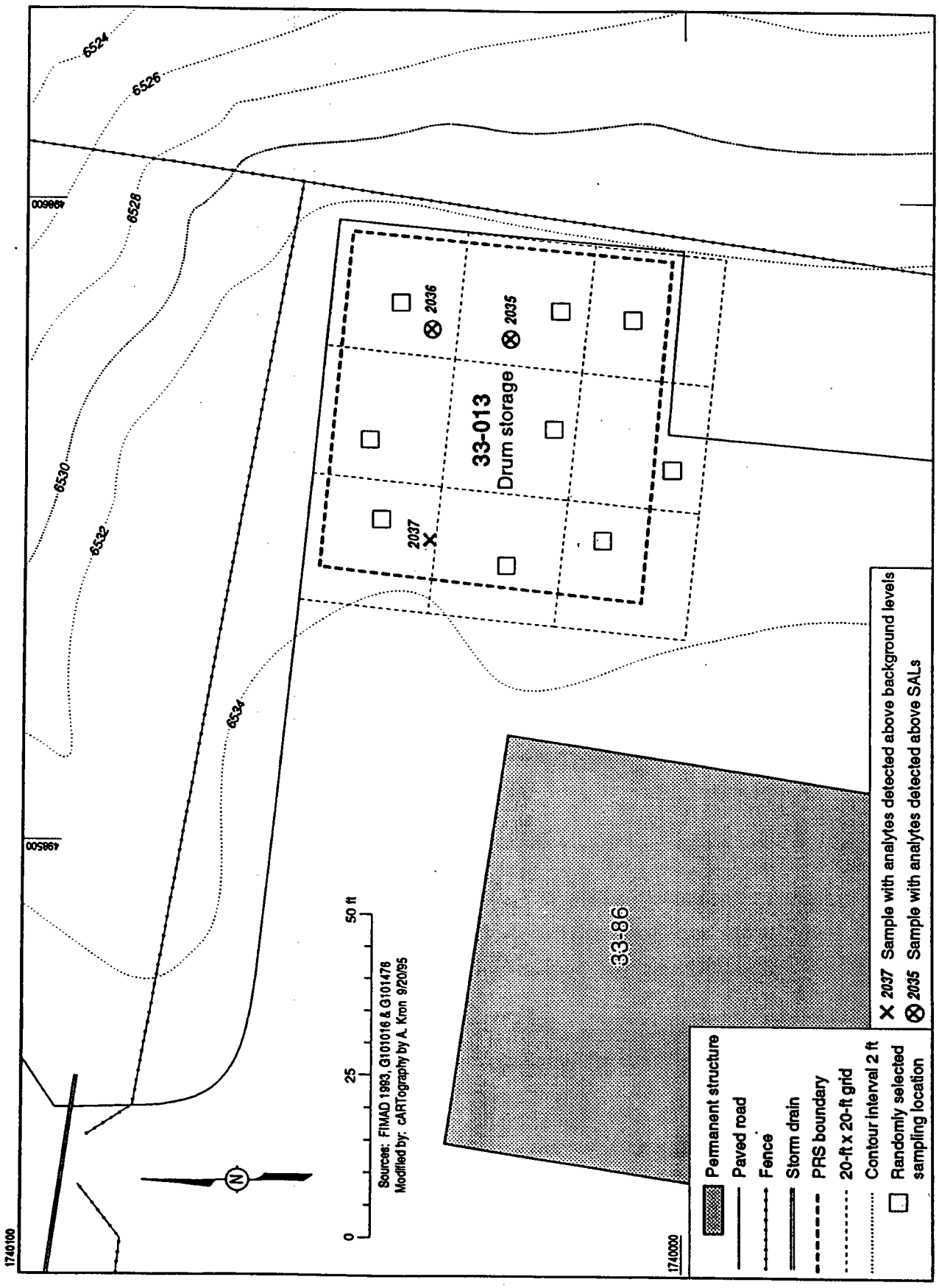


Fig. B-3. Main Site: SWMU 33-013 sampling locations.

One sample will be collected for off-site laboratory analysis from:

- each location characterized by measurements of cadmium, chromium, silver, or nickel above field instrument detection levels, lead or zinc above 200 ppm, or beryllium above background,
- the location of sample AAA2035, or
- a randomly selected subset of the remaining grid locations, if fewer than four samples are selected by the preceding criteria.

These samples will consist of surface soil (0 to 6 in.) if the grid location is unpaved, or collected within 2 ft beneath the pavement, if paved.

Laboratory Analysis The selected soil samples will be submitted for inorganic and total uranium analyses.

4.0 PHASE II SAMPLING AND ANALYSIS PLAN FOR SWMU 33-017 VEHICLE MAINTENANCE AREA

4.1 Phase II Sampling Objectives

Phase II sampling in the area to the east of shop TA-33-39 will address the following issues.

(1) The high estimates of polycyclic aromatic hydrocarbons (PAH) risk are driven by three Phase I samples.

- One sample, AAA2051, was collected from the southeast corner of TA-33-39.
- Two samples, AAA2053 and AAA2054, were collected above the point where runoff from activities behind TA-33-39 (the vehicle maintenance area, storage area, and outfalls) enters main drainage channel.

Samples AAA1978, AAA1979, and AAA1980 from the southern 33-004(i) outfall contained PAHs above 1 mg/kg, as did sample AAA1976 from the northern SWMU 33-004(i) outfall. No other sample in the vehicle maintenance area contained PAHs above 1 mg/kg.

These observations raise questions about whether these PAHs are associated with the activities behind the shop or with general runoff from the entire paved site. A number of additional biased samples will be collected in Phase II sampling to complete the assessment

of PAH concentrations in areas associated with activities behind TA-33-39 (Fig. B-4). Because of the history of TA-33-39 as a metals-handling facility, samples will be field screened for inorganics.

- Three Phase II sampling locations are designed to further assess the extent of high PAH contamination at the southeast corner of TA-33-39. Two additional samples will be collected across the gravel road from this area. These five points are shown as circles in Fig. B-4.
- Two samples will also be collected below the collapsed wooden platform east of TA-33-39. PAHs above 1 mg/kg were observed in sample AAA1976, the outfall sample closest to this platform. These points are shown as circles in Fig. B-4.
- Two additional samples will be collected in the main drainage, approximately 200 ft and 400 ft below sample AAA2054. These points are shown as circles in Fig. B-4.
- To address vertical extent of contamination, an 18 in. sample will be taken at points exhibiting soil staining.

These samples will be analyzed for SVOCs and field screened for inorganics.

All Phase I samples were biased and the Phase II samples specified above are also biased. In order to obtain a more representative sample for the purposes of risk assessment, an additional eight surface samples will be collected from within the exposure unit boundaries, east of the gravel road that runs east of TA-33-39, avoiding runoff channels and outfall drainages. Within these constraints, the sampling locations, shown as squares in Fig. B-4, will be selected randomly. These samples will be analyzed for semivolatile organic compounds (SVOCs).

Low level PCBs were observed in two of the three samples analyzed for PCBs. Additional PCB analyses are needed in the main drainage channel as well because this channel would have received runoff from the transformer adjacent to TA-33-114.

A field survey using the PCB D TECH™ field kit (Appendix C) will analyze five pavement samples from the northeast side of the shop, three samples from the adjacent unpaved gravel roadway, three samples from around and below the collapsed wooden platform just east of SWMU 33-012(a) which may have been used for vehicle maintenance, and four samples from

the main drainage. These samples are shown as triangles on Fig. B-4. Samples with field results greater than 1 mg/kg will be submitted for confirmatory analysis. The field crew may, at its discretion, collect additional samples near samples with high results to ascertain the extent of the apparent release. A sample will be taken at 18 in. below any sample exhibiting greater than 5 mg/kg PCBs as measured by field screening.

4.2 Phase II Sampling and Analysis Plan for SWMU 33-017

Phase II sampling will focus on determining the levels and extent of SVOCs and PCBs at SWMU 33-017. See Appendix C for a discussion of the use of the field PCB immunoassay kit. Appropriate health and safety precautions will be undertaken according to the site-specific health and safety plan. All samples will be field screened for radioactivity and organic vapors to identify gross concentrations of contaminants.

Sampling Techniques Surface soil samples will be collected with the spade and scoop technique (LANL-ER-SOP-06.09) to a depth of 6 in. The specific technique will be determined by the field team leader. See Fig. B-4 for planned sample locations.

Sampling Summary SWMU 33-017 includes three target areas that will undergo Phase II sampling (Fig. B-4).

- **East of Building TA-33-39** Nine Phase II surface soil samples (0 to 6 in.) will be collected immediately east of TA-33-39. These biased samples will be analyzed for SVOCs. Three of the samples will be located at the southeast corner of TA-33-39. Two additional samples will be located further to the east across the gravel road. Two samples will be taken below the collapsed wooden platform. An additional two samples will be collected in the main drainage, located approximately 200 ft and 400 ft southeast of the sample AAA2054 location. An additional sample will be taken at 18 in. at any point exhibiting visible soil staining.

- **Random Samples** Eight surface soil samples will be collected east of the gravel road at the rear of TA-33-39. The sample locations will be randomly selected with the constraint that they will not be collected from drainages. These samples will be analyzed for SVOCs.

- **PCB Samples** Fifteen surface soil samples will be collected at the pavement adjacent to TA-33-39 and in the main drainage channel. These samples will be tested in the field using a D TECH™ field PCB test kit. Five samples will be collected from the pavement area; three from the adjacent unpaved road; three samples from the area of the collapsed wooden platform east of SWMU 33-012(a); and four samples from the main drainage. Samples with PCB field results above 1 mg/kg will be submitted for confirmatory laboratory analysis. The field team may collect additional samples adjacent to locations with elevated readings to determine the extent of the apparent release. A sample will be collected at a depth of 18 in. at any location exhibiting greater than 5 mg/kg PCBs as measured by field screening.

Laboratory Analysis Samples from the first two target areas will be analyzed in the laboratory for SVOCs. Samples from the third target area with field PCB results above 1 mg/kg will be sent to the laboratory for further PCB analysis.

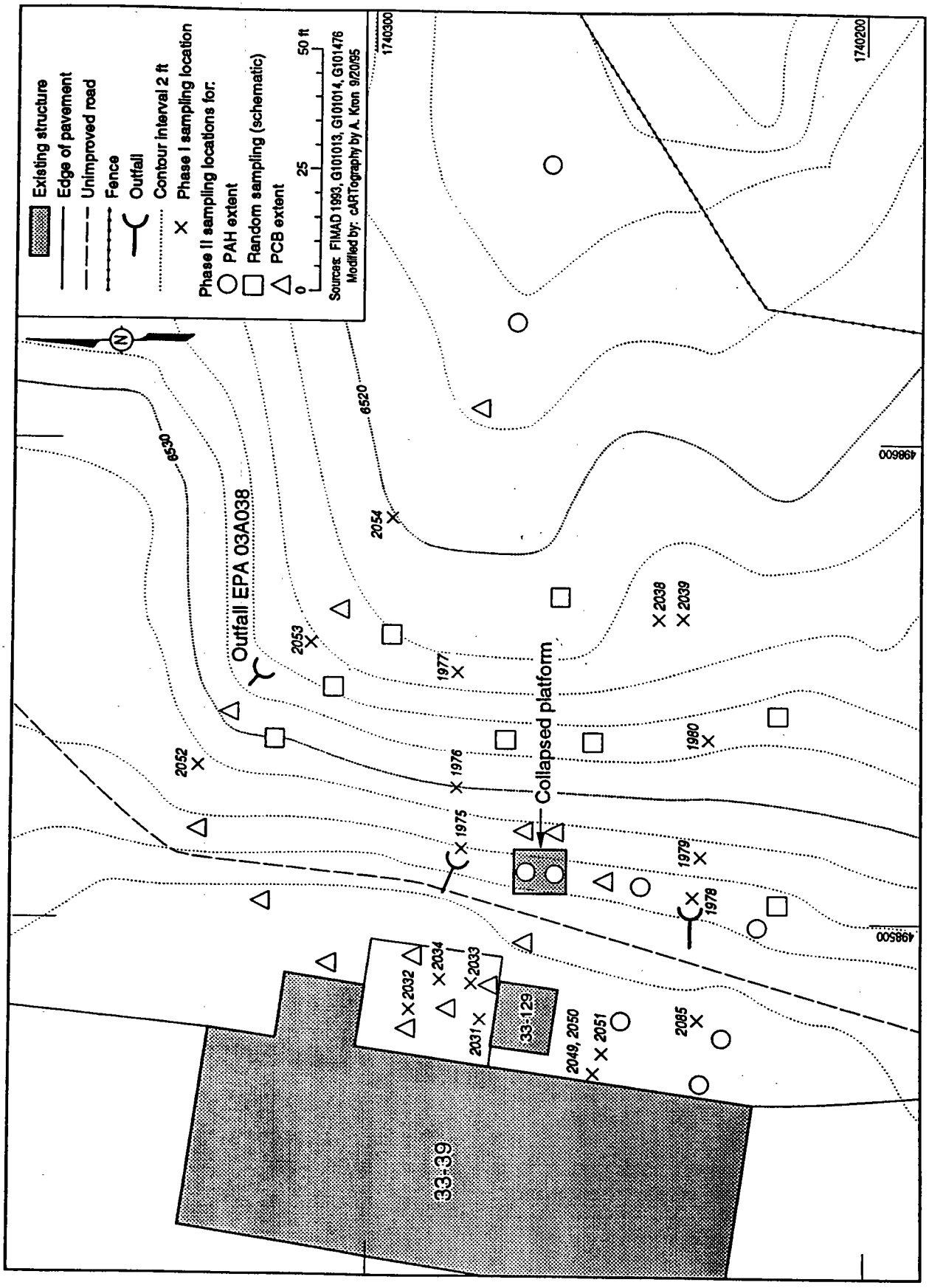


Fig. B-4. SWMU 33-017 Phase II sampling locations.

APPENDIX C PCB IMMUNOASSAY KIT

Field testing for polychlorinated biphenyls (PCBs) will be done using the D TECH™ PCB Field Test Kit, produced by EM Science/Strategic Diagnostics Inc. of Gibbstown, New Jersey. This kit can be used with a color comparison card in the range of 1 to 50 mg/kg, but it also comes with a hand-held reflectometer (the DTECHTOR™) for interpreting results of the tests. The reflectometer provides output in percentages, together with a suggested conversion to PCB equivalents (mg/kg) (Table C-1).

TABLE C-1

INTERPRETATION OF DETECHTOR™ READINGS (from D TECH™ Instruction Guide)

DTECHTOR™ READING (%)	PCB[a] EQUIVALENTS (mg/kg)
LO-10	<0.5
10-20	0.5-1.0
20-40	1.0-4.0
40-60	4.0-15.0
60-80	15.0-50
HI	>50

[a] PCB = Polychlorinated biphenyls.

Additional data on performance of the kit have been provided to LANL. These data are plotted in Fig. C-1, and show an approximately linear relationship between the DETECHTOR™ reading and the logarithm of the concentration as measured by SW-846 gas chromatography method 8080, for samples in the range of 0.1 to 120 mg/kg. The diagonal sequence of boxes shows how the samples would be classed by the algorithm of Table C-1. Samples within the boxes would be correctly classified; those above the boxes would be incorrectly classified into a lower category (8 samples out of 50), and those below would be incorrectly classified into a higher category (14 samples out of 50). As these error rates show, the algorithm is biased high, which is desirable for a screening procedure. This is also seen in Fig. C-1, where the regression line runs below the center of the boxes.

In these data, no sample above 10 mg/kg (as measured by gas chromatography) has a DETECHTOR™ reading of less than 44%. Tolerance bound calculations indicate that the probability of classifying a sample with true concentration of 10 mg/kg as "<4 mg/kg" is about

0.2, while half of samples at 10 mg/kg will be classified as ">15 mg/kg". The rules for collecting extra samples and for submitting waste characterization samples that are proposed in Appendix B Subsection 1.3 of this report are based on these results. Both DETECHTOR™ readings and classification results per Table C-1 will be reported, but the rules are stated in terms of the classification results, with cutoffs at 4 mg/kg (40% DETECHTOR™ reading) and 15 mg/kg (60% DETECHTOR™ reading).

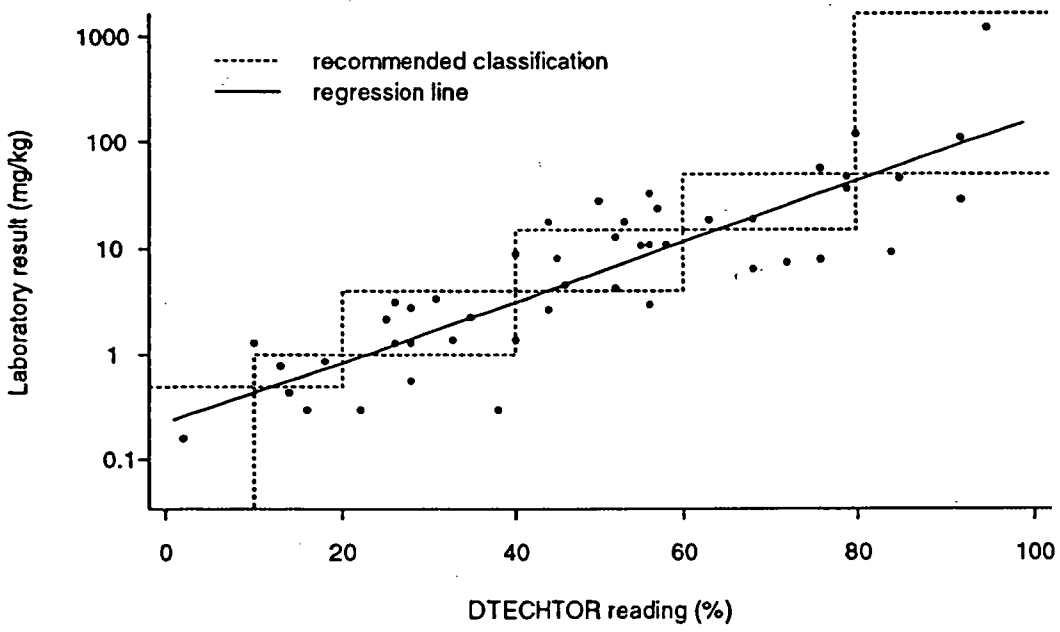


Fig. C-1. D-TECH plot.

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APPENDIX D RISK ASSESSMENT CALCULATIONS FOR SWMU 33-017

1.0 EXPOSURE ASSESSMENT

Exposure assessment requires identification of appropriate land use scenarios, exposure units, potential human receptors and exposure routes, and estimates of contaminant intake. For the risk assessments described in this report, it is assumed that all land may be used for future residential sites. For an exposure unit under the residential scenario, it is assumed that each residence will occupy approximately 0.15 acres (500 m2). The human exposure assumptions are that residents will be exposed to existing site contaminants for 20 hours/day, 350 days/year, for 30 years. The exposure pathways that are considered under the residential scenario include inhalation of vapors and wind-blown dust; ingestion of contaminated soil, water, and fruits or vegetables grown in contaminated soil; and contaminated soils or water coming into contact with the skin. Attachment 1 to Appendix K of the Installation Work Plan (IWP) provides additional detail about the intake assumptions used for each exposure pathway, under each land use scenario (LANL 1993, 1017).

2.0 TOXICITY ASSESSMENT

Toxicity assessment requires identifying appropriate toxicity values for contaminants of potential concern. Slope factors, which express the potential of a contaminant to cause cancer, are obtained from the Environmental Protection Agency's (EPA) Integrated Risk Information System, EPA's Health Effects Assessment Summary Tables, or the Superfund Health Risk Technical Support Center. Reference doses, which express non-carcinogenic toxicity of contaminants, are based on the most sensitive data set available for a given target organ or system (e.g., the liver or central nervous system).

Characterizing risk consists of two steps: calculating a quantified estimate of risk (e.g., exposure may result in a one in a million chance of developing cancer), and considering the uncertainties associated with the estimate to place risk in perspective. The numerical estimate of risk is calculated using methods found in EPA's Risk Assessment Guidance for Superfund (EPA 1989, 0305). The uncertainty analysis considers both the uncertainties inherent in the risk assessment process and the uncertainties specific to a particular site.

Appendix K of the IWP presents a detailed description of the risk assessment process adopted by LANL's Environmental Restoration ER Project (LANL 1993, 1017).

3.0 RISK CALCULATION FOR LEAD AT SWMU 33-017 VEHICLE MAINTENANCE AREA

Preliminary risk assessment results for the area east of TA-33-39 were discussed in Subsection 4.8.3.3 of this RFI report. This subsection discusses the calculations leading to these results. Analytical results for lead used in the calculations are given in Table D-1.

TABLE D-1

LEAD VALUES IN EXPOSURE UNIT EAST OF TA-33-39

PRS[a]	SITE ID	SAMPLE ID	LEAD (mg/kg)
33-004(i), north	33-1055	AAA1975	10
	33-1056	AAA1976	79
	33-1057	AAA1977	73
33-004(i), south	33-1058	AAA1978	800
	33-1059	AAA1979	71
	33-1060	AAA1980	210
33-012(a)	33-1086	AAA2031	104
	33-1087	AAA2032	118
	33-1088	AAA2033	53
	33-1089	AAA2034	9
33-017, vehicle maintenance area	33-1102	AAA2049	64
	33-1103	AAA2050	90
	33-1104	AAA2051	170
33-017, top of main drainage	33-1105	AAA2052	46
	33-1106	AAA2053	98
	33-1107	AAA2054	200

[a] PCB = Polychlorinated biphenyls.

3.1 Calculations for Lead at the SWMU 33-017 Exposure Unit

The calculation of the mean and upper confidence bound for lead contamination in the exposure unit east of TA-33-39 followed the method for minimum variance unbiased (MVU) estimation for lognormal populations described by Gilbert (1987, 0506), pp. 165-166. The data in Table D-1 are seen to be approximately lognormally distributed in the probability plot of Fig. D-1. (This is a probability plot, that is, the observed values have been sorted and plotted on a logarithmic scale against order statistics from the standard normal distribution. Data from a log-normal distribution should fall approximately along a straight line in such a plot. The departures from a straight line that occur at the low end in Fig. D-1 inflate the estimate of the variance and the estimates of the mean, see Equation 1 below, and especially of the upper confidence interval.)

The MVU estimate of the mean is

$$\hat{\mu} = [\exp(\bar{y})]\Psi_n\left(\frac{s_y^2}{2}\right) \qquad (1)$$

where is the sample mean of the logged data, is the sample variance, n is the sample size, and is a function tabled in Gilbert's book (although for our calculations we programmed this function using the series expansion given on p. 165 of that book and verified our program by comparing its results with Gilbert's Table A9.) An unbiased estimator of the variance of is given by

$$s^2(\hat{\mu}) = \exp(2\bar{y})\left\{\left[\Psi_n\left(\frac{s_y^2}{2}\right)\right]^2 - \Psi_n\left(\frac{s_y^2(n-2)}{n-1}\right)\right\} \qquad (2)$$

and thus a 95% upper confidence interval for the mean is computed finally as

$$\hat{\mu} + t_{n-1,0.95}s(\hat{\mu}) \qquad (3)$$

assuming approximate normality of the estimate (an application of the Central Limit Theorem of probability theory) with the usual number of degrees of freedom.

Risks were estimated using the EPA's Integrated Exposure Uptake Biokinetic (IEUBK) Model, Version 0.99d (EPA 1994, 1178). This model considers exposure to lead from several pathways and correlates total exposure to a blood lead level, which is the standard descriptor of lead exposure. The IEUBK model applies to young children from birth to seven years because children are more sensitive to lead toxicity than adults. According to EPA, an acceptable risk for lead exposure is less than 5% of the population expected to have blood lead levels of greater than 10 µg/dL. Results of the modeling effort for TA-33 reveal that 1.66% of a hypothetical population of children exposed to 416.3 mg/kg of lead would exceed the standard value of 10 µg/dL, indicating that adverse health effects from lead exposure are unlikely at this site.

3.2 Results of the EPA Lead Model (version 0.99d) based on 95% UCL Lead Concentration in Soil at the SWMU 33-017 Exposure Unit

Results of the EPA Lead (Pb) Model (Version 0.99d) based on 95% Upper Confidence Limit (UCL)

AIR CONCENTRATION:	0.100 µg Pb/m^3 DEFAULT		
Indoor air Pb Concentration:	40.0 percent of outdoor		
OTHER AIR PARAMETERS			
Age	**Time Outdoors (hr)**	**Ventilation Rate (m^3/day)**	**Lung Absolute (%)**
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Concentration: 4.00 µg Pb/L DEFAULT
WATER Consumption: DEFAULT

SOIL AND DUST Soil: Constant concentration Dust: Multiple source analysis		
AGE	**SOIL (µg Pb/g)**	**HOUSE DUST (µg Pb/g)**
0-1	350.0	255.0
1-2	350.0	255.0
2-3	350.0	255.0
3-4	350.0	255.0
4-5	350.0	255.0
5-6	350.0	255.0
6-7	350.0	255.0
Additional dust source: None		DEFAULT
Soil contribution conversion factor: 0.70		
Air contribution conversion factor: 100.0		

PAINT INTAKE: 0.00 µg Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Contribution: 2.50 µg Pb/dl

CALCULATED BLOOD Pb and Pb UPTAKES			
YEAR	BLOOD LEVEL (µg /dl)	TOTAL UPTAKE (µg /day)	SOIL + DUST UPTAKE (µg /day)
0.5-1	5.2	9.66	6.80
1-2	5.8	14.12	10.64
2-3	5.5	14.71	10.80
3-4	5.2	14.85	10.97
4-5	4.3	12.27	8.35
5-6	3.7	11.80	7.59
6-7	3.4	11.76	7.21

YEAR	DIET UPTAKE (µg /day)	WATER UPTAKE (µg /day)	PAINT UPTAKE (µg /day)	AIR UPTAKE (µg /day)
0.5-1	2.48	0.36	0.00	0.03
1-2	2.55	0.88	0.00	0.04
2-3	2.91	0.93	0.00	0.08
3-4	2.84	0.96	0.00	0.08
4-5	2.81	1.03	0.00	0.08
5-6	2.99	1.10	0.00	0.11
6-7	3.32	1.12	0.00	0.11

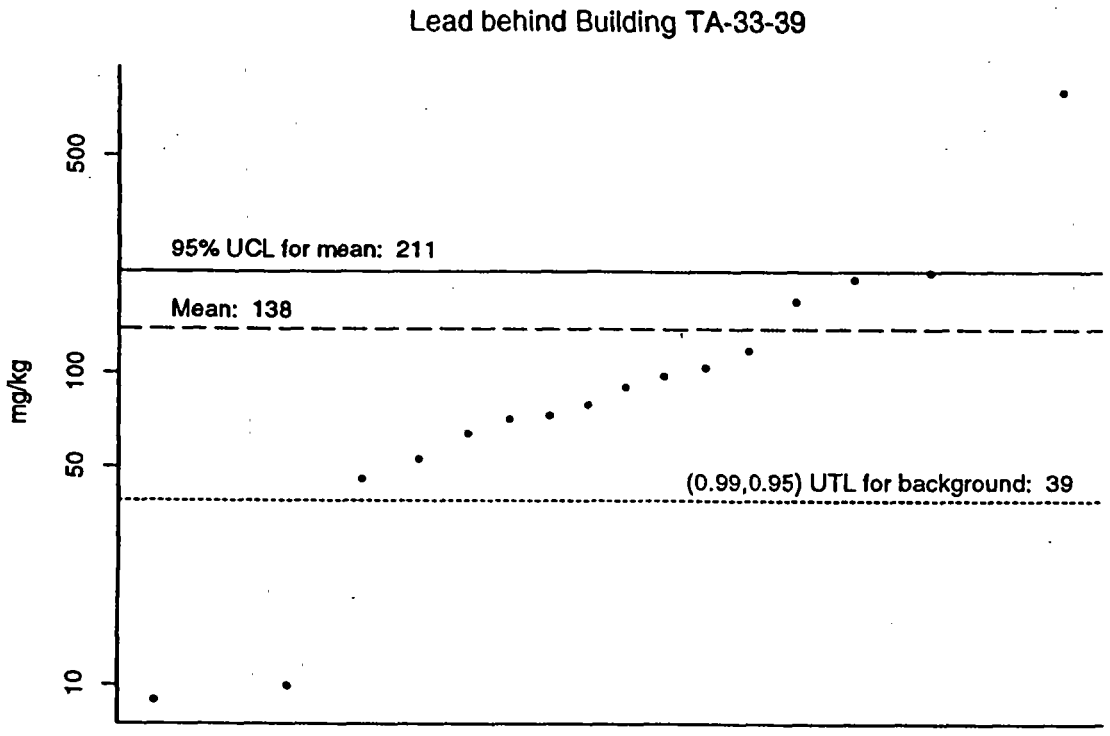


Fig. D-1. Probability plot of lead values.

4.0 RISK CALCULATION FOR PAHs AT SWMU 33-017 VEHICLE MAINTENANCE AREA

4.1 Risk Calculations for PAHs

The same formulas were used to calculate means and 95% UCLs for the seven PAHs shown in Table D-2. Below-detection-level observations were replaced by one-half the detection level. The approximate log-normality of the above-detection-level observations is illustrated in Fig. D-2 for benzo[a]anthracene, which is typical of the PAHs for which six to nine of the 16 observations are above the detection level (i.e., five of the seven constituents in Table D-2).

TABLE D-2

PAHs IN EXPOSURE UNIT EAST OF TA-33-39

	33-017: VEHICLE MAINTENANCE AREA			33-017: TOP OF MAIN DRAINAGE		
	AAA2049	AAA2050	AAA2051	AAA2052	AAA2053	AAA2054
Benzo[a]anthracene	<0.33	<0.33	8.20	<0.33	4.10	3.50
Benzo[a]pyrene	<0.33	<0.33	7.50	<0.33	4.70	4.00
Benzo[b]fluoranthene	0.34	<0.33	9.80	<0.33	6.20	5.20
Benzo[k]fluoranthene	0.34	<0.33	7.10	<0.33	4.30	3.90
Chrysene	0.35	<0.33	9.20	<0.33	5.50	4.60
Dibenzo[a,h]anthracene	<0.33	<0.33	<0.33	<0.33	0.59	<0.33
Indeno[1,2,3-cd]pyrene	<0.33	<0.33	4.20	<0.33	2.20	3.30
	33-004(i): NORTH OUTFALL			33-004(i): SOUTH OUTFALL		
	AAA1975	AAA1976	AAA1977	AAA1978	AAA1979	AAA1980
Benzo[a]anthracene	<0.33	1.80	0.39	1.30	1.60	0.60
Benzo[a]pyrene	<0.33	0.64	<0.33	0.86	1.30	0.62
Benzo[b]fluoranthene	<0.33	1.10	0.45	1.50	3.10	0.80
Benzo[k]fluoranthene	<0.33	<0.33	<0.33	0.36	<0.33	0.57
Chrysene	<0.33	2.00	0.54	1.50	1.50	0.64
Dibenzo[a,h]anthracene	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33
Indeno[1,2,3-cd]pyrene	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33

TABLE D-2 (CONTINUED)

PAHs IN EXPOSURE UNIT EAST OF TA-33-39

	33-012(a): STORAGE AREA			
	AAA2031	AAA2032	AAA2033	AAA2034
Benzo[a]anthracene	<0.33	0.51	<0.33	<0.33
Benzo[a]pyrene	<0.33	<0.33	<0.33	<0.33
Benzo[b]fluoranthene	<0.33	0.43	<0.33	<0.33
Benzo[k]fluoranthene	<0.33	0.52	<0.33	<0.33
Chrysene	<0.33	0.54	<0.33	<0.33
Dibenzo[a,h]anthracene	<0.33	<0.33	<0.33	<0.33
Indeno[1,2,3-cd]pyrene	<0.33	<0.33	<0.33	<0.33

Observations for seven PAHs detected in sixteen samples from this area are shown in Table D-3. Mean and 95% UCLs were computed for these seven cPAHs using the MVU lognormal estimators. Observations below detection level were replaced by one-half the detection level (EPA 1989, 0305). Calculated values are shown in Table D-3.

TABLE D-3

MEAN AND 95% UCLs FOR PAHs IN EXPOSURE UNIT EAST OF TA-33-39

PAH	MEAN (mg/kg)	95% UCL[a] (mg/kg)	SAL[b] (mg/kg)
Benzo[a]anthracene	1.35	2.28	1.0
Benzo[a]pyrene	1.11	1.89	0.10
Benzo[b]fluoranthene	1.74	3.03	1.0
Benzo[k]fluoranthene	0.88	1.45	1.0
Chrysene	1.61	2.74	22.0
Dibenzo[a,h]anthracene	0.19	0.21	0.1
Indeno[1,2,3-cd]pyrene	0.54	0.86	1.0

a UCL = Upper confidence limit.
b SAL = Screening action level.

Risks were estimated using the methodology outlined in Appendix K of the IWP for carcinogenic, nonradioactive compounds (LANL 1993, 1017). Two different exposure scenarios were considered:

- construction, which assumes that the exposure unit would continue to be used by LANL and that construction workers working in the unit would have the highest exposure potential; and
- residential, which assumes that the exposure unit would ultimately be used for housing.

Results show that the estimated carcinogenic risk to construction workers is low at both the mean and the 95% UCL concentrations: 2.7E-07 and 5.6E-07, respectively. Estimated risk to future residents based on the mean PAH concentration is 3.1E-06 and when based on all seven 95% UCLs, estimated risk rises to 2.1E-05. Printouts showing results of the calculations are included in Attachment D-1 of this appendix

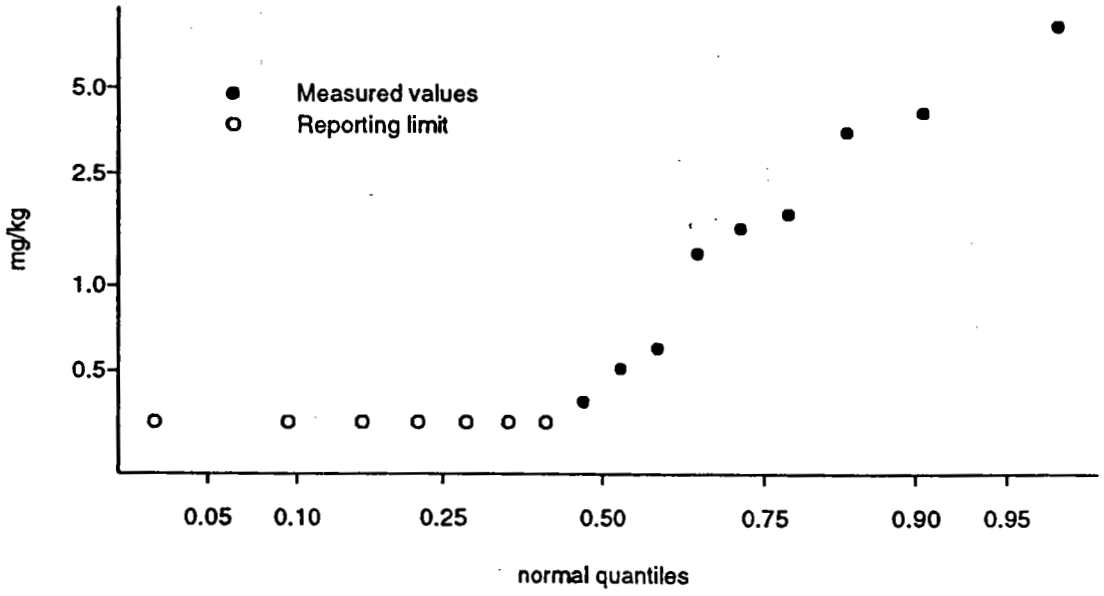


Fig. D-2. Distribution of benzo[a]anthracene in SWMU 33-017 exposure unit (lognormal plot).

5.0 REFERENCES

EPA (US Environmental Protection Agency), February 1994. "Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children," EPA 540-R-93-081, Office of Emergency and Remedial Response, Washington, DC. **(EPA 1994, 1178)**

Gilbert, R. O., 1987. Statistical Methods for Environmental Pollution Monitoring, Van Nostrand Reinhold, New York, New York. **(Gilbert 1987, 0506)**

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

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ATTACHMENT D-1

RESULTS OF RISK CALCULATIONS FOR PAHs AT THE SWMU 33-017 VEHICLE MAINTENANCE EXPOSURE UNIT

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TABLE C-C
STATISTICAL SUMMARY OF SOIL DATA
VEHICLE MAINTENANCE AREA
LANL, LOS ALAMOS, NEW MEXICO

COPCs	FOD	Minimum Detected Conc.	Maximum Detected Conc.	Arithmetic Mean	95% UCL	Lesser of Max. or 95% UCL
Semivolatiles						
Benzo(a)anthracene	9/16	< 0.33	8.2	1.352	2.282	2.282
Benzo(a)pyrene	7/16	< 0.33	7.5	1.114	1.891	1.891
Benzo(b)fluoranthene	10/16	< 0.33	9.6	1.744	3.034	3.034
Benzo(k)fluoranthene	7/16	< 0.33	7.1	0.875	1.454	1.454
Chrysene	10/16	< 0.33	9.2	1.607	2.745	2.745
Dibenzo(a,h) anthracene	1/16	< 0.33	0.59	0.187	0.214	0.590
Indeno(1,2,3-cd)pyrene	9/16	< 0.33	4.2	0.544	0.863	0.863
Inorganics						
Antimony	13/16	0.1	0.4	0.096	0.133	0.133
Arsenic	16/16	1.25	4.14	2.119	2.392	2.392
Barium	16/16	39	220	80.668	99.885	99.885
Beryllium	16/16	0.16	0.62	0.413	0.472	0.472
Cadmium	11/16	< 0.4	2.3	1.146	1.702	1.702
Chromium	16/16	4.2	84	18.412	25.800	25.800
Lead	16/16	9	800	138.22	210.958	210.958
Nickel	14/16	< 2.0	87	24.158	38.593	38.593
Selenium	3/16	< 0.2	1.2	0.096	0.133	0.133
Silver	2/16	< 1.0	46	1.69	2.762	2.762
Zinc	16/16	37	1700	385.144	608.07	608.070

COPCs = Chemicals of potential concern
FOD = Frequency of detection
Conc. = Concentration
UCL = Upper confidence limit
Max. = Maximum detected concentration
All concentrations are in units of mg/kg.

TABLE D-1
AIR CONCENTRATIONS OF CHEMICALS ADHERED ONTO DUSTS
VEHICLE MAINTENANCE AREA
LANL, LOS ALAMOS, NEW MEXICO

COPCs	RME EPC (Cs) (mg/kg)	RME EPC (Cp) (mg/m^3)
Semivolatiles		
Benzo(a)anthracene	2.28E+00	2.05E-07
Benzo(a)pyrene	1.89E+00	1.70E-07
Benzo(b)fluoranthene	3.03E+00	2.73E-07
Benzo(k)fluoranthene	1.45E+00	1.31E-07
Chrysene	2.75E+00	2.47E-07
Dibenzo(a,h) anthracene	5.90E-01	5.31E-08
Indeno(1,2,3-cd)pyrene	8.63E-01	7.77E-08
Inorganics		
Antimony	1.33E-01	1.20E-08
Arsenic	2.39E+00	2.15E-07
Barium	9.99E+01	8.99E-06
Beryllium	4.72E-01	4.25E-08
Cadmium	1.70E+00	1.53E-07
Chromium	2.58E+01	2.32E-06
Lead	2.11E+02	1.90E-05
Nickel	3.86E+01	3.47E-06
Selenium	1.33E-01	1.20E-08
Silver	2.78E+00	2.50E-07
Zinc	6.08E+02	5.47E-05

COPCs = Chemicals of potential concern
RME EPC = Reasonable Maximum Exposure Exposure Point Concentration
Cs = Concentration in soil
Cp = Concentration in dust particles = Cs x PC
PC = Particulate Concentration in Air = 9×10^{-8} kg/m^3

TABLE T-1
TOXICITY CRITERIA FOR CHEMICALS OF POTENTIAL CONCERN
VEHICLE MAINTENANCE AREA
LANL, LOS ALAMOS, NEW MEXICO

COPCs	Inhalation CSF (mg/kg/day)$^{-1}$	Chronic Oral CSF (mg/kg/day)$^{-1}$	Chronic Inhalation RfD (mg/kg/day)	Chronic Oral RfD (mg/kg/day)	Oral Absorption Fraction	Adjusted Dermal CSF (mg/kg/day)$^{-1}$	Adjusted Dermal RfD (mg/kg/day)
Semivolatiles							
Benzo(a)anthracene	7.30E-01	7.30E-01	NA	NA	0.84	8.69E-01	NA
Benzo(a)pyrene	7.30E+00	7.30E+00	NA	NA	0.84	8.69E+00	NA
Benzo(b)fluoranthene	7.30E-01	7.30E-01	NA	NA	0.84	8.69E-01	NA
Benzo(k)fluoranthene	7.30E-02	7.30E-02	NA	NA	0.84	8.69E-02	NA
Chrysene	7.30E-03	7.30E-03	NA	NA	0.84	8.69E-03	NA
Dibenzo(a,h) anthracene	7.30E+00	7.30E+00	NA	NA	0.84	8.69E+00	NA
Indeno(1,2,3-cd)pyrene	7.30E-01	7.30E-01	NA	NA	0.84	8.69E-01	NA
Inorganics							
Antimony	NC	NC	NA	4.00E-04	0.1	NC	4.00E-05
Arsenic	1.80E+01	1.80E+00	NA	3.00E-04	1	1.80E+00	3.00E-04
Barium	NC	NC	1.40E-04	7.00E-02	0.05	NC	3.50E-03
Beryllium	8.40E+00	4.30E+00	NA	5.00E-03	0.005	8.60E+02	2.50E-05
Cadmium	6.30E+00	NA	NA	5.00E-04	0.07	NC	3.50E-05
Chromium	4.20E+01	NA	NA	5.00E-03	0.1	NC	5.00E-04
Lead	UBM	UBM	UBM	UBM	0.5	NA	NA
Nickel	NC	NC	NA	2.00E-02	0.1	NC	2.00E-03
Selenium	NC	NC	NA	5.00E-03	0.97	NC	4.85E-03
Silver	NC	NC	NA	5.00E-03	1	NC	5.00E-03
Zinc	NC	NC	NA	3.00E-01	0.3	NC	9.00E-02

COPCs = Chemicals of potential concern
CSF = Cancer Slope Factor
RfD = Reference Dose
Adjusted Dermal CSF = Chronic Oral CSF / Oral Absorption Fraction
Adjusted Dermal RfD = Chronic Oral RfD x Oral Absorption Fraction
NA = No available data
NC = Not carcinogenic
UBM = Evaluated using the EPA Uptake Biokinetic Model

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TABLE E-E
EXPOSURE PARAMETERS
VEHICLE MAINTENANCE AREA
LANL, LOS ALAMOS, NEW MEXICO

Exposure Parameter	Symbol	Units	Residents		References
			Adults	Children	
Inhalation Rate – indoor air	IRa	m^3/hr	0.83	0.66	
Inhalation Rate – outdoor air	IRa	m^3/hr	1.7	1.3	
Soil Ingestion Rate	IGs	mg/day	100	200	
Skin Surface Area Exposed	SA	cm^2/day	5000	2000	
Soil–skin Adherence Factor	SAF	mg/cm^2	1	1	
Exposure Time	ET	hr/day	20	20	
Exposure Frequency	EF	days/yr	350	350	
Exposure Duration	ED	year	30	6	
Fraction Ingested, Inhaled or Contacted from Site	FI or FC	unitless	1	1	
Conversion Factor	CF	kg/mg	1E-06	1E-06	Conversion Factor
Body Weight	BW	kg	70	15	
Averaging Time – Cancer	ATc	days	25550	25550	365 days/year x 70 years (lifetime)
Averaging Time – NonCancer	ATnc	days	10950	2190	365 days/year x ED

LADD/ADD = Lifetime Average Daily Dose/Average Daily Dose

Inhalation LADD Intake Rate Factors – outdoor air	2.00E-01	1.42E-01
Inhalation ADD Intake Rate Factors – outdoor air	4.66E-01	1.66E+00
Soil Ingestion LADD Intake Rate Factors	5.87E-07	1.10E-06
Soil Ingestion ADD Intake Rate Factors	1.37E-06	1.28E-05
Dermal Contact LADD Intake Rate Factors	2.94E-05	1.10E-05
Dermal Contact ADD Intake Rate Factors	6.85E-05	1.28E-04

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TABLE I-1
CARCINOGENIC RISKS FROM SOIL INGESTION
FUTURE RESIDENT SCENARIO (CHILDREN)
VEHICLE MAINTENANCE AREA

COPCs	RME EPC (Cs) (mg/kg)	Child LADD (mg/kg/day)	Oral CSF (mg/kg/day)$^{-1}$	Child Cancer Risk
Semivolatiles				
Benzo(a)anthracene	2.28E+00	2.60E-06	7.30E-01	1.8E-06
Benzo(a)pyrene	1.89E+00	2.07E-06	7.30E+00	1.5E-05
Benzo(b)fluoranthene	3.06E+00	3.32E-06	7.30E-01	2.4E-06
Benzo(k)fluoranthene	1.45E+00	1.59E-06	7.30E-02	1.2E-07
Chrysene	2.76E+00	3.01E-06	7.30E-03	2.2E-08
Dibenzo(a,h) anthracene	5.90E-01	6.47E-07	7.30E+00	4.7E-06
Indeno(1,2,3-cd)pyrene	8.63E-01	9.46E-07	7.30E-01	6.9E-07
Inorganics				
Antimony	1.33E-01	1.46E-07	NC	NC
Arsenic	2.39E+00	2.62E-06	1.50E+00	4.7E-06
Barium	9.99E+01	1.09E-04	NC	NC
Beryllium	4.72E-01	5.17E-07	4.30E+00	2.2E-06
Cadmium	1.70E+00	1.87E-06	NA	NA
Chromium	2.58E+01	2.83E-05	NA	NA
Lead	2.11E+02	2.31E-04	NA	NA
Nickel	3.86E+01	4.23E-05	NC	NC
Selenium	1.33E-01	1.46E-07	NC	NC
Silver	2.78E+00	3.05E-06	NC	NC
Zinc	6.06E+02	6.66E-04	NC	NC
TOTAL RISK				3.2E-05

COPCs = Chemicals of potential concern
RME EPC = Reasonable Maximum Exposure Exposure Point Concentration in soil
LADD = Lifetime Average Daily Dose = Cs x LADD Factor
[Soil Ingestion Intake Rate LADD Factor = 1.10E-06]
CSF = Carcinogenic Slope Factor
NC = Noncarcinogen
NA = Not Applicable

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TABLE I -2
NONCARCINOGENIC RISKS FROM SOIL INGESTION
FUTURE RESIDENT SCENARIO (CHILDREN)
VEHICLE MAINTENANCE AREA

COPCs	RME EPC (Cs) (mg/kg)	Child ADD (mg/kg/day)	Chronic Oral RfD (mg/kg/day)	Child HQ
Semivolatiles				
Benzo(a)anthracene	2.28E+00	2.92E-05	NA	NA
Benzo(a)pyrene	1.89E+00	2.42E-05	NA	NA
Benzo(b)fluoranthene	3.03E+00	3.88E-05	NA	NA
Benzo(k)fluoranthene	1.45E+00	1.86E-05	NA	NA
Chrysene	2.75E+00	3.51E-05	NA	NA
Dibenzo(a,h) anthracene	5.90E-01	7.54E-06	NA	NA
Indeno(1,2,3-cd)pyrene	8.63E-01	1.10E-05	NA	NA
Inorganics				
Antimony	1.33E-01	1.70E-06	4.00E-04	4.3E-03
Arsenic	2.39E+00	3.06E-05	3.00E-04	1.0E-01
Barium	9.99E+01	1.28E-03	7.00E-02	1.8E-02
Beryllium	4.72E-01	6.03E-06	5.00E-03	1.2E-03
Cadmium	1.70E+00	2.18E-05	5.00E-04	4.4E-02
Chromium	2.58E+01	3.30E-04	5.00E-03	6.6E-02
Lead	2.11E+02	2.70E-03	NA	NA
Nickel	3.86E+01	4.93E-04	2.00E-02	2.5E-02
Selenium	1.33E-01	1.70E-06	5.00E-03	3.4E-04
Silver	2.78E+00	3.56E-05	5.00E-03	7.1E-03
Zinc	6.08E+02	7.77E-03	3.00E-01	2.6E-02
TOTAL HAZARD INDEX				2.8E-01

RME EPC = Reasonable Maximum Exposure Exposure Point Concentration
ADD = Average Daily Dose = Cs x ADD Factor
Soil Ingestion Intake Rate ADD Factor = 1.28E-05
RfD = Reference Dose
HQ = Hazard Quotient
NC = Noncarcinogen
NA = Not Applicable

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TABLE D-1
CARCINOGENIC RISKS FROM DERMAL CONTACT
FUTURE RESIDENT SCENARIO (CHILDREN)
VEHICLE MAINTENANCE AREA

COPCs	RME EPC (Cs) (mg/kg)	Dermal AF (unitless)	Child LADD (mg/kg/day)	Adjusted Dermal CSF (mg/kg/day)$^{-1}$	Child Cancer Risk
Semivolatiles					
Benzo(a)anthracene	2.28E+00	0.15	3.75E-06	8.69E-01	3.3E-06
Benzo(a)pyrene	1.89E+00	0.15	3.11E-06	8.69E+00	2.7E-05
Benzo(b)fluoranthene	3.03E+00	0.15	4.99E-06	8.69E-01	4.3E-06
Benzo(k)fluoranthene	1.45E+00	0.15	2.39E-06	8.69E-02	2.1E-07
Chrysene	2.75E+00	0.15	4.51E-06	8.69E-03	3.9E-08
Dibenzo(a,h) anthracene	5.90E-01	0.15	9.70E-07	8.69E+00	8.4E-06
Indeno(1,2,3 -cd)pyrene	8.63E-01	0.15	1.42E-06	8.69E-01	1.2E-06
Inorganics					
Antimony	1.33E-01	0.01	1.46E-06	NC	NC
Arsenic	2.39E+00	0.01	2.62E-07	1.80E+00	4.7E-07
Barium	9.99E+01	0.01	1.09E-05	NC	NC
Beryllium	4.72E-01	0.01	5.17E-06	8.60E+02	4.4E-05
Cadmium	1.70E+00	0.01	1.87E-07	NA	NA
Chromium	2.56E+01	0.01	2.83E-06	NA	NA
Lead	2.11E+02	0.01	2.31E-05	NA	NA
Nickel	9.88E+01	0.01	4.23E-06	NC	NC
Selenium	1.33E-01	0.01	1.46E-06	NC	NC
Silver	2.78E+00	0.01	3.05E-07	NC	NC
Zinc	6.08E+02	0.01	6.66E-05	NC	NC
TOTAL RISK					8.9E-05

AF = Adherence Factor
RME EPC = Reasonable Maximum Exposure Exposure Point Concentration
LADD = Lifetime Average Daily Dose = Cs x LADD Factor
Dermal Contact Intake Rate LADD Factor = 1.10E-05
CSF = Carcinogenic Slope Factor
NC = Noncarcinogen
NA = Not Applicable

TABLE D-2
NONCARCINOGENIC RISKS FROM DERMAL CONTACT
FUTURE RESIDENT SCENARIO (CHILDREN)
VEHICLE MAINTENANCE AREA

COPCs	RME EPC (Cs) (mg/kg)	Dermal AF (unitless)	Child ADD (mg/kg/day)	Adjusted Dermal RfD (mg/kg/day)	Child HQ
Semivolatiles					
Benzo(a)anthracene	2.28E+00	0.15	4.38E-05	NA	NA
Benzo(a)pyrene	1.89E+00	0.15	3.63E-05	NA	NA
Benzo(b)fluoranthene	3.03E+00	0.15	5.82E-05	NA	NA
Benzo(k)fluoranthene	1.45E+00	0.15	2.79E-05	NA	NA
Chrysene	2.75E+00	0.15	5.28E-05	NA	NA
Dibenzo(a,h) anthracene	5.90E-01	0.15	1.13E-05	NA	NA
Indeno(1,2,3-cd)pyrene	8.63E-01	0.15	1.66E-05	NA	NA
Inorganics					
Antimony	1.33E-01	0.01	1.70E-07	4.00E-05	4.3E-03
Arsenic	2.39E+00	0.01	3.06E-06	3.00E-04	1.0E-02
Barium	9.99E+01	0.01	1.28E-04	3.50E-03	3.6E-02
Beryllium	4.72E-01	0.01	6.03E-07	2.50E-05	2.4E-02
Cadmium	1.70E+00	0.01	2.18E-06	3.50E-05	6.2E-02
Chromium	2.58E+01	0.01	3.30E-05	5.00E-04	6.6E-02
Lead	2.11E+02	0.01	2.70E-04	NA	NA
Nickel	3.66E+01	0.01	4.93E-05	2.00E-03	2.5E-02
Selenium	1.33E-01	0.01	1.70E-07	4.85E-03	3.5E-05
Silver	2.76E+00	0.01	3.56E-06	5.00E-03	7.1E-04
Zinc	6.06E+02	0.01	7.77E-04	9.00E-02	8.6E-03
TOTAL HAZARD INDEX					2.4E-01

RME EPC = Reasonable Maximum Exposure Exposure Point Concentration
ADD = Average Daily Dose = Cs x ADD Factor
Dermal Contact Intake Rate ADD Factor = 1.28E-04
RfD = Reference Dose
HQ = Hazard Quotient
NC = Noncarcinogen
NA = Not Applicable

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TABLE R-R
SUMMARY OF CARCINOGENIC RISKS
FUTURE RESIDENT SCENARIO (CHILDREN)
VEHICLE MAINTENANCE AREA

COPCs	Soil Ingestion	Dermal Contact	Inhalation of Dusts	TOTAL CANCER RISK	Percent Contribution
Semivolatiles					
Benzo(a)anthracene	1.6E-06	3.3E-06	2.1E-08	5E-06	4%
Benzo(a)pyrene	1.5E-05	2.7E-05	1.8E-07	4E-05	31%
Benzo(b)fluoranthene	2.4E-06	4.3E-06	2.8E-08	7E-06	5%
Benzo(k)fluoranthene	1.2E-07	2.1E-07	1.4E -09	3E-07	0%
Chrysene	2.2E-08	3.9E-08	2.6E-10	6E-08	0%
Dibenzo(a,h) anthracene	4.7E-06	8.4E-06	5.5E-08	1E-05	10%
Indeno(1,2,3-cd)pyrene	6.9E-07	1.2E-06	8.1E-09	2E-06	1%
Inorganics					
Antimony	NC	NC	NC	NA	0%
Arsenic	4.7E-06	4.7E-07	4.6E-07	6E-06	4%
Barium	NC	NC	NC	NA	0%
Beryllium	2.2E-06	4.4E-05	5.1E-08	5E-05	34%
Cadmium	NA	NA	1.4E-07	1E-07	0%
Chromium	NA	NA	1.4E-05	1E-05	10%
Lead	NA	NA	NA	NA	0%
Nickel	NC	NC	NC	NA	0%
Selenium	NC	NC	NC	NA	0%
Silver	NC	NC	NC	NA	0%
Zinc	NC	NC	NC	NA	0%
TOTAL CANCER RISK	3E-05	9E-05	1E-05	1E-04	100%
Percent Contribution	23%	66%	11%	100%	

COPCS = Chemicals of potential concern
NC = Noncarcinogen
NA = Not Available

TABLE H-H
SUMMARY OF HAZARD INDICES
FUTURE RESIDENT SCENARIO (CHILDREN)
VEHICLE MAINTENANCE AREA

COPCs	Soil Ingestion	Dermal Contact	Inhalation of Dusts	TOTAL HAZARD INDEX	Percent Contribution
Semivolatiles					
Benzo(a)anthracene	NA	NA	NA	NA	0%
Benzo(a)pyrene	NA	NA	NA	NA	0%
Benzo(b)fluoranthene	NA	NA	NA	NA	0%
Benzo(k)fluoranthene	NA	NA	NA	NA	0%
Chrysene	NA	NA	NA	NA	0%
Dibenzo(a,h) anthracene	NA	NA	NA	NA	0%
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	0%
Inorganics					
Antimony	4.3E-03	4.3E-03	NA	9E-03	1%
Arsenic	1.0E-01	1.0E-02	NA	1E-01	18%
Barium	1.8E-02	3.6E-02	1.1E-01	2E-01	25%
Beryllium	1.2E-03	2.4E-02	NA	3E-02	4%
Cadmium	4.4E-02	6.2E-02	NA	1E-01	17%
Chromium	6.6E-02	6.6E-02	NA	1E-01	21%
Lead	NA	NA	NA	NA	0%
Nickel	2.6E-02	2.5E-02	NA	5E-02	8%
Selenium	3.4E-04	3.6E-05	NA	4E-04	0%
Silver	7.1E-03	7.1E-04	NA	8E-03	1%
Zinc	2.6E-02	8.6E-03	NA	3E-02	5%
HAZARD INDEX	3E-01	2E-01	1E-01	6E-01	100%
Percent Contribution	46%	37%	17%	100%	

COPCs = Chemicals of potential concern
NA = Not Available

ADDENDUM 1

VOLUNTARY CORRECTIVE ACTION PLAN COMPLETION REPORT FOR SOLID WASTE MANAGEMENT UNIT 33-016 SUMP WITH OUTFALL

SEPTEMBER 1995

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Voluntary Corrective Action Plan Completion Report
Potential Release Site 33-016
Sump with Outfall

DESCRIPTION

Potential Release Site 33-016 is a sump that once served the sink and floor drain in a bunker located south of main site, building TA-33-23 (Fig. 1). The bunker was used to prepare propellant charges for use at South Site in the 1950's and then as storage for EES-1. PRS 33-016 is listed in the Hazardous and Solid Waste Amendments (HSWA) Module of the Los Alamos National Laboratory's (LANL's) Resource Conservation and Recovery Act (RCRA) Permit.

The sump is on the west side of the building and is approximately 5 ft long by 2.5 ft wide by 7 ft deep. The sludge was analyzed during RFI sampling in 1993. This analysis indicated the presence of HE by-products, PAHs, and SVOCs above health-based levels. Analytical results are presented in Table 1. The soil at the outfall was sampled but revealed no contamination. The sludge was sampled again during the VCA cleanup and is addressed below.

CORRECTIVE ACTION

The proposed treatment for the site was to remove the sludge, abandon the concrete sump in-place, and backfill with gravel and sand. The cleanup followed the VCA Plan except in sampling. During sludge removal, there were elevated readings on the photoionization detector (PID). Because of the 10 to 20 ppm PID readings, additional sludge and liquid samples were collected and analyzed for lead, volatile, and semivolatile organics using EPA methods 6010, 8260 and 8270, respectively.

The initial cleanup involved pumping water from the sump into seven lined 55-gal barrels. During sludge removal it was decided to sample the sludge to examine the factor(s) contributing to the elevated PID readings. The analytical results were reviewed and determined to be non-RCRA by the ESH-19 hazardous waste regulator and

the Field Team leader. Analytical results are presented in Table 2 and are provided in Attachment A. The sludge was removed and placed in one, lined 55-gal. barrel. The sump was filled with gravel and sand and capped with 1 ft of concrete. The non-hazardous waste generated at this site is scheduled to be disposed of at the Liquid Waste Facility and a clean landfill.

All samples were collected for waste characterization and are compared to RCRA limits; any data associated with this PRS will be made available upon request.

This VCA was considered a final remedy to PRS 33-016, and this report serves as the formal request for regulator concurrence to remove PRS 33-016 from the HSWA module.

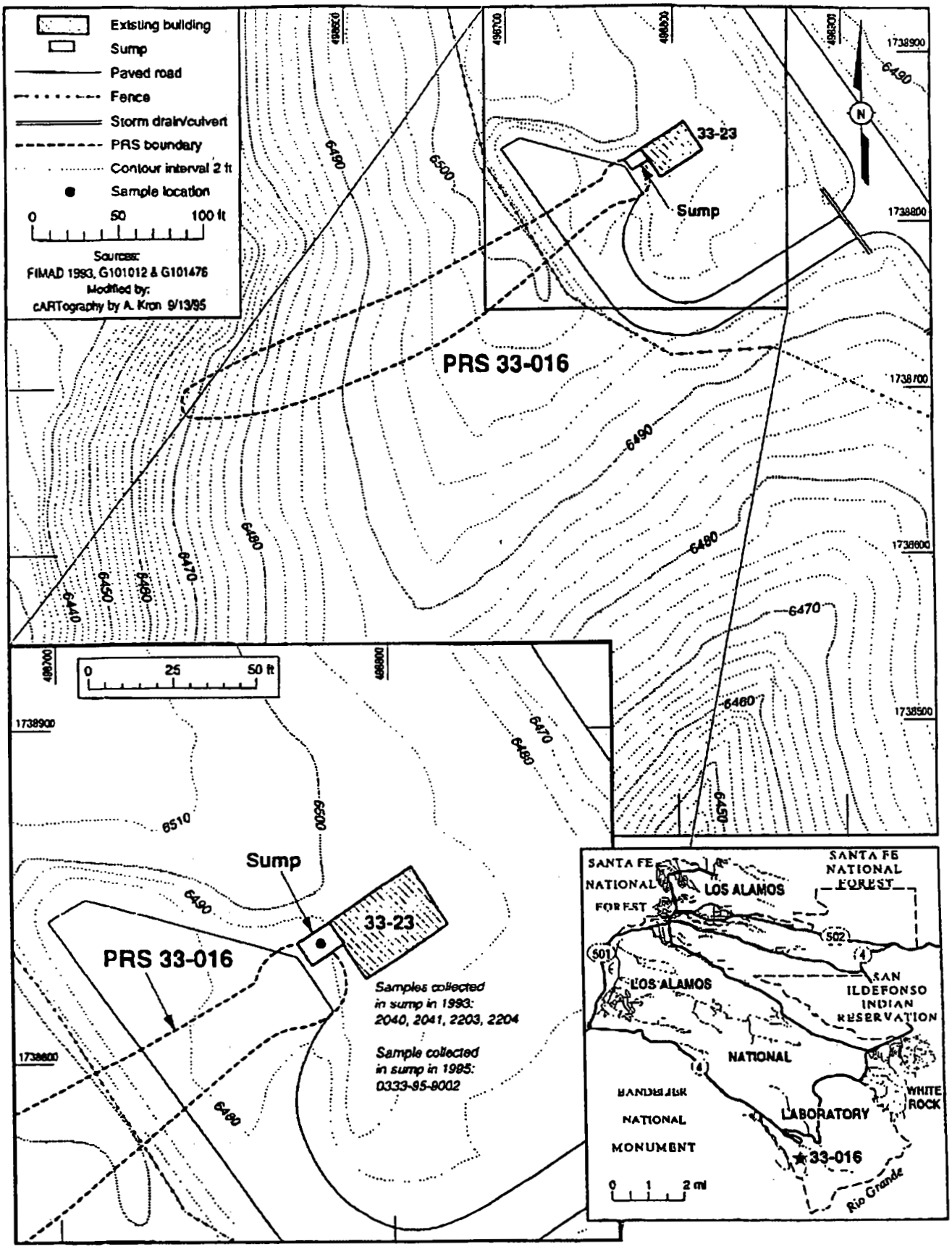


Figure 1. Location of PRS 33-016, proposed for VCA.

TABLE 1

SAMPLE RESULTS FOR SLUDGE SAMPLES AAA2041 AND AAA2204

ANALYTE	SAMPLE RESULT AAA2041 (ppm) [a]	SAMPLE RESULT AAA2204 (ppm)	SAL (ppm)
Benzo(a)pyrene	16.0	18	0.1
Benzo(a)anthracene	23.0	20	1
Benzo(b)fluoranthene	13.0	12	1
Benzo(k)fluoranthene	19.0	19	1
Chrysene	24	24	22
Indeno[1,2,3-cd]pyrene	9.7	15	1
2,4-Dinitrotoluene	nd	2.5	1
Bis(2-ethylhexyl)phthalate	24	111	50

[a] Only samples results above SALs are reported.

TABLE 2

SAMPLE RESULTS FOR SLUDGE AND LIQUID SAMPLES [a]

ANALYTE	0333-95-0002 (µg/g)	0333-95-0001 (µg/l)	0333-95-0003 (µg/l)	RCRA LIMIT [c] (mg/L)
1,1-Dichloroethylene	210			0.7
1,1-Dichloroethane		3.84	3.45	
Acetone		18.9	142	-
Methyl chloride			2.34	-
2-Methylnaphthalene	73.5			-
Di-n-butyl phthalate			15.2	-
Phenathrene	70.2			-
bis(2-Ethylhexyl)phthalate	244		24.6	-
Mercury	0.291			0.2
Silver	20.1			5.0
Aluminum	5 010	102	293	-
Arsenic	7.06			5.0
Barium	94.3	186	105	100.0
Calcium	4 750	68 600	73 300	-
Cadmium	1.76			1.0
Cobalt	4.47			-
Chromium	52.4			5.0
Copper	285		18.8	-
Iron	12 600	802	1310	-
Potassium	768	12 300	12 700	-
Magnesium	2 970	2 580	2 660	-
Manganese	112	199	114	-
Sodium	414	34 300	24 500	-
Nickel	88.5	29.9	35.2	-
Lead	293 [b]	14.5	17	5.0
Antimony	1.49			-
Selenium	0.972			1.0

TABLE 2 (CONTINUED)

SAMPLE RESULTS FOR SLUDGE AND LIQUID SAMPLES [a]

ANALYTE	0333-95-0002 (µg/g)	0333-95-0001 (µg/l)	0333-95-0003 (µg/l)	RCRA LIMIT
Vanadium	28.2			-
Zinc	458	69.3	87.6	-

[a] Only sample results above detection limits are reported.

[b] Lead was the only sludge component that resulted in a detectable value (245µg/l) during TCLP analysis.

c. Maximum Concentration of Contaminants for the Toxicity Characteristic, 40 CFR 261.24.

CERTIFICATION OF COMPLETION

I certify that all work pertaining to the voluntary corrective action (VCA) 33-016 has been completed in accordance with the Department of Energy approved VCA plan entitled **VCA Plan for PRS 33-016, Sump with Outfall.** Based on my personal involvement or inquiry of the person or persons who managed this clean up, a review of all data gathered and a visit to the site, to the best of my knowledge and belief, all criteria of the plan have been met or exceeded. I believe that the completion of the VCA is both protective to human health and the environment. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Brad Martin

Brad Martin
Field Unit 3 Project leader
Environmental Restoration Program
Los Alamos National Laboratory

9/6/95

Date Signed