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TA-32

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LOS ALAMOS NATIONAL LABORATORY
RCRA FACILITY INVESTIGATION REPORT
FOR SOLID WASTE MANAGEMENT UNITS
32-001 AND 32-002 (a-b)
FORMER TECHNICAL AREA 32

FINAL DRAFT

(December 14, 1994)

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EXECUTIVE SUMMARY

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report describes the Phase I investigation performed at Technical Area (TA) 32. TA-32 was the medical research and training facility at Los Alamos National Laboratory between the years 1944 to 1954. Research at that time included work in the areas of organic chemistry, radiobiology, and biochemistry.

TA-32 was located south of Trinity Drive, behind the present Los Alamos County Roads Division, near the north edge of Los Alamos Canyon. The site was decommissioned in 1954. The SWMU's identified with this site are SWMU 32-001, a former incinerator location, and SWMUs 32-002(a-b), two septic tank systems.

The objectives of the Phase I Investigation were to determine if there was residual soil contamination associated with the incinerator, the septic tanks systems, and outfall areas. In addition, the objective was to determine if the septic tank lines remained, and if found, to remove them.

No Contaminants of Concern (COCs) were above background levels, Screening Action Levels (SALs), or regulatory guidelines at the locations of the former incinerator or the above-ground wooden septic tank. Therefore, SWMU 32-001 and SWMU 32-002(a) are recommended for No Further Action (NFA).

The results of the investigation indicated the presence of a septic tank line on the mesa top leading to SWMU 32-002(b). RCRA metals were found in the pipe and in the underlying soils. An Expedited Cleanup (EC) is recommended for removing the septic tank line and surrounding soils.

Reconnaissance sampling in the outfall area downgradient from SWMU 32-002(b) indicated the presence of RCRA metals, the PCB Aroclor 1260 and the possibility of radioactive contamination. A Phase II Sampling Investigation is recommended to define the nature and extent of contamination in this area.

1.0 INTRODUCTION

This report presents the results of the Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at the site of former Technical Area 32 (TA-32) at Los Alamos National Laboratory (LANL). Included in this report are data assessment, analysis approach, site specific results, conclusions and recommendations.

1.1 Facility Background

Technical Area 32 was the medical research and training facility at LANL between the years 1944 to 1954. Research at that time included work in the areas of organic chemistry, radiobiology, and biochemistry. The Contaminants of Concern in the RFI Work Plan for OU 1079 at TA-32 are identified as Carbon-14, Plutonium 238 and 239, Americium 241, Tritium, Volatile Organic Compounds (VOC), Semivolatile Organic Compounds (SVOC) and Target Analyte List (TAL) Metals.

TA-32 is located south of Trinity Drive, behind the Los Alamos County Roads Division, near the north edge of Los Alamos Canyon (Figure 1). The TA-32 facilities consisted of four laboratories, an office building, three warehouses, an incinerator, two septic tanks, a valve house, and a transformer station The site was decommissioned in 1954 and most structures were demolished at that time. The SWMUs identified with this site are SWMU 32-001, a former incinerator location, and SWMUs 32-002(a-b), two septic tank systems.

The former incinerator location (SWMU 32-001) is currently under a paved parking lot within the Los Alamos County Roads Division storage yard. SWMU 32-002(a), a wooden septic tank, was thought to have been left at the site following decommissioning in 1954. Wood debris remaining at the site was assumed to be the remains of SWMU 32-002(a). SWMU 32-002(b), the other septic tank, was constructed of reinforced concrete and was removed in 1988.

1.2 RFI Phase I Work Plan Overview

The objectives of the investigation were to determine if there was residual soil contamination associated with the incinerator and the septic tank systems. The objective of the outfall sampling strategy was to determine the presence of contaminants along the drainage of the potential outfalls, from the mesa top to the toe of the hill slope.

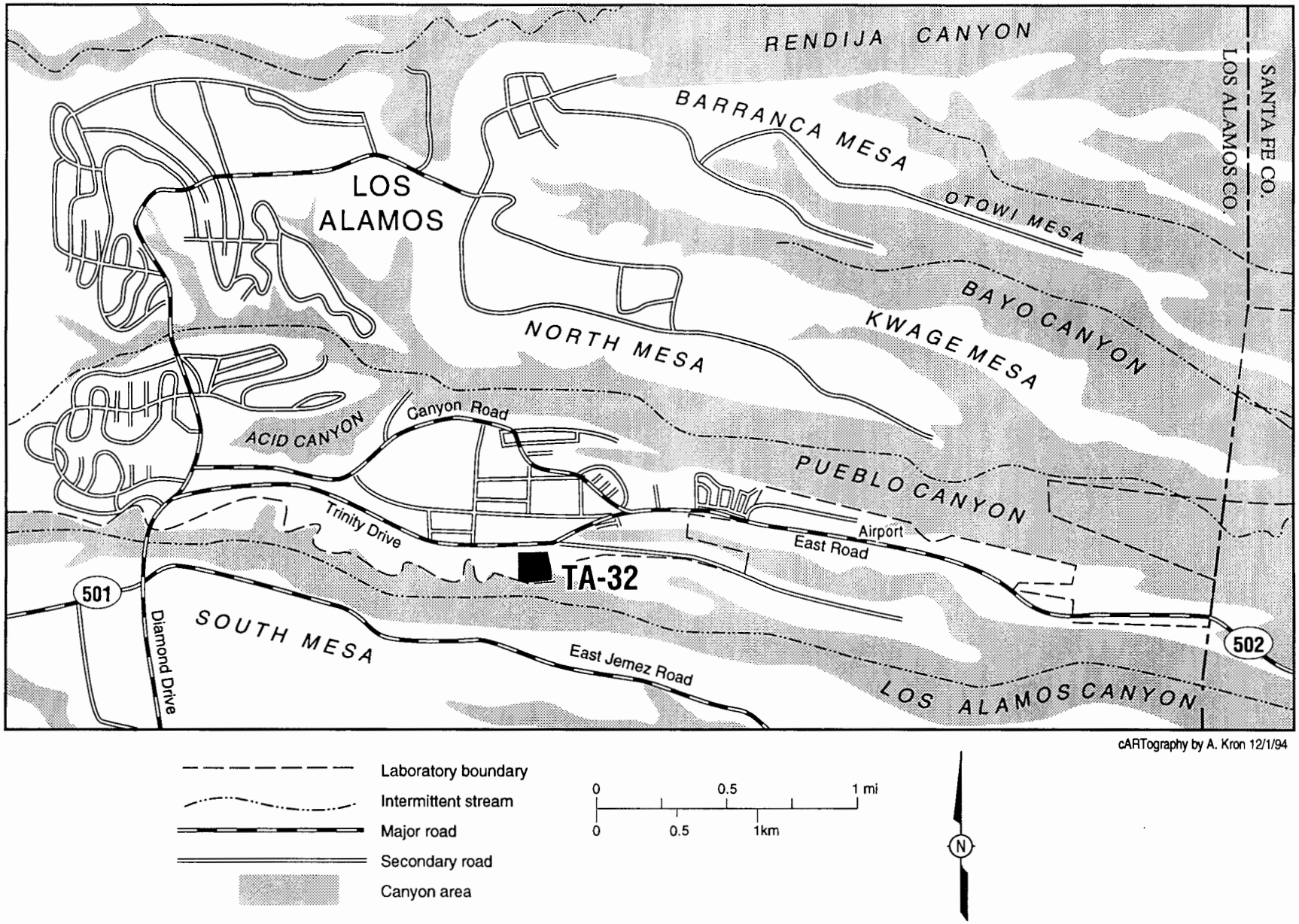


Fig. 1. General location of TA-32.

Another objective of the investigation was to determine if the septic tank lines still remained, and if found, to remove them. It is unknown whether the septic lines from the former TA-32 laboratory building to the septic tanks were removed during decommissioning. No lines were found during the septic tank removal in 1988. (LANL,1992, 0783).

1.3 Field Activities

Field activities at TA-32 consisted of sampling the former incinerator location, former septic tank locations, and outfalls. Two trenches were dug to locate the former septic system lines and soil samples were taken from each trench. (ICF Kaiser, 1993 XXX)

All samples were field screened for radioactivity, using a Ludlum Model 2221 with a Ludlum probe 44-9 (Standard Geiger-Muller) and for volatile organic vapors, using a Photoionization Detector (HNu). If radioactivity was detected in any sample during the field screening, those samples were to be analyzed using gamma spectrometry to identify individual radionuclides. If volatile organic vapors were detected during field screening, those samples were to be analyzed for volatile organic compounds. All soil samples were then analyzed for Target Analyte List (TAL) metals and semivolatile organic compounds. The TAL list includes aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

For the purposes of waste characterization, all samples were analyzed for polychlorinated biphenyls (PCBs) and subsurface soil samples were analyzed for volatile organic compounds. Two field duplicates and one rinsate sample were collected for quality assurance. In addition, one field blank, two matrix spike and matrix spike duplicate samples were collected in order to meet the Quality Assurance Project Plan (QAPjP) requirements.

2.0 ENVIRONMENTAL SETTING

2.1 Climate

The Los Alamos area of North-Central New Mexico is classified as a semiarid mountain climate. Wind speeds are generally less than 2.5 m/s (5.5 mph) about 40% of the time and greater than 5 m/s (11 mph) about 20% of the time. Strong winds occur mainly in the spring. The predominant wind direction, especially for strong winds, is to the north-northeast. Forty percent of the precipitation

occurs as brief, intense thunderstorms during July and August, which often produce significant runoff of surface water. Winter snowfall averages 130 cm (51 in) annually (ESG 19890, 0308).

2.2 Geology

The former site of TA-32 is located on the south side of East Mesa at an elevation of nearly 7200 feet above sea level. Bandelier Tuff, composed of volcanic air fall and ash flow deposits of silicic rock, forms the bedrock at the site. At the south side of site, the ground slopes steeply to the south into Los Alamos canyon. The canyon walls adjacent to the mesa top are steep slopes and alternating cliffs.

2.3 Hydrology

There is no surface water present at TA-32. Surface runoff results from summer thunderstorms and spring snow melt. The prevalence of short, intense precipitation from summer thunderstorms suggests that water-driven erosion of surface soils is an important mechanism in transporting surface contaminants.

The main aquifer beneath East Mesa is at an elevation of nearly 6000 feet above sea level and lies chiefly within the sediments of the Puye and Tesuque geologic formations. For mesa-top sites such as TA-32, between 1000 and 1200 feet of unsaturated tuff sediments separate the surface from the main aquifer. A shallow alluvial aquifer and a perched aquifer were located at an intermediate depth (325 feet below Los Alamos Canyon) in drill hole LADP-3 at nearby TA-21. These aquifers may or may not be present beneath TA-32. Their lateral continuity is not known.

2.4 Wildlife Habitats

The mesa top has heavy commercial development and urban disturbance from the town site. Comprehensive plant and animal inventories were not performed for the mesa top because of the disturbance levels. The wildlife habitats on the mesa top can be characterized as manmade urban plant and animal communities. Therefore the screening assessment for the mesa top will not include an ecological component.

The wildlife habitats which reside on the south facing cliff side (hillside) and in the canyon bottom were not highly disturbed until the recent installation of the gas pipeline. Below (east) of TA-32 , Los Alamos canyon bottoms have some disturbance from TA-41 and TA-2 operations but contain a

restricted and undisturbed stretch of canyon from TA-2 to the Loop 4 State Highway called the lower canyon (Color Plate 1). The canyon bottom contains ponderosa pine and riparian plant communities because a stream flows in the canyon during the spring runoff and intermittently from summer rains. A paved highway runs along the canyon bottom to the technical areas. On the south facing slopes in the TA-32 area two habitats are evident: a rocky cliff-face habitat and an ecotone community composed of species from the pinion-juniper and ponderosa pine plant communities on the benches and drainages. These communities gradate to ponderosa pine habitats on the canyon bottom and then merge to mixed conifer habitats on the north facing slope across from the hillside areas at TA-1.

3.0 DATA ASSESSMENT AND ANALYSIS APPROACH

3.1 Summary of QA/QC Activities

Thirty-two soil samples (including 6 field duplicates and a field blank) were collected at TA-32. One liquid sample (an equipment rinsate) was also submitted for analyses. Radiation screening results (gross alpha, gross beta, and gross gamma) for all samples were below detection limits with the exception of one sample. Radiological emissions were detected at a level slightly above background, in outfall soil sample, AAA 4705, using a Model 2221 with a Ludlum probe 44-9 (Standard Geiger-Muller), a radiological field screening instrument. The instrument had a reading of 200 counts per minute (cpm) at the time of collection, background levels were 80-140 cpm. The sample was further analyzed by the mobile radiological van, and was found to contain a concentration of gamma radiation of 24.90 pCi/g. The Minimum Detection Activity (MDA) for gamma radiation is 4.4 pCi/g. The sample was inadvertently not sent to a laboratory for isotopic analysis. However, in future sampling of the site, close attention will be paid to radiological field screening and the need for laboratory isotopic analyses.

Selected samples were analyzed for TAL metals, volatile organics, semivolatile organics, PCBs, ^{3}H, ^{90}Sr, ^{137}Cs, ^{234}U, ^{235}U, ^{238}U, ^{238}Pu, ^{239}Pu and ^{241}Am (Appendix A).

Thirty-two samples were submitted for TAL metals analysis. They were submitted for analysis in 2 batches under request numbers 15719 and 15735. In request 15719, there was a problem with one blind QC sample. Almost all of the elements in this blind QC sample were outside of acceptable QC limits. A second blind QC sample had analyte values within the allowable limits, except for mercury. Since matrix spikes, duplicates, and run-time QC samples were all without problems during the analyses of these samples, the data are considered valid, with the exception of mercury.

Mercury was analyzed in the 2 different QC samples. The values for the first blind QC sample were 30% to 40% lower than the expected value for mercury. All QC run during the analyses of the samples were within acceptable QC limits. However, since there was some variation in the sample duplicates along with the problems with the blind QC samples, the mercury data from request 15719 are rated as "J" and "UJ", detected and undetected estimated quantities. This means that the mercury values are uncertain by 40%. As long as no values are detected within 40% of SAL, there should be no problem in using this data. The SAL of mercury is 24 mg/kg. Forty percent of 24 mg/kg is 9.6 mg/kg. Therefore, any mercury value of 14.4 mg/kg or greater may be at or above the mercury SAL.

In request 15735 all analytes except cadmium had QC values within acceptable ranges. The cadmium values were 25% low in the QC sample. However, since the cadmium values for the samples ranged from <0.4 to 0.6 mg/kg and the SAL is 80 mg/kg, the 25% error does not affect the usability of the data. Therefore all of the data with this request are valid.

Twenty-five samples were analyzed for volatile organic compounds. They were submitted under request number 15718. The QC for this request were all within acceptable ranges.

Thirty-two samples were analyzed for semivolatile organic compounds. They were submitted for analysis under request numbers 15718 and 15736. Request 15718 had no QC problems. Request 15736 had di-n-butyl phthalate, butyl benzyl phthalate and bis(2-ethylhexyl) phthalate detected in the method blanks as well as in the samples. However, the highest value was found in the method blank, so that laboratory contamination in all samples is indicated. Since all of the values were quite low, and the blank had the highest value, the presence of these compounds is attributed to laboratory contamination. In request 15736 there were several high surrogate recoveries. However, since no analytes were detected in the sample, this does not affect the usability of the data. All of the data are rated valid.

Thirty-two samples were analyzed for PCBs under two requests, 15718 and 15736. There were no QC problems associated with 15718. In request 15736 the equipment rinsate (AAA4712) missed the holding time by 48 hours. All other samples were analyzed within the holding times. However, since no PCBs were found in any of the samples in this request and the equipment rinsate is related to these samples, the missed holding time should not affect the usability of the data.

One field blank was analyzed for ^{137}Cs, ^{234}U ^{235}U, ^{238}U, ^{241}Am, ^{238}Pu and ^{239}Pu under request 15721. All of the QC associated with this request was good, therefore all of the data are usable.

3.2 Screening Assessment Approach

Screening assessment of the data makes use of simple comparisons to determine which constituents require further evaluation and which do not. Constituents requiring further evaluation are retained as Chemicals of Potential Concern (COPCs). Constituents not requiring further evaluation are subsequently eliminated as COPCs. A detailed discussion of the Screening Assessment may be found in Chapter 4 and Appendix K of the LANL Installation Workplan (LANL 1993, 1017). Screening is conducted on all detected analytes at a site. A summary of all analytical results, as well as their respective screening action levels (SALs) is located in Appendix B. Analytes that are not detected are eliminated from the screening process, except in the case of non-detects with SALs which are less than the limit of detection (LOD). These analytes are assessed later in the SALs Comparison in the category called Special Case.

3.2.1 Background Comparison

The first step for performing the screening assessment is a background comparison. Analytes which occur naturally in soils (such as inorganics like arsenic and beryllium) are compared to uncontaminated background soil concentrations in Los Alamos County. Analytes such as polycyclic aromatic hydrocarbons (PAHs), which occur anthropogenically, as well as naturally in soils, are compared to anthropogenic background levels. Discussion on the urban background levels and rationale for comparison is presented in Appendix C. If the analyte has detected values that fall within background ranges, it is eliminated as a COPC. If the analyte has detected values greater than background, then it is carried forward in the screening process to the next step -comparison to SALs.

3.2.2 Screening Action Levels Comparison

The second step in performing the screening assessment is comparison to SALs. SALs are conservative risk-based levels (primarily based on formulas presented in RCRA Subpart S) which are intended for use as a preliminary screening tool. Appendix K of the Installation Work Plan (LANL 1993, 1017) provides an in depth explanation of the derivation of the SALs. All individual analytes which are detected at concentrations greater than the LOD and background levels, (plus those analytes previously placed in the "Special Case" category at the very beginning of the Screening

Assessment) are compared to their respective SALs. Based on this comparison, each analyte is placed into one of four categories:

Exceeds SAL indicates that at least one sample value exceeds the respective SAL for that analyte. Any analyte that exceeds its SAL remains a COPC unless an applicable regulatory guideline takes precedent.

Special Case indicates that the sample values are less than the corresponding SAL, however that SAL is also less than the LOD. In the Special Case category, if there is reason to expect that a chemical may be present at the site based on process knowledge, then that chemical may need special analysis in order to achieve detection limits below the SAL. If there is no reason to expect these chemicals should be present at the site, then the LOD is used in place of the SAL (LANL 1993, 1017). Those analytes not expected to be present at the site that have sample values less than the LOD are then eliminated as COPCs.

No SAL indicates that there is currently no SAL available for comparison and that at least one analyte value is greater than the LOD. Regulatory guidelines are checked to determine if there are any appropriate criteria for comparison.

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

It is possible that chemicals in combination, while near, but not exceeding their SALs, could prove deleterious to human health. In determining multiple effects, a simplistic screening approach assuming additive effects is used to normalize concentration data by using SALs. If the sum of proportions for the different analytes which are below SAL is less than one, then these analytes are eliminated as COPCs.

If the sum of proportions for the different analytes which are below SAL is greater than one, the effect of the multiple constituents is considered adverse. It should be noted that this evaluation is used for screening purposes only and the normalized sums or proportions do not indicate any sort of risk levels. The equation for calculating the appropriate normalized sum is

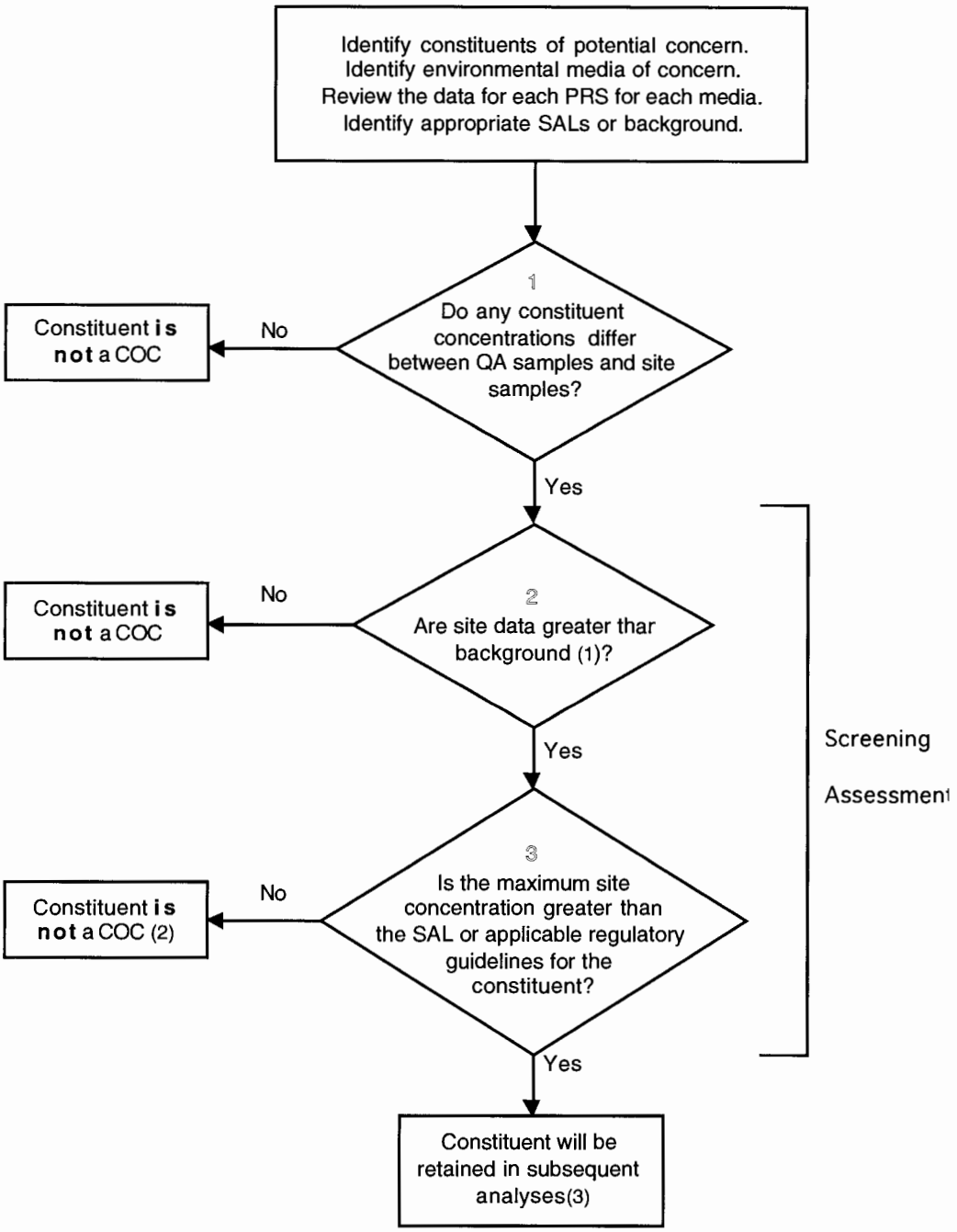
$$M = \max_{samples} \left\{ \sum_{\text{PCOCs}} C_i / SAL_i \right\}$$

where:

M	=	maximum sum of proportions;
C_i	=	maximum concentration of the ith chemical for a given site; and
SAL_i	=	chemical-specific SAL for the ith chemical.

3.3 Development of Conclusions and Recommendations

Conclusions and recommendations are based upon the results of the screening assessment performed upon the analytical results of reconnaissance sampling of the site. Figure 2 shows the decision logic utilized in data analysis and the screening assessment.



(1) Inorganics are compared to LANL background concentrations, and organics are compared to the ATSDR/Bradley urban background concentrations.

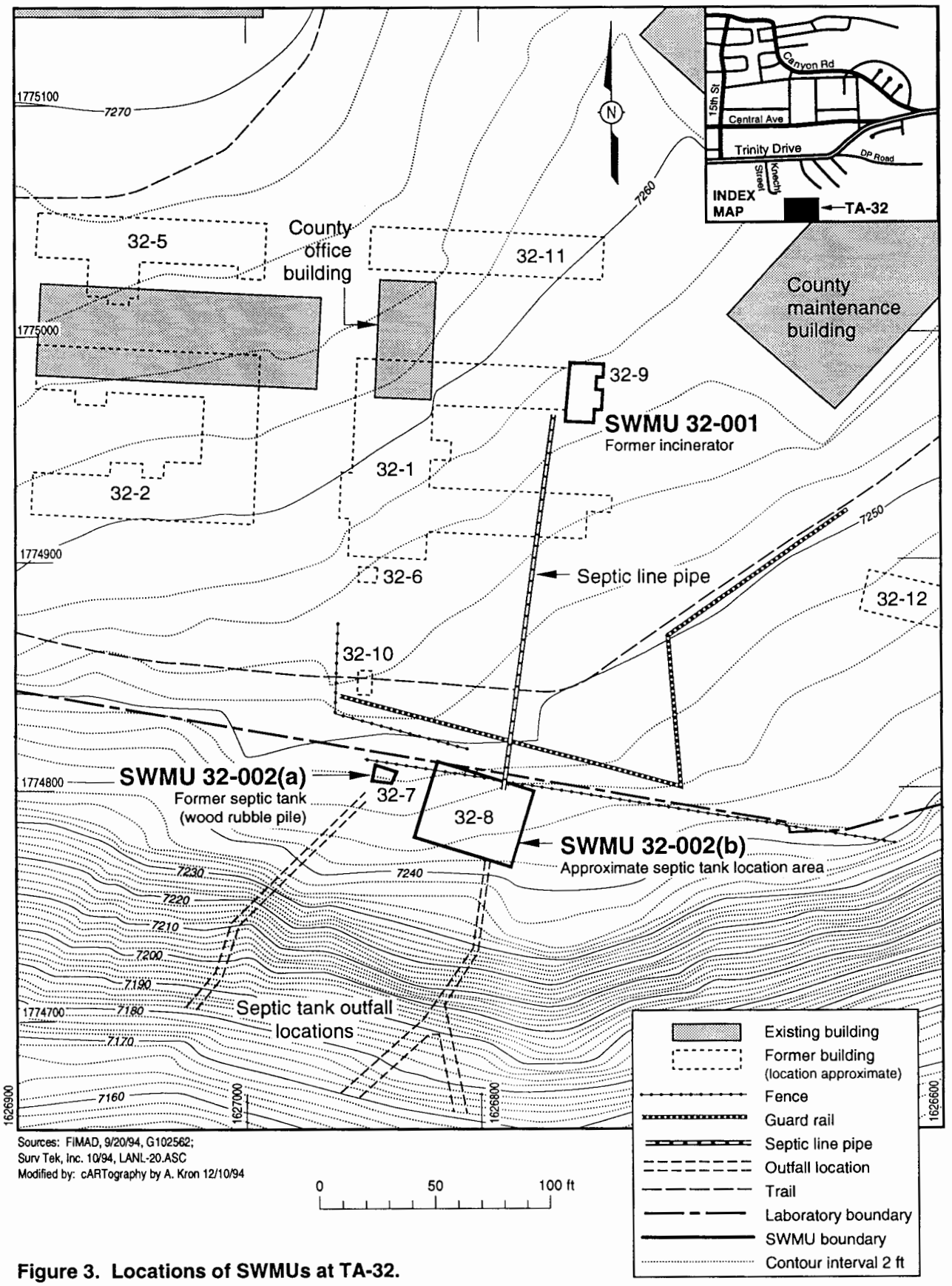
(2) Site data will be reviewed for multiple constituents that are less than the SAL and are above background.

(3) RFI Phase II data collection or risk assessment

Figure 2. Data analysis and screening assessment flow chart.

4.0 SITE-SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

TA-32 readily lends itself into a division of two different areas, the Mesa Top and the Outfall, based on past land use and topography. The Mesa Top is currently paved, with the County of Los Alamos shops and warehouses situated on it. The only SWMU in this area is the former incinerator location (SWMU 32-001). The Outfall, however, is rugged undeveloped territory with steep cliffs. The former septic tanks (SWMUs 32-002(a-b)) are located on the edge of the mesa, and the associated outfalls are located on the side of the hill slope adjacent to Los Alamos Canyon (Figure 3).



Sources: FIMAD, 9/20/94, G102562;
Surv Tek, Inc. 10/94, LANL-20.ASC
Modified by: cARTography by A. Kron 12/10/94

Figure 3. Locations of SWMUs at TA-32.

4.1 Mesa Top (SWMU 32-001) Unit Description

The Mesa Top includes the area of the former incinerator and the septic system line leading to the former septic tanks.

4.1.1 Field Investigation and Sampling Activities

Sampling activities were conducted at TA-32 on September 16, 17, and 20, 1993. Field work was performed in accordance with the RFI Work Plan (LANL 1992, 0783), the Laboratory's Environmental Restoration (ER) Program, and approved subcontractor procedures.

Incinerator. Sample locations were selected at fractures in the asphalt pavement. If these fractures existed at the time of the incinerator operations, then contaminants would most likely be located at these points. Two soil samples were collected from beneath the former base of the incinerator and downgradient area using a stainless steel hand auger (Figure 4).

Septic System Line Locations. Two trenches were excavated perpendicular to the former septic tank line locations with a backhoe in order to determine if these lines had been previously removed. Both trenches were excavated in an east to west direction. The length of the trenches was determined in the field and was based on exposing enough area to locate the pipe. The width of the trench was dictated by the width of the bucket on the backhoe. The depth of the trench was dictated by the depth to tuff or exposed pipe. The trenches were dug by excavating to the soil/tuff interface and digging or scraping until either a pipe or previously excavated line was encountered. Samples from the trenches were collected using stainless-steel spoons and bowls at depths of 1.5 to 3.2 ft. above the bedrock tuff (Figure 4).

Septic Tank Line Trench 1. Trench 1 was excavated approximately 35 ft. north of the abandoned septic tank locations, and was 60 feet long x 1.6 feet wide x 3.4 feet deep. No septic system pipe was located in trench 1. Three soil samples were collected from Trench 1 at depths of 1.5, 1.7 and 1.5 feet, along the walls of the trench at the soil/tuff interface. (ICF Kaiser, 1993, XXXX) (Figure 4).

Septic Tank Line Trench 2. Trench 2 was excavated approximately 40 ft. north of trench 1, and was 14 feet long x 1.6 feet wide x 3.2 feet deep. Septic system pipeline was found in trench 2. The pipe was made of steel, seamed, and had a clean-out extension. Three samples were collected from trench 2, one from within the clean-out extension and two from beneath the pipe seam on either side of the pipe (ICF Kaiser, 1993, XXXX) (Figure 4).

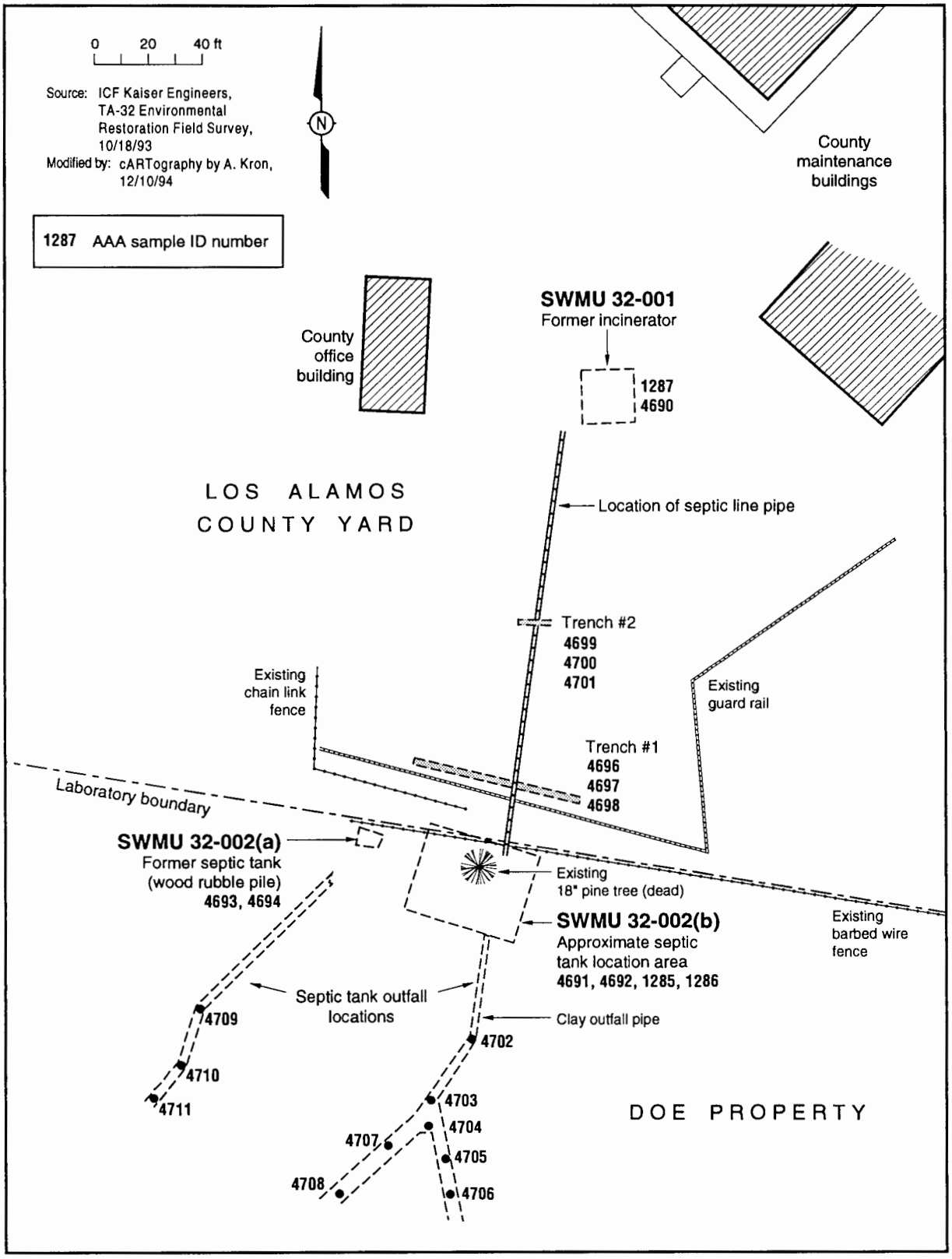


Figure 4. Location of Phase I sample IDs.

No radioactivity was detected from samples collected from trenches 1 and 2 using the field screening instruments. The samples were submitted to the Mobile Radiation Laboratory for analyses, for quick turnaround results. Analytical results indicated no radioactive contamination, and trenches 1 and 2 were backfilled.

4.1.2 Screening Assessment

4.1.2.1 Mesa Top Background Comparison

A comparison of inorganic analytical results for TA-32 Mesa Top to background concentrations for Los Alamos is summarized in Table 1. Aluminum, barium, calcium, magnesium, manganese, potassium, selenium, vanadium, and zinc concentrations are within background ranges and are eliminated as COPCs. All of the remaining inorganics, arsenic, beryllium, cadmium, chromium, cobalt, copper, iron, lead, mercury, nickel, silver, sodium, and thallium are carried forward to the SAL comparison stage of the screening assessment.

TABLE 1

TA-32 Mesa Top Soil Concentrations[a] for Inorganics

Compared to Los Alamos Background Concentrations

ANALYTE	TA-32 Sample Range	Los Alamos Background Range [b]	Below LOD	Within Background	Greater than Background
Aluminum	6.7-11,000.0	0.0-62,000		X	
Antimony	below LOD	Not Available	X		
Arsenic	2.0-25.0	0.7-11.2			X
Barium	50.0-150.0	27.0-730.0		X	
Beryllium	0.55-130.0	0.31-4.0			X
Cadmium	1.0-19.0	0.2-2.7			X
Calcium	930-5,600	900.0-87,000		X	
Chromium	5.6-170.0	1.9-37.0			X
Cobalt	1.3-430.0	5.5-41.0			X
Copper	1.3-73.0	0.25-16.0			X
Iron	300-62,000	3,300-36,000			X
Lead	11.0-570.0	2.0-38.0			X
Magnesium	680.0-2,000	680-10,000		X	
Manganese	150.0-490.0	76.0-1,100		X	
Mercury	0.1-420.0	0.05-0.1			X
Nickel	6.0-260.0	1.0-30.0			X
Potassium	180.0-1,600	750-6,900		X	
Selenium	0.4-1.1	0.1-1.7		X	
Silver	3.0-200.0	0.0-2.5			X
Sodium	120.0-3,000	58.0-1,800			X
Thallium	0.3-1.4	0.065-0.9			X
Vanadium	9.0-42.0	4.0-57.0		X	
Zinc	28.0-89.0	14.0-120.0		X	

[a] All concentrations shown in mg/kg. TA-32 analytical data extracted from FIMAD October 31, 1994
[b] (Longmire, Reneau, Watt, Gardner, Duffy, 1994, XXXX).

A comparison of PAH analytical results to worldwide anthropogenic background concentrations is summarized in Table 2. Because the results of this comparison are exactly the same for the Mesa Top as for the Outfall, the entire TA-32 data set (both the Mesa Top and the Outfall data) is shown here and will not be repeated in the Outfall section. All the analytical results for PAHs at TA-32 with applicable backgrounds fall below or within the ATSDR/Bradley urban background ranges (ATSDR 1993, XXXX, Bradley, L,1994, 1144) and are eliminated as COPCs.

Table 2

TA-32 Soil Concentrations for PAHs Compared to ASTDR/Bradley Urban Background Concentrations [a]

ANALYTE	TA-32 Range	ATSDR/Bradley Urban Background	Within Background
Acenaphthene	<LOD @ 0.33	0.024-3.4	X
Acenapthylene	<LOD @ 0.33	0.018-1.1	X
Anthracene	<LOD @ 0.33	0.029-5.7	X
Benzo(a)anthracene	1.8	0.048-59.0	X
Benzo(a)pyrene	2.0	0.04-13.0	X
Benzo(b)fluoranthene	0.36-3.1	0.049-62.0	X
Benzo(g,h,i)perylene	1.3	0.2-47.0	X
Benzo(k)fluoranthene	0.77	0.043-26.0	X
Chrysene	0.36-2.0	0.038-21.0	X
Dibenzo(a,h)anthracene	<LOD @ 0.33	0.02-2.9	X
Fluoranthene	0.42-2.2	0.11-166.0	X
Fluorene	<LOD @ 0.33	0.02-3.3	X
Indeno(1,2,3-cd)pyrene	1.2	0.09-61.0	X
Methyl naphthalene (2-)	<LOD @ 0.33	0.017-0.64	X
Naphthalene	<LOD @ 0.33	0.018-0.66	X
Phenanthrene	0.4-0.59	0.07-36.0	X
Pyrene	0.36-4.1	0.08-147.0	X

[a] All concentrations are given in mg/kg

4.1.2.2 Mesa Top Screening Action Levels Comparison

This section discusses the results of the screening assessment for the TA-32 constituents which were analyzed in samples from the Mesa Top.

Exceeds SAL. Two analytes, lead and mercury fall within this category (Appendix B). They will be continued through the screening process. Appendix E contains information on guidance used for polychlorinated biphenyls (PCBs).

Special Case. The category "Special Case" identifies those analytes with values and SALs less than the LOD. The four analytes in this category are: m-Benzidine, bis(2-chloroethyl) ether, n-Nitrosodi-n-propylamine, and n-Nitrosodimethylamine (Appendix B). Three of these analytes, bis(2-chloroethyl) ether, n-Nitrosodi-n-propylamine, and n-Nitrosodimethylamine are not expected to be present at the site due to historical LANL processes. Therefore these analytes with values less than the LOD are eliminated as COPCs. M-Benzidine is used in laboratories as a reagent for the detection of blood. While it is possible that this chemical was used at the medical research laboratory, we have no documented spills of this substance. All values of this analyte were below the LOD at this site. Therefore, this analyte is also eliminated as a COPC.

No SAL. The five analytes are arsenic, beryllium, cobalt, iron and sodium (Appendix B). These are retained as COPCs. (Please note that the modified RCRA Sub-part S SALs are not used here for arsenic and beryllium because Los Alamos background naturally contains levels of these two analytes higher than the SAL).

Below SAL. Eleven analytes have measured concentrations below their respective SALs and above the LOD (Appendix B). These 11 analytes are listed in Table 3, where they have been addressed in the multiple constituent evaluation.

To evaluate multiple constituent effects for the mesa top data set, analytes below their respective SALs were normalized to one and summed as described in section 3.2.3. Analysis of the TA-32 mesa top data set is shown in Table 3.

Table 3

Multiple Constituent Evaluation

for TA-32 Mesa Top Data

Analyte	Maximum Concentration	Soil SAL	Maximum Concentration/SAL	Location Notes
	mg/kg	mg/kg	normalized values	
SAL based on carcinogenic effects				
Chromium	170	400	0.43	within pipe
Total			0.43	
SAL based on non-carcinogenic effects				
Acetone	0.05	8000	0.00	
Barium	150	5600	0.03	
Cadmium	19	80	**0.24**	below pipe
Copper	73	3000	0.02	
Di-n-butyl phthalate	0.46	8000	0.00	
Nickel	260	1600	**0.16**	below pipe
Silver	200	400	**0.50**	below pipe
Thallium	1.4	6.4	**0.22**	within pipe
Toluene	0.023	910	0.00	
Xylenes	0.028	160000	0.00	
Total			**1.17**	

The multiple constituent analysis shows that there are no analytes in the radionuclide category. The analysis based on carcinogenic effects is less than one, at 0.43, indicating that resultant health effects from exposure would be unlikely. The non-carcinogenic analyte analysis indicates that adverse human health effects are of potential concern because the normalized sum, at 1.17, is greater than one. The analytes that comprise 90 percent of the total normalized sum (bolded in the table) are silver at 0.5, cadmium at 0.24, thallium at 0.22, and nickel at 0.16. These analytes and their locations will be discussed under Characterization of the Mesa Top Site.

The results of the screening assessment performed thus far on the sampling data for TA-32 mesa top show that eleven analytes require further investigation. These eleven are arsenic, beryllium, cadmium, cobalt, iron, lead, mercury, nickel, silver, sodium, and thallium. The rest of the analytes occur at levels below SALs or at levels within the Los Alamos County natural background or anthropogenic urban background levels.

4.1.2.3 Characterization of the Mesa Top Site

The next step is to look at the location of the analytes that have been retained as COPCs and characterize the site. These COPCs are arsenic, beryllium, cadmium, cobalt, iron, lead, mercury, nickel, silver, sodium, and thallium (Figure 5).

Arsenic. Arsenic is a COPC because it was detected at a concentration above the background range of 0.7 to 11.2 mg/kg. The one analysis above background, sample ID AAA 4700 at 25.0 mg/kg, is located at the sampling point within the pipe.

Beryllium. Beryllium is a COPC because it was detected at a concentration above the background range of 0.31 to 4.0 mg/kg. The one analysis above background, sample ID AAA 4699, at 130 mg/kg, 4699, is located at the sampling point beneath the pipe.

Cadmium. Cadmium is a COPC because it was detected at a concentration above the background, range of 0.2 to 2.7 mg/kg and is an analyte of concern in the multiple constituent evaluation. The one analysis above background range, sample ID AAA 4699, at 19 mg/kg, is located at the sample point beneath the pipe.

Cobalt. Cobalt is a COPC because it was detected at a concentration above the background range of 5.5 to 41.0 mg/kg. The one analysis above background, sample ID AAA 4699 at 430 mg/kg, is located at the sampling point beneath the pipe.

Iron. Iron is a COPC because it was detected in one soil sample above background levels, and there is no SAL. This one soil sample was collected from within the steel pipe, sample ID AAA 4700.

Lead. Lead is a COPC because was detected at a concentration greater than SAL, 400 mg/kg, in one location. This one soil sample was collected from within the pipe, sample ID AAA 4700, at 570 mg/kg.

Mercury. Mercury is a COPC because it was detected in concentrations above the background range of 0.05-0.1 mg/kg, and above the SAL of 24 mg/kg. It was detected in three replicate soil samples within the pipe, sample ID 4700, at an average concentration of 316.66 mg/kg. It was also detected in three replicate soil samples beneath the pipe at concentrations elevated above background that averaged 3.16 mg/kg.

Nickel. Nickel is a COPC because it was detected in a concentration above the background range of 1.0 to 30.0 mg/kg, and was identified as an analyte of concern in the multiple constituent evaluation. Nickel was detected in only one soil sample above background, sample ID AAA 4699, at 260.0 mg/kg. This sample was collected at the sampling point beneath the pipe.

Sodium. Sodium is a COPC because it was detected above the background range of 58.0 to 1,800 mg/kg, in one sample, and there is no SAL. The one soil sample, at 3,000 mg/kg, was collected from within the steel pipe at the sample location of sample ID AAA 4700.

Silver. Silver is a COPC because it was detected in concentrations above the background range of 0.0 to 2.5 mg/kg. Silver was identified as an analyte of concern in the multiple constituent evaluation. Silver was detected above background in only one soil sample, sample ID AAA 4699 at 200.0 mg/kg, collected at the sampling point beneath the pipe.

Thallium. Thallium is a COPC because it was detected at a concentration above the background range of 0.065 to 0.9 mg/kg, and was identified as an analyte of concern in the multiple constituent evaluation. Thallium was detected above background in only one soil sample, sample ID AAA 4700 , at 1.4 mg/kg, located at the sampling point within the pipe.

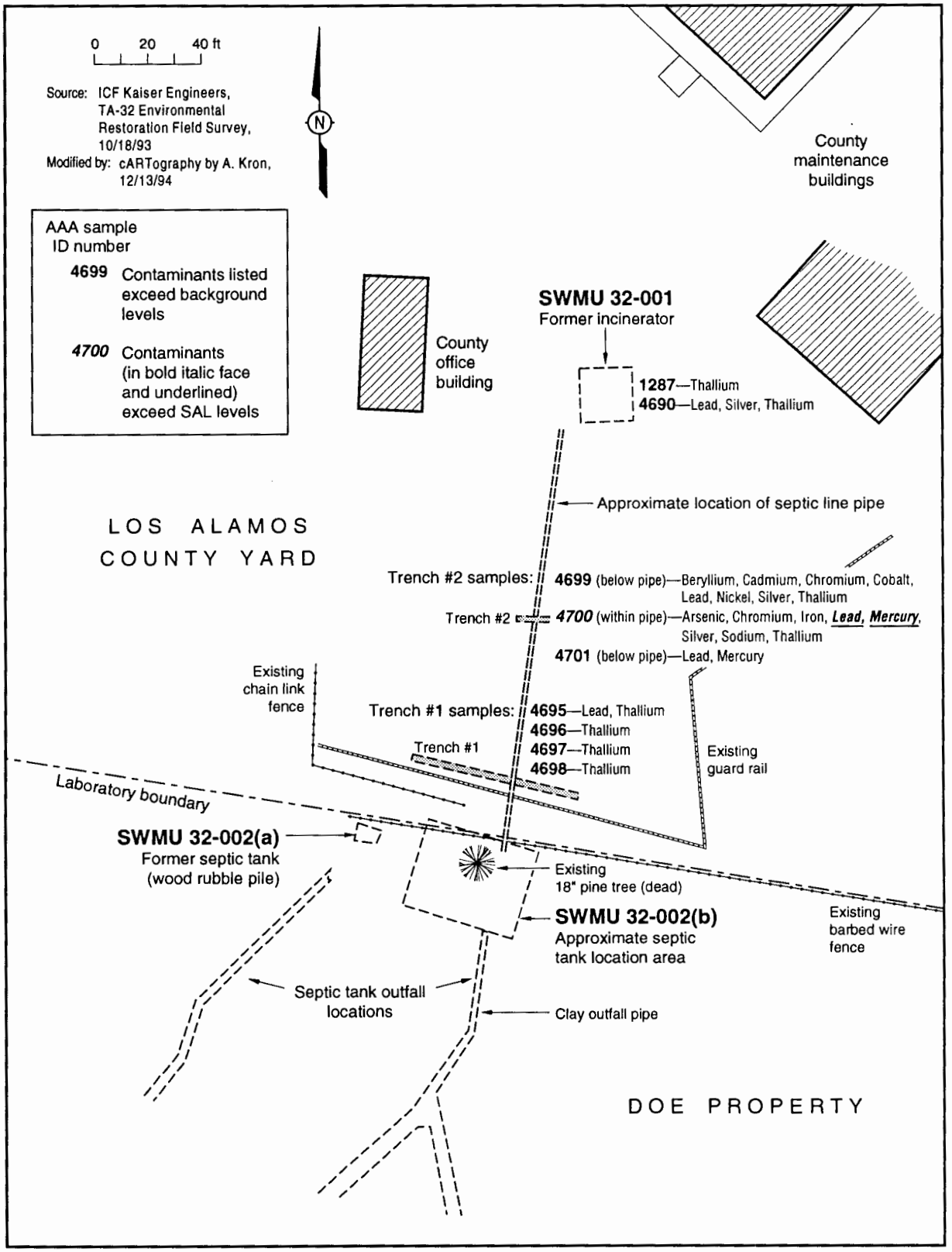


Figure 5. Location of analytes retained as COPCs at mesa top.

4.1.2.6 Summary of Chemicals of Concern

The results of the screening assessment were used to identify the COPCs for TA-32 Mesa Top. Table 4 summarizes the results of the screening assessment. All chemicals detected in the TA-32 Mesa Top soils are listed. The table indicates how they were eliminated, or if they were retained as COPCs. The COPCs are highlighted in bold typeface in the table.

Table 4

Results of the Screening Assessment for TA-32[a] Mesa Top Soils

Analyte	Below Background	Below SAL	Below Regulatory Concern	Rationale for Retention As COPC
Aroclor 1260			X	
Acetone		X		
Aluminum	X			
Arsenic				above background
Barium	X			
Benzene		X		
Benzo(a)anthracene	X			
Benzo(a)pyrene	X			
Benzo[b] fluoranthene	X			
Benzo(g,h,i)perylene	X			
Benzo[k] fluoranthene	X			
Beryllium				above background
Indeno[1,2,3-cd]pyrene	X			
Cadmium				multiple constituent evaluation
Calcium	X			
Chromium		X		
Chrysene	X			
Cobalt				above background
Copper		X		
Di-n-butyl phthalate		X		
Fluoranthene	X			
Indeno(1,2,3-cd)pyrene	X			
Iron				above background
Lead				**above SAL**
Magnesium	X			
Manganese	X			
Mercury				**above SAL**
Nickel				multiple constituent evaluation
Phenanthrene	X			
Potassium	X			
Pyrene	X			
Selenium	X			
Silver				multiple constituent evaluation
Sodium				above background
Thallium				multiple constituent evaluation
Toluene		X		
Vanadium	X			
Xylenes	X			
Zinc	X			

In summary, all analytes detected at TA-32, with the exception of arsenic, beryllium, cadmium, cobalt, iron, lead, mercury, nickel, silver, sodium, thallium, do not warrant further investigation. They were eliminated from further evaluation because they were below background, below their respective SAL, or contributed negligibly to a normalized SAL in the multiple constituent evaluation.

4.1.2.7 Recommendations for Mesa Top

At the former incinerator location (SWMU 32-001), no COPCs were above background levels, SALs, or regulatory guidelines. Therefore, SWMU 32-001 is recommended for No Further Action (NFA).

The mesa top septic line leading into outfall SWMU 32-002(b) had COPCs that were located either within the septic line pipe or within soils just beneath the pipe. Removing the source of contamination on the mesa top and in the outfall pipe eliminates risk associated with these contaminants. Therefore, it is recommended that an Expedited Cleanup (EC) be performed to remove the septic line pipe, the outfall pipe and the surrounding soils at SWMU 32-002(b).

4.2 Outfall Area (SWMUs 32-002 (a-b))Unit Description

The Outfall area consists of the former septic tanks, the outfall pipes and associated outfalls.

4.2.1 Field Investigation and Sampling Activities

Sampling activities were conducted at TA-32 on September 16, 17, and 20, 1993. Field work was performed in accordance with the RFI Work Plan, the Laboratory's Environmental Restoration (ER) Program, and approved subcontractor procedures.

Septic Tank (SWMU 32-002(a)). The exact location of this wooden septic tank was unknown. The location was determined by visual inspection. The area supports a growth of thick scrub and trees with a small cleared area containing a pile of wood debris. Two samples were collected from this location using a stainless steel hand auger to depths immediately above the bedrock which was approximately four inches (Figure 6).

Septic Tank (SWMU 32-002(b)). A single point described as a "septic tank" in a field log dating from the early 1950s gave the location of this tank. The former septic tank was surveyed according to identification from an employee who was in charge of the 1988 tank removal. A total of four samples were collected from this location. Three samples were collected at the soil/bedrock interface. One of

the three samples was collected from the influent tank line location. The fourth sample was located at the "survey tank point" (Figure 6).

Outfalls. Two outfall pipes were located by the edge of Los Alamos Canyon. The first outfall pipe, a four inch, vitrified clay pipe, was located in place, near SWMU 32-002(b). One sample was collected directly at the mouth of the clay pipe. Two samples were collected down the main drainage from this pipe. The topography causes the drainage to split into two directions at this point, one slightly to the east and the other slightly to the west. Two samples were collected from the eastern drainage and two samples were collected from the western drainage. (Figure 6).

The second outfall pipe, a steel pipe, was located above the surface near SWMU 32-001(a). It was difficult to determine whether this pipe was in its original location. Three samples were collected directly down-drainage from the steel pipe (Figure 6).

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

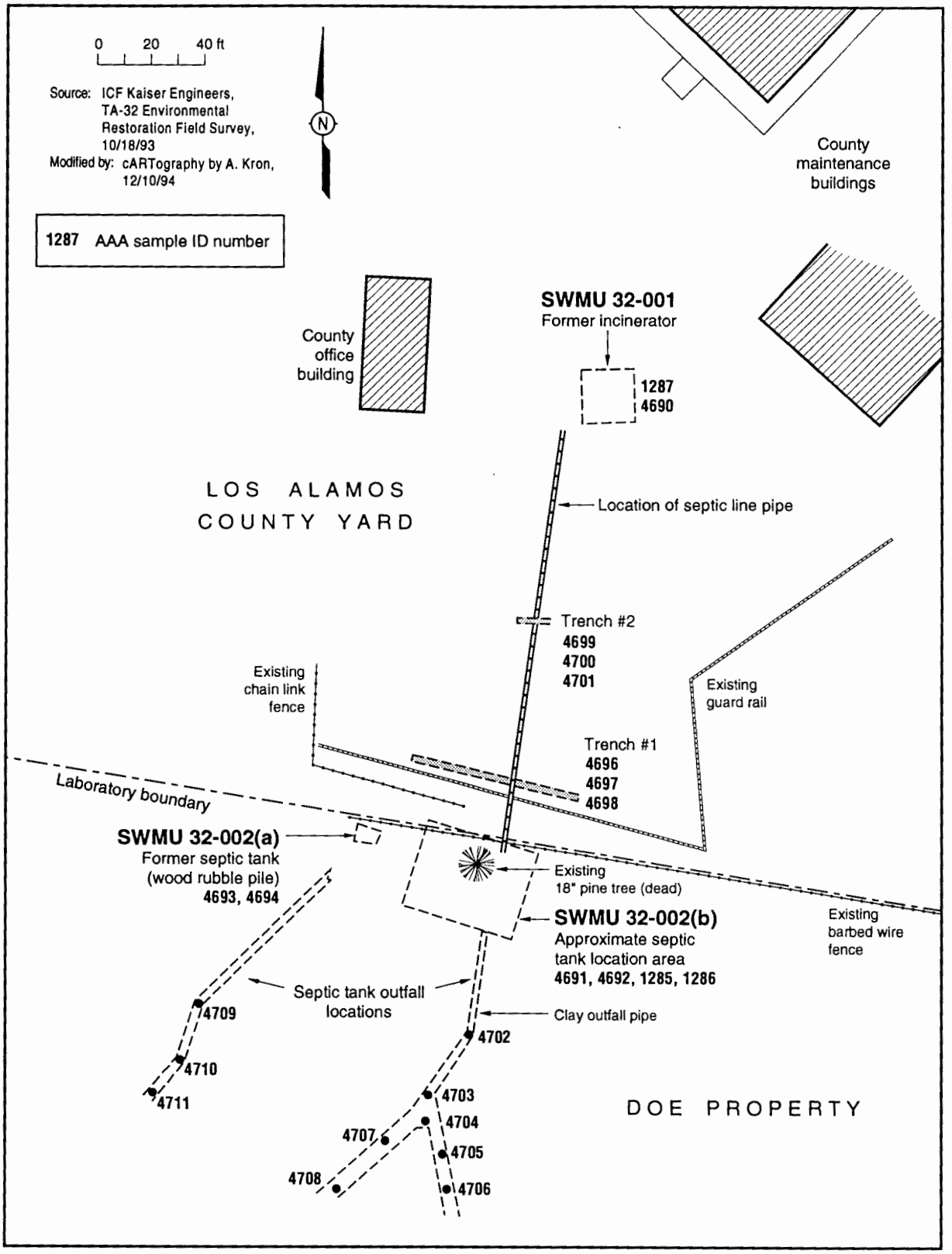


Figure 6. Location of Phase I sample IDs.

4.2.2 Screening Assessment

4.2.2.1 Outfall Background Comparison

A comparison of inorganic analytical results at the TA-32 Outfall to background concentrations at Los Alamos is summarized in Table 5. Aluminum, beryllium, calcium, cobalt, iron, magnesium, nickel, potassium, and selenium, are within background ranges and are eliminated as COPCs. All the remaining inorganics, arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, silver, sodium, thallium, vanadium, and zinc are carried forward to the SAL comparison stage of the screening assessment.

Table 5

TA-32 Outfall Soil Concentrations[a] for Inorganics

Compared to Los Alamos Background Concentrations

ANALYTE	TA-32 Sample Range	Los Alamos Background Range[b]	Within Background	Greater than Background
Aluminum	980-10,000	0.0-62,000	X	
Arsenic	1.1-18.0	0.7-11.2		**X**
Barium	16.0-920	27.0-730		**X**
Beryllium	0.31-0.89	0.31-4.0	X	
Cadmium	0.4-5.6	0.2-2.7		**X**
Calcium	310.0-8,500	900.0-87,000	X	
Chromium	1.0-440	1.9-37.0		**X**
Cobalt	0.52-4.5	5.5-41.0	X	
Copper	1.6-170	0.25-16.0		**X**
Iron	3,800-11,000	3,300-36,000	X	
Lead	15.0-1,600	2.0-38.0		**X**
Magnesium	220.0-1,800	680.-10,000	X	
Manganese	180.0-1,600	76.0-1,100		**X**
Mercury	0.2-303	0.05-0.1		**X**
Nickel	2.0-11.0	1.0-30.0	X	
Potassium	77.0-1,300	750-6,900	X	
Selenium	0.4-1.7	0.01-1.7	X	
Silver	2.6-150	0.0-2.5		**X**
Sodium	63.0-1,100	58.0-1,800	X	
Thallium	0.2-2.4	0.065-0.9		**X**
Vanadium	3.3-59.0	4.0-57.0		**X**
Zinc	32.0-320.0	14.0-120.0		**X**

[a] All concentrations shown in mg/kg. TA-32 analytical data extracted from FIMAD October 31, 1994

[b] (Longmire, Reneau, Watt, Gardner, Duffy, 1994, XXXX)

All the PAHs at TA-32 with applicable backgrounds were shown to fall below or within the ATSDR/Bradley urban background ranges (Table 2) and are excluded from further analyses. This data was analyzed in the Mesa Top Background Comparison section and is discussed further in Appendix C.

4.2.2.3 Outfall Screening Action Levels Comparison

Exceeds SAL. Four analytes, aroclor 1260, chromium, lead and mercury are included in this category. These analytes will be carried to the next step of the screening process.

Special Case. The category "Special Case" identifies those analytes with values and SALs less than the LOD. The four analytes in this category are: m-Benzidine, bis(2-chloroethyl) ether, n-Nitrosodi-n-propylamine, and n-Nitrosodimethylamine. Three of these analytes, bis(2-chloroethyl) ether, n-Nitrosodi-n-propylamine, and n-Nitrosodimethylamine are not expected to be present at the site due to historical LANL processes. Therefore these analytes with values less than the LOD are eliminated as COPCs. M-Benzidine is used in laboratories as a reagent for the detection of blood. While it is possible that this chemical was used at the medical research laboratory, we have no documented spills of this substance. All values of this analyte were below the LOD at this site. Therefore, this analyte is also eliminated as a COPC.

No SAL. There is one analyte, arsenic, that falls into this category, and it is retained as a COPC. (Please note that the RCRA Sub-part S SAL is not used here for arsenic because Los Alamos background naturally contains levels of this analyte higher than the SAL).

Below SAL. Fifteen analytes have concentrations below their respective SALs and above the LOD. These 15 analytes, listed in Table 6, will be further analyzed in the multiple constituent evaluation.

To evaluate multiple constituent effects for the Outfall data set, analytes not exceeding their respective SALs were grouped first as to whether or not they were radionuclides and then according to their toxicological effects (carcinogenic or noncarcinogenic). SALs for all constituents were normalized to one and summed as described in section 3.2.3. Multiple constituent analysis of the TA-32 Outfall data set is shown in Table 6.

Table 6

Multiple Constituent Evaluation

for TA-32 Outfall Data

Analyte	Maximum Concentration	Soil SAL	Max Conc/SAL	Location Notes
	mg/kg	mg/kg		
SAL based on carcinogenic effects				
Benzene	0.01	0.67	0.01	
Bis(2-ethylhexyl) phthalate	1.4	5.5	0.11	
Total			0.12	
SAL based on non-carcinogenic effects				
Acetone	0.025	8000	0.00	
Barium	920	5600	**0.16**	
Butyl benzyl phthalate	1.1	1.1	0.00	
Cadmium	5.6	80	0.07	
Copper	170	3000	0.06	
Di-n-butyl phthalate	0.48	3.5	0.00	
Manganese	1600	11000	**0.15**	
Silver	150	400	**0.38**	AAA 4705
Thallium	2.4	6.4	**0.38**	AAA 4705
Toluene	0.03	910	0.00	
Vanadium	59	560	**0.11**	
Xylenes	0.04	160000	0.00	
Zinc	320	24,000	0.01	
Total			**1.32**	

The multiple constituent analysis shows that there are no analytes in the radionuclide category. The analysis based on carcinogenic effects is less than one, at 0.12, indicating that resultant health effects from exposure would be unlikely. The non-carcinogenic analyte analysis indicates that adverse human health effects are of potential concern because the normalized sum, at 1.32, is greater than one. The analytes that comprise 90 percent of the total normalized sum (bolded in the table) are barium at 0.16, manganese at 0.15, silver at 0.38, thallium at 0.38 and vanadium at 0.11. The locations of these analytes will be discussed in the section on Characterization of the Outfall Site.

The results of the screening assessment performed on the TA-32 Outfall sampling data show that ten analytes require further investigation. These ten are aroclor 1260, arsenic, barium, chromium, lead,

manganese, mercury, silver, thallium, and vanadium. The rest of the analytes occur at levels below SALs or at levels within the Los Alamos County natural background or anthropogenic urban levels.

4.2.2.4 Characterization of the Outfall Site

The next step is to look at the location of the analytes that have been retained as COPCs and characterize the site. These COPCs are aroclor 1260, arsenic, barium, chromium, lead, manganese, mercury, silver, thallium, and vanadium (Figure 7).

Aroclor 1260. Aroclor 1260 is a COPC because it was detected above the SAL of 0.09 mg/kg. Aroclor 1260 was detected in two different locations. It was detected at the former wooden septic tank (SWMU 32-002(a)) location, at 1.5 and 4.0 mg/kg, at depths of 1-4 inches. These concentrations fall at the 10^{-5} excess cancer risk, within the protective range of 10^{-4} to 10^{-6} excess cancer risk. Because the concentration of Aroclor 1260 at the site falls within protective guidelines (see Appendix E), and there is no historical information indicating that there was ever a PCB spill at the site, Aroclor 1260 is eliminated as a COPC at SWMU 32-002(a).

Aroclor 1260 was detected at 17 mg/kg in the sample taken at the mouth of the vitrified clay outfall pipe. This concentration falls outside the protective range and Aroclor 1260 is retained as a COPC for the this location.

Arsenic. Arsenic is a COPC because it was detected in one soil sample, sample ID AAA 4705, at 18.0 mg/kg, above the background range of 0.7-11.2 mg/kg. This sample location, AAA4705, (Figure 7) which will be referred to as the "outfall hotspot" for the rest of this report.

Barium. Barium is a COPC because it contributed to 90 percent of the normalized sum over one in the Multiple Constituent Evaluation. The one soil sample, sample ID AAA 4705, above the background range of 27.0 to 730 mg/kg is located at the outfall hotspot.

Chromium. Chromium is a COPC because it was detected in one soil sample, sample ID AAA 4705, at 440 mg/kg, above the SAL of 400 mg/kg. Cromium was detected at the location of the Outfall hotspot. There are also elevated levels (above background, but still below SAL) of Chromium in the sampling points immediately upgradient and downgradient from the outfall hotspot.

Lead. Lead is a COPC because it was detected in two soil sample analyses above the SAL of 400 mg/kg. At the outfall hotspot, the lead concentration is 1600 mg/kg. The lead concentration at the

sampling point immediately upstream from the hotspot is 450 mg/kg. The lead concentration at the sampling point immediately downstream, sample ID AAA 4706, at 200 mg/kg, is below SAL but still elevated above the background range of 2.0 to 38.0 mg/kg.

Manganese. Manganese is a COPC because it contributed to 90 percent of the normalized sum over one in the Multiple Constituent Evaluation. Manganese was above the background range of 76.0 to 1,100 mg/kg at only one sampling location (sample ID AAA 4702), the mouth of the clay outfall pipe.

Mercury. Mercury is a COPC because it was detected in three replicate soil samples above the SAL of 24.0 mg/kg. These three samples, averaged at 271.7 mg/kg, were located at the outfall hotspot. Mercury has also been detected at concentrations above background, though still below SAL in soil samples collected upgradient, (sample ID AAA 4704 averaged at 40.6 mg/kg), and downgradient of the Outfall hotspot, (sample ID AAA 4706 averaged at 14.3 mg/kg).

Silver. Silver is a COPC because it contributed to 90 percent of the normalized sum over one in the Multiple Constituent Evaluation. Only one soil sample, collected at the Outfall hotspot, resulted in Silver being identified as a concern. Soil samples collected upgradient and downgradient of the Outfall hot spot had concentrations of Silver above background but below the SAL.

Thallium. Thallium is a COPC because it contributed to 90 percent of the normalized sum over one in the Multiple Constituent Evaluation. Only one soil sample, collected at the Outfall hotspot, resulted in Thallium being identified as a concern in the multiple constituent evaluation.

Vanadium. Vanadium is a COPC because it contributed to 90 percent of the normalized sum over one in the Multiple Constituent Evaluation. Only one soil sample, collected at the Outfall hotspot, resulted in Vanadium to be identified as a concern in the multiple constituent evaluation.

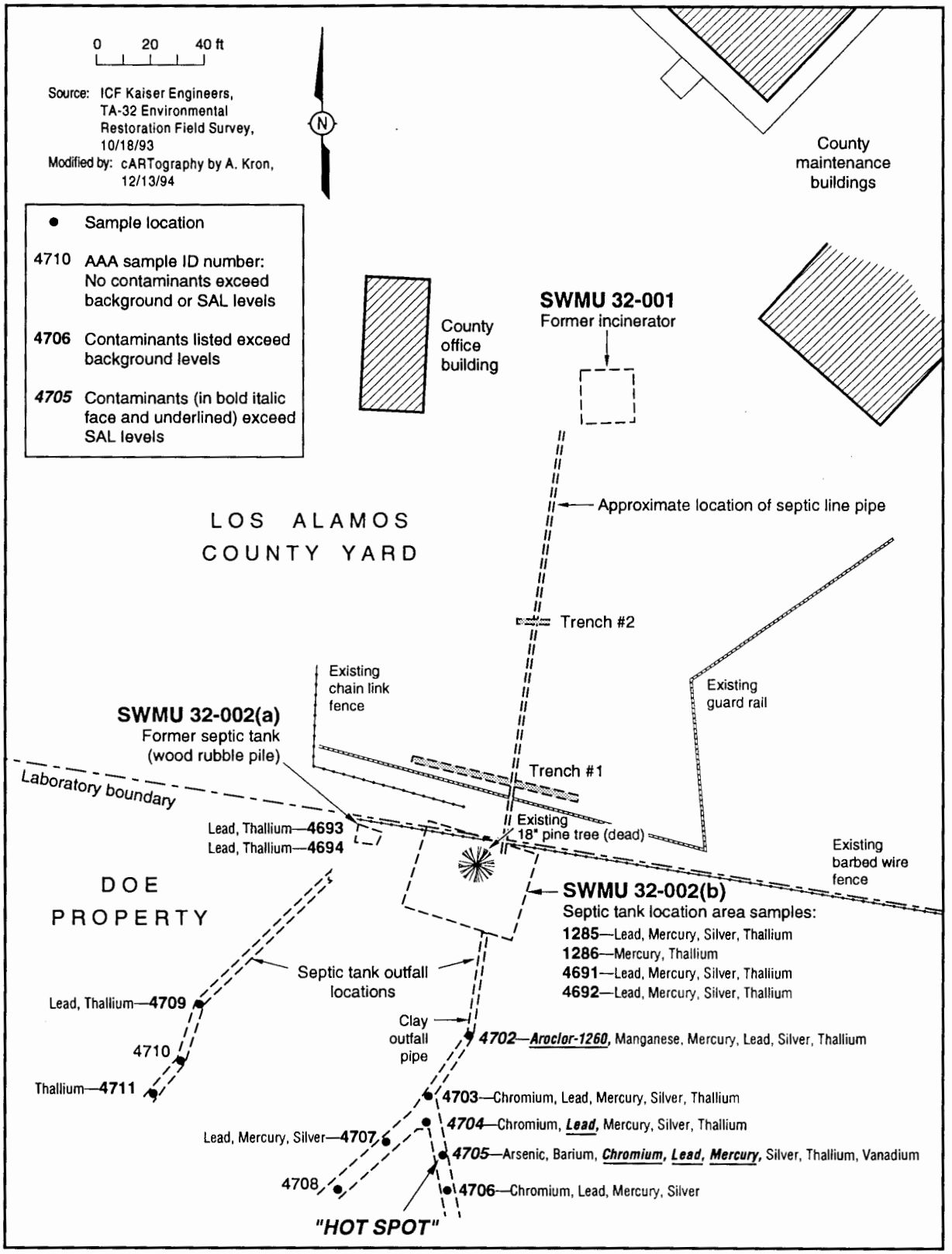


Figure 7. Location of analytes retained as COPCs in outfall.

4.2.2.6 Summary of Chemicals of Concern

The results of the screening assessment were used to identify the COPCs for the TA-32 Outfall. Table 7 summarizes the results of the screening assessment for analytes detected in the TA-32 Outfall soils. The table lists all chemicals detected in the soil and indicates how they were screened out or if they were retained as COPCs, which are highlighted in bold typeface in the table.

Table 7

Results of the Screening Assessment for TA-32 Outfall Soils

Analyte	Below Background	Below SAL	Retained As COPC
Acetone		X	
Aroclor 1260			above SAL
Aluminum	X		
Arsenic			above background
Barium			Multiple Constituent Evaluation
Benzene		X	
Benzo[b] fluoranthene	X		
Beryllium	X		
Bis(2-ethylhexyl)phthalate		X	
Cadmium		X	
Calcium	X		
Chromium			above SAL
Chrysene	X		
Cobalt	X		
Copper		X	
Di-n-butyl phthalate		X	
Fluoranthene	X		
Iron	X		
Lead			above SAL
Magnesium	X		
Manganese		X	Multiple Constituent Evaluation
Mercury			above SAL
Nickel	X		
Phenanthrene	X		
Potassium	X		
Pyrene	X		
Selenium	X		
Silver			Multiple Constituent Evaluation
Sodium	X		
Thallium			Multiple Constituent Evaluation
Toluene		X	
Vanadium		X	Multiple Constituent Evaluation
Xylenes		X	
Zinc		X	

In summary, all analytes detected at TA-32 Outfall, with the exception of aroclor 1260, arsenic, barium, chromium, lead, manganese, mercury, silver, thallium, and vanadium do not warrant further

investigation. They have been found to be either below background, below their respective SAL, or contributed negligibly to a normalized SAL in the multiple constituent evaluation.

In addition to these COPCs, the following analytes will be evaluated for their ecological effect on the fauna and flora in the outfall at TA-32: cadmium; copper; and zinc.

4.2.2.7 Recommendations for the Outfall

SWMU 32-002(a). No COPCs were above background levels, SALs or regulatory guidelines at the location of the above ground wooden septic tank. Therefore, SWMU 32-002(a) is recommended for No Further Action (NFA).

SWMU 32-002(B).

Sample ID AAA 4705 location. The data indicate analyte concentrations that may pose an unacceptable risk are concentrated at sampling point AAA 4705, the Outfall hotspot. The COPCs of arsenic, barium, chromium, lead, mercury, silver, thallium, and vanadium are all present at this spot. Arsenic and thallium are also found in elevated levels (with respect to background) at the sampling point immediately upgradient from the hotspot. Chromium and lead values are above SAL, while mercury, and silver are found in elevated levels (with respect to background levels) at the sampling points immediately upgradient and at lesser concentrations, immediately downgradient from the hotspot (Figure 7). The values for mercury, however, may be up to forty percent higher than reported as mentioned in section 3.1, Summary of QA/QC Activities.

Radiological emissions were detected at a level slightly above background, at the Outfall hotspot, using a Ludlum Model 2221 with a Ludlum probe 44-9 (Standard Geiger-Muller), a radiological field screening instrument. The instrument had a reading of 200 counts per minute (cpm) at the time of collection, background levels were 80-140 cpm. The sample was further analyzed by the mobile radiological van, and was found to contain a concentration of gamma radiation of 24.90 pCi/g. The Minimum Detection Activity (MDA) for gamma radiation is 4.4 pCi/g. The sample was inadvertently not sent to a laboratory for isotopic analysis.

Sample ID AAA 4702 location. Aroclor 1260 was detected at 17 mg/kg in soil sample ID AAA 4702, taken at the mouth of the vitrified clay pipe. Mercury was also detected in this sample above background, although below the SAL (Figure 7). The values for mercury, however, may be up to forty percent higher than reported as mentioned in section 3.1, Summary of QA/QC Activities. The soil from this location will be removed and resampled during the removal of the clay outfall pipe.

From an ecological perspective the septic tank outfall areas and runoff channels to Los Alamos canyon require further sampling to determine any potential impact to the biota. Heavy metals at the outfall substantiates the need to determine whether these COPCs have migrated into the canyon ecosystem.

Further sampling and analysis is recommended to define the nature and extent of the contamination found in the Outfall associated with SWMU 32-002(b). The Phase II Sampling Plan, chapter 5, addresses this recommendation.

5.0 PHASE II SAMPLING PLAN

This chapter describes the technical approach used in performing the Phase II sampling activities associated with the septic system outfall at Technical Area 32 (TA-32). Laboratory analysis of soil samples collected during Phase I sampling in the outfall area down gradient from SWMU 32-002(b) indicated the presence of RCRA metals, Aroclor 1260 (a polychlorinated byphenyl (PCB) and the possibility of radioactive contamination. A Phase II Sampling Investigation has been recommended to define the nature and extent of contamination in this outfall.

5.1. SITE BACKGROUND

5.1.1 Site History

TA-32 was the medical research and training facility at Los Alamos National Laboratory between the years 1944 to 1954. Research at that time included work in the areas of organic chemistry, radiobiology, and biochemistry. The Contaminants of Concern in the RFI Work Plan for OU 1079 at TA-32 are identified as Carbon-14, Plutonium 238 and 239, Americium 241, Tritium, Volatile Organic Compounds (VOC), Semivolatile Organic Compounds (SVOC) and Target Analyte List (TAL) Metals.

TA-32 is located south of Trinity Drive, behind the Los Alamos County Roads Division, near the north edge of Los Alamos Canyon. The site was decommissioned in 1954. The SWMU's identified with this site are SWMU 32-001, a former incinerator location, and SWMUs 32-002(a-b), two septic tank systems.

The Phase I sampling investigation was performed on September 16, 17 and 20, 1993.

5.1.2 Site Geology

The site geology and topography drive the outfall sampling strategy. The following section describes the site geology and topography to help understand the rationale for the Phase II sample locations.

The mesa top and most of the slope, to the bottom of Los Alamos Canyon are developed on the Upper Member of the Bandelier Tuff. The Upper Member is comprised of three "cooling" units, designated 1 to 3. These units are shown on Figure 8, and on Color Plate 1. The TA-32 topography is predominately controlled by the physical characteristics of these distinct units. The mesa top is developed on the cliff forming part of Unit 3. The outfall pipes extended to the edge of the cliff. No

sediment catchment areas were identified on these cliffs. Unit 2 underlies Unit 3. The physical characteristics of the upper part of Unit 2 result in the formation of slopes. The slope is characterized by very thin sediment and vegetation cover. All sampling of the outfall area conducted during the Phase I investigation was limited to this slope. The lower portion of Unit 2 erodes to vertical cliffs. No catchment areas are present on the cliffs. Unit 1, Lower Member of the Bandelier Tuff, and possibly Cerro Toledo tuffs, present near the base of the cliff, form a slope which descends to the flat alluvial floor of the canyon. Phase I sampling did not include this lower slope.

The Phase I sampling was limited to the slope of the upper part of Unit 2. Drainages developed on the slope of Unit 2 are shallow and narrow, typically only a few inches deep and wide. These drainages are discontinuous, alternating with areas of slope which have been broadly scoured by sheetflow erosion. Where drainage is well defined, no true sediment basins are present. Minor catchments are present between talus boulders. Minor areas of catchment are, in some cases, present within thin slopping debris "fans." At the base of the slope a narrow topographic "bench" is developed. Drainages from above converge on the bench and then drop over the cliff in two separate areas.

The drainage divides near the top of the slope at the location of Phase I sample ID 4704. At this time, the major drainage is to the west (Figure 8). Elevated concentrations of metals detected in the Phase I analyses were found in the relatively minor drainage to the east. The presence of contaminants suggests that either the eastern drainage was the major drainage when the site was active, or that, because of greater water transport through the western drainage, all sediments (and metals) have been efficiently flushed from the western drainage, or both.

The two drainages falling from the bench developed on Unit 2 splash down on the fan-shaped slope at the base of the lower cliff of Unit 1. One drainage flows to the east and the other drainage flows slightly to the west before flowing into Los Alamos Canyon ephemeral stream. Both the east and west drainages will be sampled in Phase II.

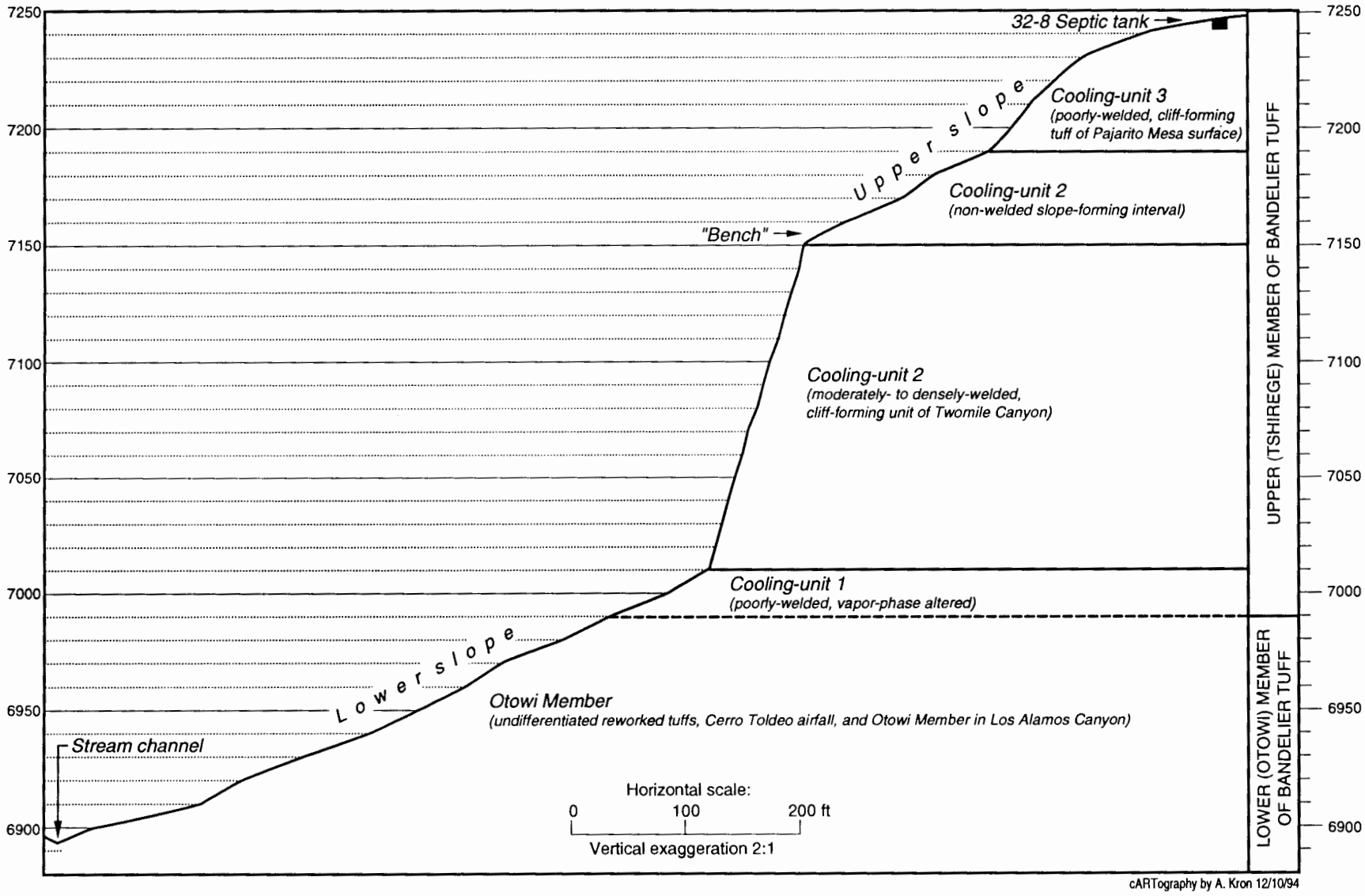


Figure 8. Cross section showing stratigraphic units at TA-32 (see Fig. 11 for location of cross section).

5.1.3 Phase I Sampling Description

The Phase I sampling investigation consisted of sampling the areas most likely to be contaminated if a release had occurred. Sampling focused on the outfalls, the former incinerator location, and the former septic tank locations. In addition, two trenches were excavated to locate the former septic system lines and soil samples were collected from each trench.

All samples were field screened for radioactivity and volatile organic compound (VOC) vapors. All soil samples were then analyzed for TAL metals and semivolatile organic compounds (SVOCs). For the purposes of waste characterization, all samples were analyzed for PCBs and subsurface soil samples were analyzed for VOCs.

5.1.4 Phase I Sampling Results

SWMU 32-001, SWMU 32-002(a)

No COPCs were detected above background levels, SALs, or regulatory guidelines at the locations of the former incinerator or the above-ground wooden septic tank. Therefore, SWMU 32-001 and SWMU 32-002(a) were recommended for NFA.

SWMU 32-002(b)

The results of the investigation indicated the presence of a septic tank line on the mesa top leading to SWMU 32-002(b). Metal concentrations above background and/or SALs were detected by laboratory analysis of samples collected from the pipe and underlying soils. An Expedited Cleanup (EC) was recommended for removing the septic tank line and surrounding soils.

Analytical results of soil samples collected during Phase I sampling in the outfall area downgradient from SWMU 32-002(b) indicated the presence of metals, Aroclor 1260, and the possibility of radioactive contamination. The Phase II Sampling Investigation was recommended to define the nature and extent of contamination in this area.

Table 8 summarizes the screening assessment for the outfall. It lists all chemicals with positive results and indicates how they were eliminated from further evaluation or if they were retained as COPCs. COPCs are highlighted in bold typeface in the table.

Table 8

Results of the Screening Assessment for TA-32 Outfall Soils

Analyte	Below Background	Below SAL	Retained As COPC
Acetone		X	
Aroclor 1260			above SAL
Aluminum	X		
Arsenic			above background
Barium			Multiple Constituent Evaluation
Benzene		X	
Benzo[b] fluoranthene	X		
Beryllium	X		
Bis(2-ethylhexyl)phthalate		X	
Cadmium		X	
Calcium	X		
Chromium			above SAL
Chrysene	X		
Cobalt	X		
Copper		X	
Di-n-butyl phthalate		X	
Fluoranthene	X		
Iron	X		
Lead			above SAL
Magnesium	X		
Manganese		X	Multiple Constituent Evaluation
Mercury			above SAL
Nickel	X		
Phenanthrene	X		
Potassium	X		
Pyrene	X		
Selenium	X		
Silver			Multiple Constituent Evaluation
Sodium	X		
Thallium			Multiple Constituent Evaluation
Toluene		X	
Vanadium		X	Multiple Constituent Evaluation
Xylenes		X	
Zinc		X	

In summary, the COPCs, as a result of the Phase I sampling investigation, are aroclor 1260, arsenic, barium, chromium, lead, manganese, mercury, silver, thallium, and vanadium. All other analytes

have been found to be in concentrations below background, below their respective SAL, or contributed negligibly to a normalized SAL in the multiple constituent evaluation. In addition, radiological emissions were detected in one soil sample using a Ludlum Model 2221 with a Ludlum probe 44-9 (Standard Geiger-Muller), a radiological field screening instrument.

A preliminary ecological screening assessment will be performed after the results are obtained from the Phase II sampling campaign. In addition to the COPCs, the following analytes will be evaluated for their effect on the fauna and flora in the outfall at TA-32: cadmium; copper; and zinc.

5.2 PHASE II WORK PLAN

5.2.1 Conceptual Exposure Model

The conceptual exposure model describes the potential sources of contamination, the potential migration pathways for contaminants released from the source, and subsequent human and biota exposure scenarios.

5.2.1.1 Potential Sources of Contamination

The outfall pipe is located near the edge of Los Alamos Canyon. Analytical results from soil samples collected near the mouth of this pipe and downstream samples indicate that the outfall pipe is the historical source of contamination and downgradient sediment catchments are the repositories.

Clay Outfall Pipe

Soil sample ID AAA 4702 (Figure 9) was collected at the mouth of the vitrified clay pipe. The analytical results indicate the highest concentration of Aroclor 1260 found at TA-32. There were three replicate samples at this location. One had a value of 17 mg/kg of Aroclor 1260 and the other two were below the LOD of 1 mg/kg. This sample also has levels of mercury above background.

Outfall

Analytical results from soil sample ID AAA4705, collected directly downgradient from the clay outfall pipe, indicate the presence of a hot spot. The COPCs, arsenic, chromium, lead, mercury, silver, thallium and vanadium are present at this spot. Arsenic and thallium were detected in elevated levels (with respect to background) at the sampling point immediately upgradient from the hot spot. Chromium, lead, (both above SAL), mercury and silver were detected in elevated levels (with respect

to background levels) at sampling points immediately above and, at lesser concentrations, immediately downgradient from the hotspot (Figure 9).

Radiological emissions were detected at a level slightly above background, in outfall soil sample, AAA 4705, using a Ludlum Model 2221 with a Ludlum probe 44-9 (Standard Geiger-Muller), a radiological field screening instrument. The instrument had a reading of 200 counts per minute (cpm) at the time of collection, background levels were 80-140 cpm. The sample was further analyzed by the mobile radiological van, and was found to contain a concentration of gamma radiation of 24.90 pCi/g. The Minimum Detection Activity (MDA) for gamma radiation is 4.4 pCi/g.

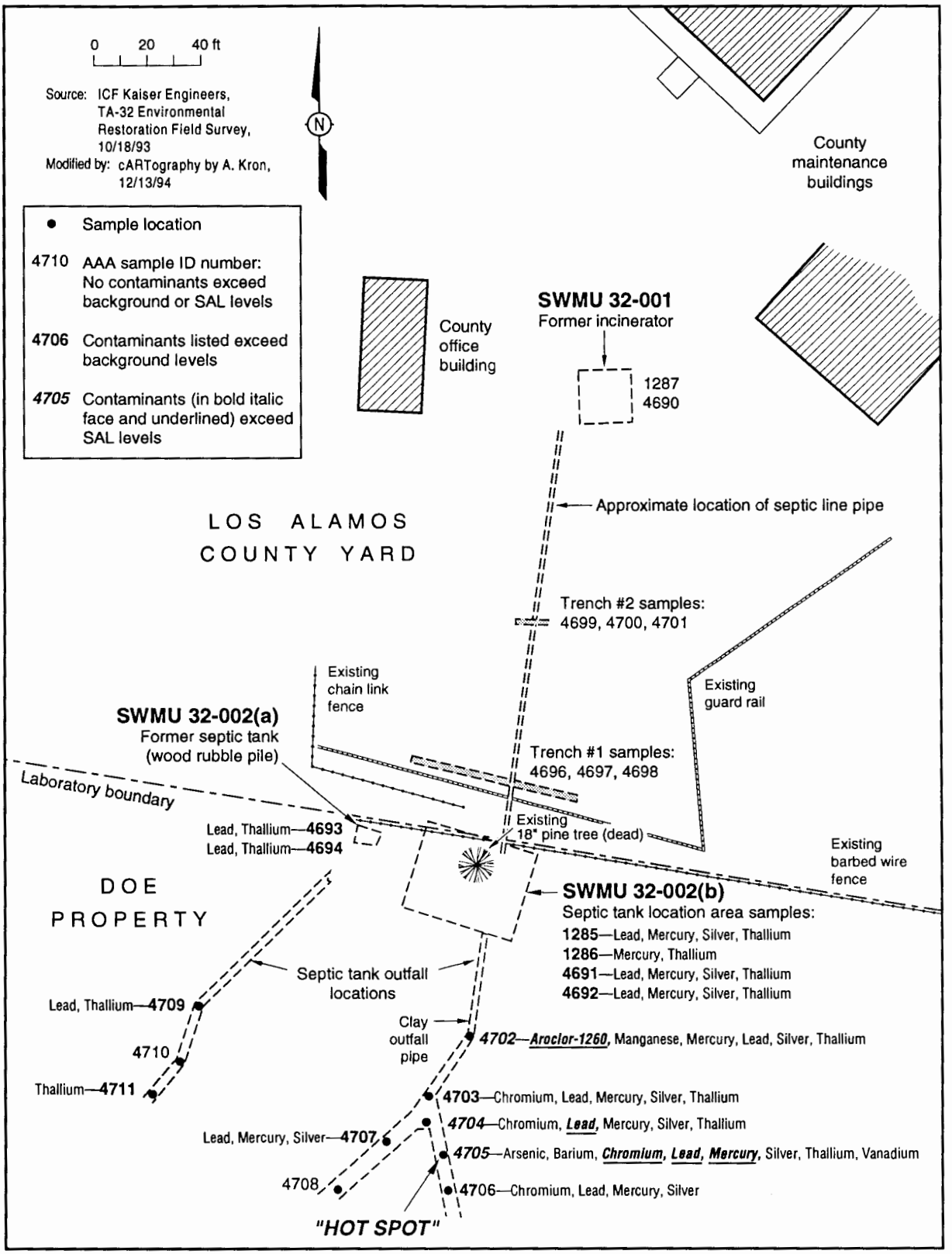


Figure 9. Potential sources of contamination in outfall at TA-32.

5.2.1.2 Potential Migration Pathways

The conceptual exposure model for the outfall at TA-32 is summarized in Figure 10. Outflow from the historical source has resulted in residual chemical and possible radiological contamination in the soil. The primary potential migration mechanisms are wind, surface runoff and perched ground water infiltration. The risk assessment will evaluate potential exposure of current trespassers, future recreational users, and future residents. The ecological risk assessment will evaluate potential current and future exposure of fauna and flora.

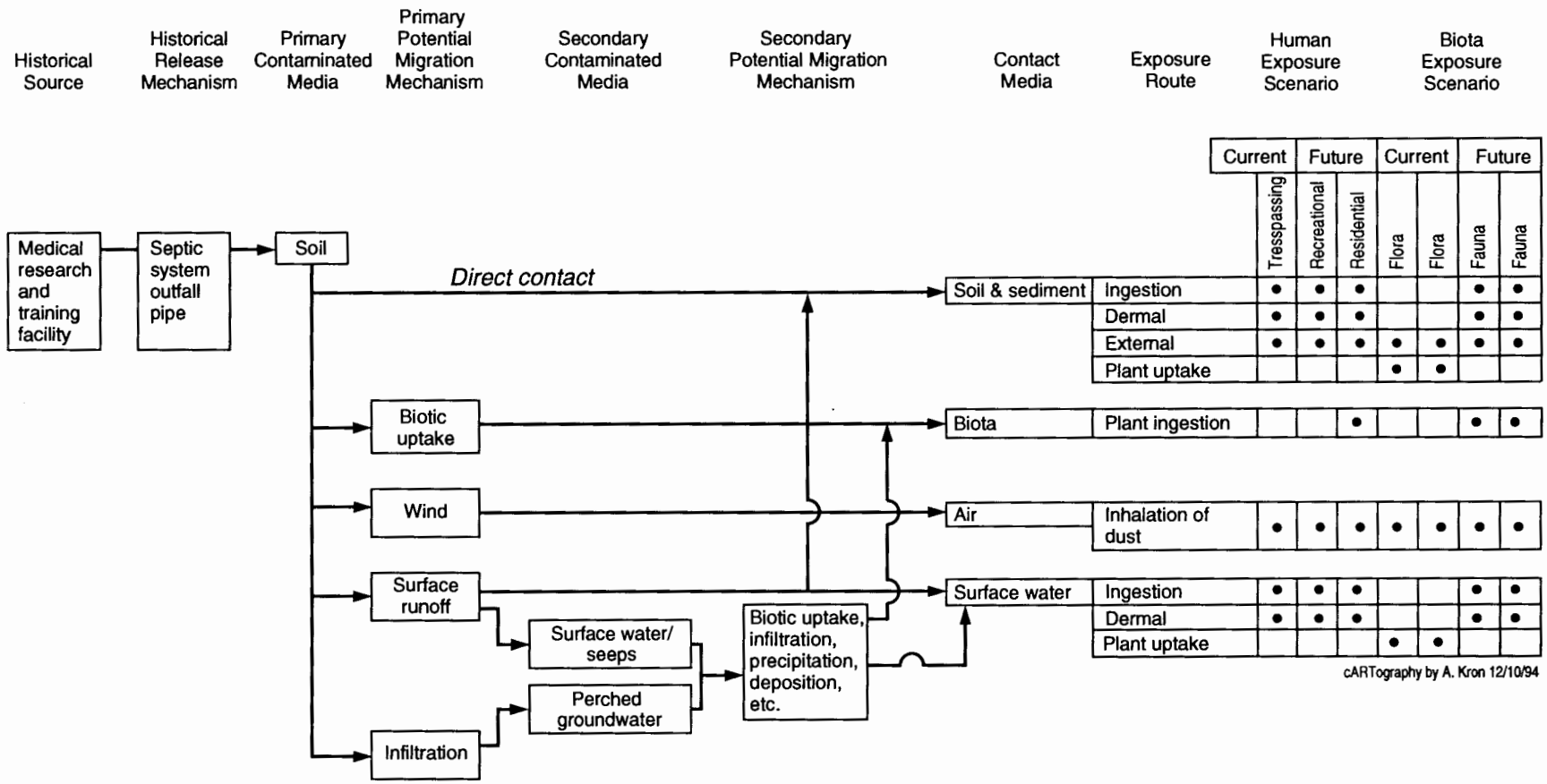


Figure 10. Conceptual exposure model for outfall at TA-32.

5.2.1.3 Human and Biota Exposure Scenarios

The potential human exposure is estimated through a model of the reasonable maximum exposed (RME) individual who is defined through assumptions of current and future land use (EPA 1992). The US Department of Energy (DOE) owns the outfall area at TA-32. The current exposure at TA-32 is limited to a trespasser scenario. The future exposure scenario is recreational and residential.

Ecotoxicological screening action levels (ESALs), (Ebinger, 1994, XXXX) were developed to guide the assessment for contaminated areas depending on the possible threatened and endangered species residing or using the area for foraging. Each ESAL is particular to a feeding guild for birds, mammals, reptiles and amphibians, specific to the area's plant community.

5.2.2 Investigation Objective

The objective of the Phase II Sampling Investigation is to assess the nature and extent of contamination in the outfall area at TA-32 and to provide sufficient data to adequately support a risk assessment or an Expedited Cleanup decision.

5.2.3 Data Needs and Data Quality Objectives

Phase I sampling at TA-32 identified a heterogeneous and sparse distribution of contaminants. Collecting samples in an evenly-spaced grid is not likely to locate pockets of contamination unless the grid is very dense. Sampling points have been chosen in the outfall area locations where contaminants are likely to be concentrated. Biased sample locations, based on the site topography, will be used to identify the nature and extent of contamination at TA-32 in the Phase II investigation.

To determine the number of samples required for the Phase II investigation at TA-32, risk decisions are based on the 95th upper confidence level of the mean, and then compared to a SAL, preliminary remediation goal (PRG), or clean-up level. There is no comparison number available for because the SAL is below background levels in Los Alamos. Table 9 provides statistics on outfall area samples for the ten analytes identified as COPCs.

TABLE 9: TA-32 Outfall Soil Sample Statistics

ANALYTE	No. OF Spls	MEAN	STANDARD DEVIATION	STANDARD MEAN ERROR	95TH U.C. LEVEL	MAXIMUM	DECISION	Total Spls
Arsenic	10	4.660	4.967	1.571	7.539	18.0	@	-----
Aroclor	10	1.533	1.685	0.533	2.510	6.33(1)	1 (C)	**
Barium	10	162.650	270.579	85.564	319.499	920.00	5600 (S)	*
Chromium	10	68.770	134.239	42.450	146.586	440.00	1300 (P)	*
Lead	10	267.15	486.645	153.891	549.249	1600.00	400 (S)	44
Manganese	10	433.500	398.581	126.042	664.550	1475.00	11000 (P)	*
Mercury	10	36.008	83.789	26.496	84.578	271.67	82.1 (P)	11
Silver	10	21.243	45.960	14.534	47.884	150.00	400 (S)	*
Thallium	10	0.470	0.710	0.225	0.882	2.40	6.4 (S)	*
Vanadium	10	15.775	16.018	5.065	25.060	59.00	560 (S)	*

(C) => Clean-up Level
(S) => Human Health SAL Value
(P) => Preliminary Remediation Goal (PRG) Value
@ => No decision Level has been stated so sample sizes cannot be calculated
* => 95th upper confidence limit of the mean is already less than the decision level
** => Can show mean is less than 1. if assume mean is 1.5
SPLs => SAMPLES
(1) => The Aroclor maximum value is the average of 3 replicate sample analyses, one value of 17 and two values below the reporting limit of 1. The average uses the reporting limit as the value of the two non-detects.

The upper 95th confidence level of the mean for barium, chromium, manganese, silver, thallium, and vanadium are below the PRG. Additional data on these analytes are not needed in order to perform a risk assessment. Lead and mercury have upper confidence levels of the mean above the decision level. The equation for calculating the minimum sample size using the confidence range for the mean is:

$$n = (ts/(d - \bar{x}))^2$$

where:

$\bar{x}$ = the mean

d = decision level

t = the t-value for 0.95

s = standard deviation

n = phase II sample size

Using the values from Table 9, and a conservative t-value of 1.8, an estimate of the sample size is calculated. The equation utilizing the mercury value gives the results of a total sample size of 11, or 1 additional sample. The equation utilizing the lead value gives the results of a total sample size of 44, or 34 additional samples.

5.2.3.1 Sample Quality Assurance and Quality Control

Appropriate Quality Control samples (blanks, replicates, rinsates) will be submitted to the analytical laboratory to provide the means to assess the quality of the data resulting from the field sampling program. Blank samples will be analyzed to check for procedural contamination and ambient conditions at the site that may cause sample contamination. Replicate samples will be analyzed to check for sampling and analytical reproducibility.

5.2.4 Summary of Field Work

5.2.4.1 Sampling and Analysis Plan

The proposed judgmental sampling plan is based on our best estimate of drainage patterns and possible catchment points where sediments and contamination are most likely to have been retained. The objective is to follow the short, discontinuous drainages downslope all the way to Los Alamos Canyon.

The Phase II Investigation will sample the areas immediately adjacent to sample points where Phase I investigations found contamination (Figure 11). Samples will be collected from possible catchment areas adjacent to these locations. Sample points at new locations have been identified to check for further contamination. Bounding samples will be collected from drainages thought to be outside of the outfall area of concern. These samples will be collected to define the boundary of the contaminated area, and will not be analyzed unless contamination is found in samples from the outfall area. Samples will also be collected from poorly defined small sediment catchment areas just above the flood plain on the canyon floor.

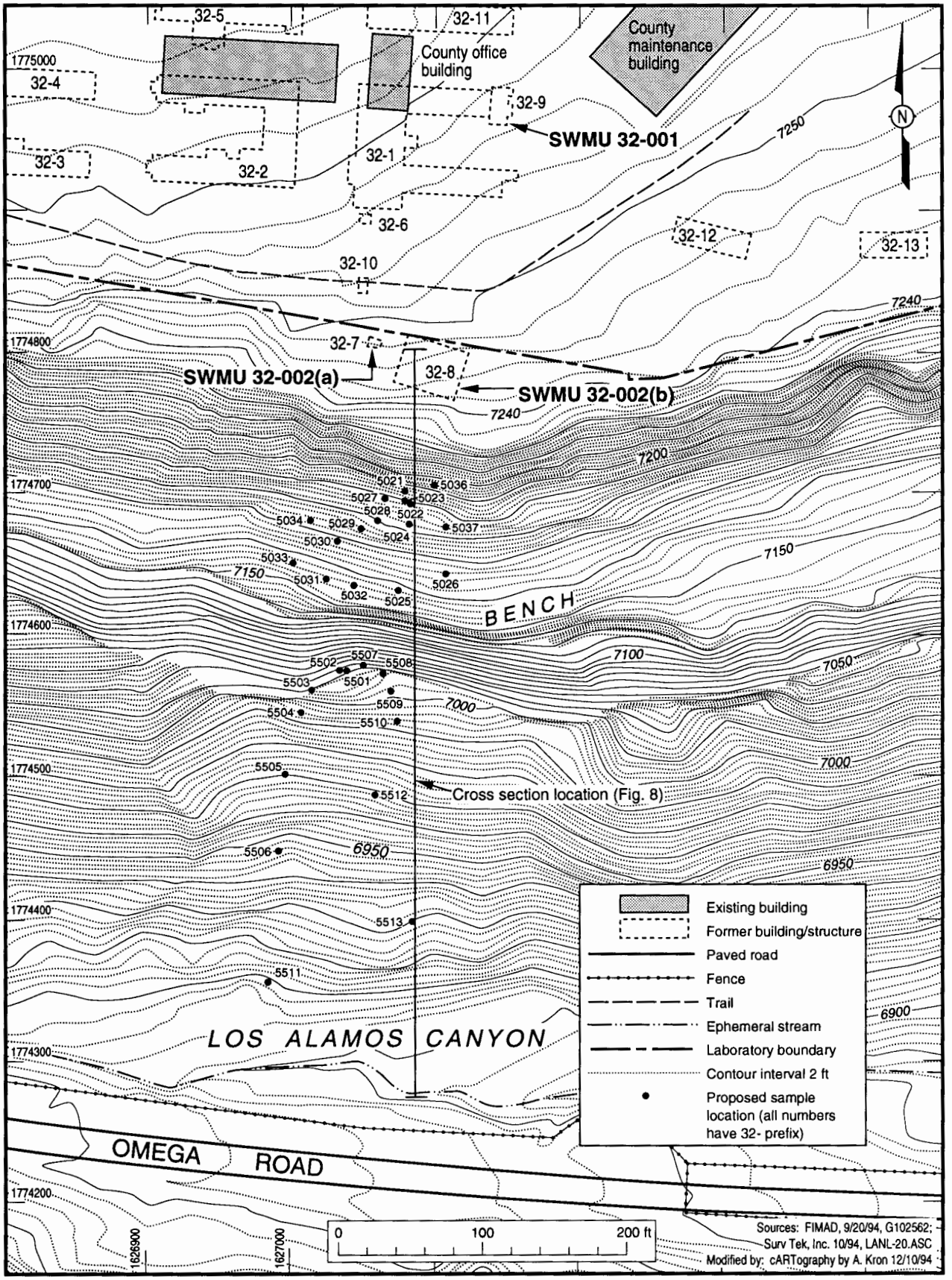


Figure 11. Phase II outfall sampling locations for TA-32.

All sample locations will be surveyed prior to sampling and located on a detailed site map. Samples will be collected from a depth of 0-6 inches below the surface, if enough sediment cover is present. All samples will be field screened for radioactivity. If radioactivity is detected in any sample during the field screening, those samples will be analyzed using gamma spectrometry to identify individual radionuclides.

All samples will be analyzed in the laboratory for PCBs, TAL metals (including arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, silver, thallium, vanadium, and zinc). Ten percent of the samples will be collected for Isotopic analysis for quality assurance purposes. Table 10 describes the sample locations and the analyses to be requested.

Table 10: Sampling Plan Summary

		Field		Fixed Lab Analysis		
Location ID	Location Description	ALPHA	B/GAMMA	PCBs	METALS	RAD
Cliff Face						
32-5021	7 ft. 3 in. small drainage east from 4704	X	X	X	X	O
32-5621	Duplicate of 32-5021	X	X	X	X	X
32-5022	Downstream 3-4 ft. below 4705	X	X	X	X	O
32-5622	Duplicate of 32-5022	X	X	X	X	X
32-5023	4.5 ft. southwest of 4705	X	X	X	X	O
32-5024	5.5 ft. south of 4706	X	X	X	X	O
32-5025	55 ft. below 32-5024, 3 ft from edge of cliff	X	X	X	X	O
32-5625	Duplicate of 32-5025	X	X	X	X	X
32-5026	Bounding Sample, 30 ft. east of small drainage	B	B	B	B	O
32-5027	6 ft. southeast from 4707	X	X	X	X	O
32-5028	Area of broad sheet flow, 23 ft. below 4707	X	X	X	X	O
32-5029	10 ft. southeast of 4708	X	X	X	X	O
32-5030	25 ft. southwest of 4708	X	X	X	X	O
32-5031	30 ft. below 32-5030, 14 ft. back from edge of cliff	X	X	X	X	O
32-5032	Bounding Sample, 20 ft. east of 32-5031	B	B	B	B	O
32-5033	Bounding Sample, 25 ft. west of 32-5031	B	B	B	B	O
32-5034	Bounding Sample, 31 ft. west of 4708	B	B	B	B	O
32-5035	Bounding Sample, 30 ft. west of 4707	B	B	B	B	O
32-5036	Bounding Sample, 25 ft. east of 4707, at base of steep cliff	B	B	B	B	O

32-5037	Bounding Sample, on grassy slope, halfway between 32-5036 and 32-5026	B	B	B	B	O
Location ID	Location Description	ALPHA	B/GAMMA	PCBs	METALS	RAD
Base of Cliff						
32-5501	Bottom of cliff, where natural water course divides - EAST	X	X	X	X	O
32-5502	Bottom of cliff - MIDDLE	X	X	X	X	O
32-5503	Bottom of cliff - WEST	X	X	X	X	O
32-5504	Below 32-5503	X	X	X	X	O
32-5505	Below 32-5503 (20 ft. from 32-5504)	X	X	X	X	O
32-5506	Below 32-5503 (20 ft. from 32-5505)	X	X	X	X	O
32-5507	Below 32-5501, EAST,	X	X	X	X	O
32-5508	Below 32-5501 (20 ft. from 32-5507)	X	X	X	X	O
32-5509	Below 32-5501 (20 ft. from 32-5508)	X	X	X	X	O
32-5510	Bounding sample, located in main drainage west of outfall	B	B	B	B	O
32-5511	Bounding sample, located in main drainage west of outfall	B	B	B	B	O
32-5512	Bounding sample, in flat area above flood cut out of LA Canyon creek	B	B	B	B	O
32-5513	Bounding sample to east, in small drainage just above flood plain	B	B	B	B	O

X Sample analyzed
B Bounding sample, only analyzed if positive result in outfall area
O Analyzed only if positive field screening result
RAD = GAMMA SPEC, TRITIUM, ISOTOPIC URANIUM, AMERICIUM 241, CARBON-14, ISOTOPIC PLUTONIUM

5.2.4.2 Soil Sampling Method

Surface soil samples are defined as samples collected from the upper 5 to 10 cm of soil. This type of soil sample will be gathered using a decontaminated stainless steel or disposable Teflon scoop. Care will be used to collect the sample to a full 10 cm depth and to cut the sides of the hole vertically to ensure equal volumes of soil are taken over the full 10 cm depth. This procedure will be followed when the soil depth allows. The applicable Standard Operating Procedure is LANL-ER-SOP-6.09, "Spade and Scoop Method for Collection of Soil Samples" (LANL 1992, 0668).

5.2.4.3 Equipment Decontamination

Decontamination is performed as a quality assurance measure and a safety precaution. It prevents cross contamination among samples and helps maintain a clean working environment for the safety of the personnel. Sampling tools are decontaminated by washing, rinsing, and drying. All efforts will be made to minimize fluids used for equipment decontamination. Decontamination fluids are considered wastes and must be collected and contained for proper disposal. The effectiveness of the decontamination process is documented through rinsate blanks submitted for laboratory analysis.

5.2.4.4 Waste Management

Requirements for segregating, containing, characterizing, treating, and disposing of each type and category of waste are provided in the applicable SOP, LANL-ER-SOP-01.06, "Management of RFI-Generated Waste" (LANL 1992, 0668) and approved Site-Specific Waste Management Plan (SSWMP).

The on-site waste manager shall be responsible for completing all waste forms and ensuring that all waste containers are labeled in accordance with the SSWMP. Records will be kept of wastes generated on-site and waste analyses will be evaluated. The on-site waste manager will assist with the coordination of waste disposal.

5.2.4.5 Health and Safety

Samples acquired as part of this sampling plan will be screened at the point of collection to identify the presence of gross contamination or conditions that may pose a threat to the health and safety of field personnel.

The Site Safety Officer (SSO) is responsible for Health and Safety Procedure development and implementation in accordance with the approved Site-Specific Health and Safety Plan (SSHSP). The SSO coordinates health and safety monitoring activities and ensures that the Laboratory's Health and Safety officers are kept informed. In addition, the SSO ensures that safe and environmentally sound work practices are followed during the sampling campaign.

5.2.4.6 Field Documentation

The following sampling documentation is required under LANL-ER-SOP-1.04, R1, Sample Control and Field Documentation: Sample labels, sample collection logs, chain-of-custody/request for analysis forms, and custody seals. Sample information shall be collected and entered on the forms and subsequently initialed and signed by the field team leader. The data will be stored in a field management database and uploaded to the ER project's central database repository (FIMAD). A field logbook will be used for detailed summaries of information pertaining to the field investigation and for recording field data.

A daily sampling report will be submitted by the field team leader to the field project leader, field operations manager and/or other pertinent individuals. This report will briefly summarize each day's sampling activities and will be submitted in electronic format. The format of this report will follow Attachment G of the LANL-ER-SOP-1.04, R1 and will contain all information required in this daily report form.

5.2.4.7 Site Restoration

The sampling methods to be utilized will create minor disturbances to the existing soils profile. The sample locations will be restored to their previous condition upon completion of the Phase II field investigation.

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Appendices

APPENDIX A: Summary Table of Individual Analytes

SMP LOCAT	AAA #	TYPE	COMMENT	MET	RAD	VOL	SVOL	PCB
32-1001	4690	Soil	Incinerator	1	-	1	1	1
32-1002	4691	Soil	Septic Tank	1	-	1	1	1
32-1002	4718	Soil	Dup of 4691	1	-	1	1	1
32-1002	4719	Soil	Dup of 4691	1	-	1	1	1
32-1003	4692	Soil	Septic Tank	1	-	1	1	1
32-1003	4713	Soil	Dup of 4692	1	-	1	1	1
32-1004	4693	Soil	Septic Tank	1	-	1	1	1
32-1005	4694	Soil	Septic Tank	1	-	1	1	1
32-1007	4695	Soil	Dup of 4696	1	-	1	1	1
32-1007	4696	Soil	Trench 1	1	-	1	1	1
32-1008	4697	Soil	Trench 1	1	-	1	1	1
32-1009	4698	Soil	Trench 1	1	-	1	1	1
32-1010	4699	Soil	Trench 2	1	-	1	1	1
32-1011	4700	Soil	Trench 2	1	-	1	1	1
32-1012	4701	Soil	Trench 2	1	-	1	1	1
32-1013	4702	Soil	Outfall	1	-	1	1	1
32-1013	4716	Soil	Dup of 4702	1	-	1	1	1
32-1013	4717	Soil	Dup of 4702	1	-	1	1	1
32-1014	4703	Soil	Outfall	1	-	1	1	1
32-1015	4704	Soil	Outfall	1	-	1	1	1
32-1016	4705	Soil	Outfall	1	-	1	1	1
32-1017	4706	Soil	Outfall	1	-	-	1	1
32-1018	4707	Soil	Outfall	1	-	-	1	1
32-1019	4708	Soil	Outfall	1	-	-	1	1
32-1020	4709	Soil	Outfall	1	-	-	1	1
32-1021	4710	Soil	Outfall	1	-	-	1	1
32-1022	4711	Soil	Outfall	1	-	-	1	1
32-1025	4715	Soil	Field Blank	1	1	1	1	1
32-1035	1287	Soil	Incinerator	1	-	1	1	1
32-1036	1285	Soil	Septic Tank	1	-	1	1	1
32-1037	1286	Soil	Septic Tank	1	-	1	1	1
None	4712	Water	Rinsate	1	-	-	1	1

Smp Locat = Sample location number.

Met = TAL metals.

Rad= Radionuclide analyses for plutonium-238, -239, uranium-234, -235, -238, strontium-90, cesium-137, and americium-241.

Vol = Volatile organic compounds .

Svol = Semivolatile organic compounds.

Dup = Duplicate sample.

1 = Sample analyzed for indicated analytes.

- = Sample not submitted for indicated analytes.

Analytical Methodology

All soil samples were routinely screened for gross alpha and beta activity using a low-level counter and for gamma activity using a deep well counter before they were submitted with chain-of-custody documentation to the sample coordination facility (SCF) for analysis. Soil samples were analyzed for TAL (target analyte list) metals by flame atomic absorption (FAA), electrothermal vaporization atomic absorption (ETVAA), cold vaporization atomic absorption (CVAA), inductively coupled plasma emission spectroscopy (ICPES) (EPA 6010), inductively coupled plasma/mass spectrometry (ICP/MS) and colorimetry (COLOR). Volatile analyses were conducted using purge and trap gas chromatography/mass spectrometry (PTGC/MS), EPA SW846 Method 8240. Semivolatile compounds were analyzed using packed column gas chromatography/mass spectrometry (GC/MS), EPA SW846 Method 8250. Polychlorinated biphenyls (PCB) were analyzed using gas chromatography/ electron capture detector (GC/ECD), EPA SW846 method 8080.

One field blank sample was analyzed for the following radio nuclides:

. ^{3}H using liquid scintillation (LC) method SL 13026,

. ^{137}Cs and ^{241}Am using gamma spectroscopy (G) method SL 13018, and

. ^{234}U, ^{235}U, ^{238}U, ^{238}Pu , ^{239}Pu and ^{241}Am using alpha spectrometry (RAS), methods OR7004 and OR7103.

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APPENDIX B: Analytical Results

PCB Results

Sample Location	AAA #	Type	Comment	PCB (ug/g)	+/-
32-1001	4690	Soil	Incinerator	2.0	0.6
32-1002	4691	Soil	Septic Tank	<1	
32-1002	4718	Soil	DUP of 4691	<1	
32-1002	4719	Soil	DUP of 4691	<1	
32-1003	4692	Soil	Septic Tank	<1	
32-1003	4713	Soil	DUP of 4692	<1	
32-1004	4693	Soil	Septic Tank	4	1.2
32-1005	4694	Soil	Septic Tank	1.5	0.3
32-1007	4695	Soil	DUP of 4696	<1	
32-1007	4696	Soil	Trench #1	<1	
32-1008	4697	Soil	Trench #1	1.0	0.3
32-1009	4698	Soil	Trench #1	1.0	0.3
32-1010	4699	Soil	Trench #2	<1	
32-1011	4700	Soil	Trench #2	<1	
32-1012	4701	Soil	Trench #2	<1	
32-1013	4702	Soil	Outfall	17	5
32-1013	4716	Soil	DUP of 4702	<1	
32-1013	4717	Soil	DUP of 4702	<1	
32-1014	4703	Soil	Outfall	<1	
32-1015	4704	Soil	Outfall	<1	
32-1016	4705	Soil	Outfall	<1	
32-1017	4706	Soil	Outfall	<1	
32-1018	4707	Soil	Outfall	<1	
32-1019	4708	Soil	Outfall	<1	
32-1020	4709	Soil	Outfall	<1	
32-1021	4710	Soil	Outfall	<1	
32-1022	4711	Soil	Outfall	<1	
32-1025	4715	Soil	Field Blank	<1	
32-1035	1287	Soil	Incinerator	<1	
32-1036	1285	Soil	Septic Tank	<1	
32-1037	1286	Soil	Septic Tank	<1	
None	4712	Water	Rinsate	<5*	(*ug/l)

TA-32 Data Summary
Data Extracted from FIMAD on October 5, 1994

OBS	ANALYTE	Total	Number >= LOD	Min Value	Max Value	SAL	UNITS	Number < LOD	Min LOD	Max LOD	Number > SAL	Number <= SAL	Number <LOD & LOD>SAL	Number w/ NO SAL	DISP
1	Acenaphthene	30	0	.	.	4800.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
2	Acenaphthylene	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
3	Acetone	18	6	0.025	0.05	8000.00	MG/KG	12	0.020	0.020	0	18	0	0	NO CONCERN
4	Aluminium	32	32	6.700	11000.00	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
5	Aniline	30	0	.	.	120.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
6	Anthracene	30	0	.	.	24000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
7	Antimony	32	0	.	.	32.00	MG/KG	32	0.100	0.100	0	32	0	0	NO CONCERN
8	Arsenic	32	32	1.100	25.00	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
9	Azobenzene	30	0	.	.	6.40	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
10	Barium	32	32	16.000	920.00	5600.00	MG/KG	0	.	.	0	32	0	0	NO CONCERN
11	Benzene	18	1	0.010	0.01	0.67	MG/KG	17	0.005	0.005	0	18	0	0	NO CONCERN
12	Benzidine [m-]	30	0	.	.	0.00	MG/KG	30	0.330	0.330	0	0	30	0	SPECIAL CASE
13	Benzo[a]anthracene	30	1	1.800	1.80	1.00	MG/KG	29	0.330	0.330	1	29	0	0	EXCEEDS SAL
14	Benzo[a]pyrene	30	1	2.000	2.00	0.10	MG/KG	29	0.330	0.330	1	0	29	0	EXCEEDS SAL
15	Benzo[b]fluoranthene	30	8	0.360	3.10	1.00	MG/KG	22	0.330	0.330	1	29	0	0	EXCEEDS SAL
16	Benzo[g,h,i]perylene	30	1	1.300	1.30	.	MG/KG	29	0.330	0.330	0	0	0	30	FURTHER EVAL
17	Benzo[k]fluoranthene	30	1	0.770	0.77	1.00	MG/KG	29	0.330	0.330	0	30	0	0	NO CONCERN
18	Benzoic acid	30	0	.	.	320000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
19	Benzyl alcohol	30	0	.	.	24000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
20	Beryllium	32	32	0.310	130.00	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
21	Bis(2-chloroethoxy)methane	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
22	Bis(2-chloroethyl)ether	30	0	.	.	0.12	MG/KG	30	0.330	0.330	0	0	30	0	SPECIAL CASE
23	Bis(2-chloroisopropyl)ether	30	0	.	.	100.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
24	Bis(2-ethylhexyl)phthalate	30	2	1.400	5.50	50.00	MG/KG	28	0.330	0.330	0	30	0	0	NO CONCERN
25	Bromobenzene	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
26	Bromochloromethane	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
27	Bromodichloromethane	18	0	.	.	11.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
28	Bromoform	18	0	.	.	89.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
29	Bromomethane	18	0	.	.	0.43	MG/KG	18	0.010	0.010	0	18	0	0	NO CONCERN
30	Bromophenylphenyl ether [4-]	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
31	Butanone [2-]	18	0	.	.	4000.00	MG/KG	18	0.020	0.020	0	18	0	0	NO CONCERN
32	Butyl benzyl phthalate	30	1	1.100	1.10	16000.00	MG/KG	29	0.330	0.330	0	30	0	0	NO CONCERN
33	Butylbenzene [n-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
34	Butylbenzene [sec-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
35	Butylbenzene [tert-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
36	Cadmium	32	16	0.400	19.00	80.00	MG/KG	16	0.400	0.400	0	32	0	0	NO CONCERN
37	Calcium	32	32	310.000	8500.00	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
38	Carbon disulfide	18	0	.	.	7.40	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
39	Carbon tetrachloride	18	0	.	.	0.21	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
40	Chloro-3-methylphenol [4-]	30	0	.	.	16000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
41	Chloroaniline [4-]	30	0	.	.	320.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
42	Chlorobenzene	18	0	.	.	67.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
43	Chlorodibromomethane	18	0	.	.	83.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
44	Chloroethane	18	0	.	.	2900.00	MG/KG	18	0.010	0.010	0	18	0	0	NO CONCERN
45	Chloroform	18	0	.	.	0.21	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
46	Chloromethane	18	0	.	.	6.40	MG/KG	18	0.010	0.010	0	18	0	0	NO CONCERN
47	Chloronaphthalene [2-]	30	0	.	.	6400.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
48	Chlorophenol [o-]	30	0	.	.	400.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
49	Chlorophenylphenyl ether [4-]	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
50	Chlorotoluene [o-]	18	0	.	.	1600.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
51	Chlorotoluene [p-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
52	Chromium	32	32	1.000	440.00	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
53	Chrysene	30	3	0.360	2.00	96.00	MG/KG	27	0.330	0.330	0	30	0	0	NO CONCERN
54	Cobalt	31	30	0.520	430.00	.	MG/KG	1	0.500	0.500	0	0	0	31	FURTHER EVAL

OBS	ANALYTE	Total	Number >= LOD	Min Value	Max Value	SAL	UNITS	Number < LOD	Min LOD	Max LOD	Number > SAL	Number <= SAL	Number <LOD & LOD>SAL	Number w/ NO SAL	DISP
55	Copper	32	32	1.30	170.0	3000.00	MG/KG	0	.	.	0	32	0	0	NO CONCERN
56	Di-n-butyl phthalate	30	11	0.46	3.5	8000.00	MG/KG	19	0.330	0.330	0	30	0	0	NO CONCERN
57	Di-n-octyl phthalate	30	0	.	.	1600.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
58	Dibenzo[a,h]anthracene	30	0	.	.	0.10	MG/KG	30	0.330	0.330	0	0	30	0	SPECIAL CASE
59	Dibenzofuran	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
60	Dibromo-3-chloropropane [1,2-]	18	0	.	.	0.50	MG/KG	18	0.010	0.010	0	18	0	0	NO CONCERN
61	Dibromoethane [1,2-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
62	Dibromomethane	18	0	.	.	0.01	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
63	Dichlorobenzene (1,2) [o-]	48	0	.	.	1600.00	MG/KG	48	0.005	0.330	0	48	0	0	NO CONCERN
64	Dichlorobenzene (1,3) [m-]	48	0	.	.	7200.00	MG/KG	48	0.005	0.330	0	48	0	0	NO CONCERN
65	Dichlorobenzene (1,4) [p-]	48	0	.	.	29.00	MG/KG	48	0.005	0.330	0	48	0	0	NO CONCERN
66	Dichlorobenzidine [3,3'-]	30	0	.	.	1.60	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
67	Dichlorodifluoromethane	18	0	.	.	16000.00	MG/KG	18	0.010	0.010	0	18	0	0	NO CONCERN
68	Dichloroethane [1,1-]	18	0	.	.	410.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
69	Dichloroethane [1,2-]	18	0	.	.	0.20	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
70	Dichloroethene [1,1-]	18	0	.	.	0.40	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
71	Dichloroethene [trans-1,2-]	18	0	.	.	1600.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
72	Dichloroethylene [cis-1,2-]	18	0	.	.	800.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
73	Dichlorophenol [2,4-]	30	0	.	.	240.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
74	Dichloropropane [1,2-]	18	0	.	.	6.50	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
75	Dichloropropane [1,3-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
76	Dichloropropane [2,2-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
77	Dichloropropene [1,1-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
78	Dichloropropene [cis-1,3-]	18	0	.	.	0.17	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
79	Dichloropropene [trans-1,3-]	18	0	.	.	0.17	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
80	Diethyl phthalate	30	0	.	.	64000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
81	Dimethyl phthalate	30	0	.	.	800000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
82	Dimethylphenol [2,4-]	30	0	.	.	1600.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
83	Dinitrophenol [2,4-]	30	0	.	.	160.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
84	Dinitrotoluene [2,4-]	30	0	.	.	1.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
85	Dinitrotoluene [2,6-]	30	0	.	.	1.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
86	Ethylbenzene	18	0	.	.	3100.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
87	Fluoranthene	30	5	0.42	2.2	3200.00	MG/KG	25	0.330	0.330	0	30	0	0	NO CONCERN
88	Fluorene	30	0	.	.	3200.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
89	Hexachlorobenzene	30	0	.	.	0.44	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
90	Hexachlorobutadiene	30	0	.	.	90.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
91	Hexachlorocyclopentadiene	30	0	.	.	560.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
92	Hexachloroethane	30	0	.	.	80.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
93	Hexanone [2-]	18	0	.	.	.	MG/KG	18	0.020	0.020	0	0	0	18	NULL CASE
94	Indeno[1,2,3-cd]pyrene	30	1	1.20	1.2	1.00	MG/KG	29	0.330	0.330	1	29	0	0	EXCEEDS SAL
95	Iron	32	32	300.00	62000.0	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
96	Isophorone	30	0	.	.	7400.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
97	Isopropylbenzene	18	0	.	.	3200.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
98	Isopropyltoluene [4-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
99	Lead	32	32	11.00	1600.0	400.00	MG/KG	0	.	.	3	29	0	0	EXCEEDS SAL
100	Magnesium	32	32	220.00	2000.0	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
101	Manganese	32	32	150.00	1600.0	11000.00	MG/KG	0	.	.	0	32	0	0	NO CONCERN
102	Mercury	90	55	0.10	420.0	24.00	MG/KG	35	0.100	0.100	9	81	0	0	EXCEEDS SAL
103	Methyl iodide	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
104	Methyl-2-pentanone [4-]	18	0	.	.	510.00	MG/KG	18	0.020	0.020	0	18	0	0	NO CONCERN
105	Methyl-4,6-dinitrophenol [2-]	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
106	Methylene chloride	18	0	.	.	5.60	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
107	Methylnaphthalene [2-]	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
108	Methylphenol [2-]	30	0	.	.	4000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN

OBS	ANALYTE	Total	Number >= LOD	Min Value	Max Value	SAL	UNITS	Number < LOD	Min LOD	Max LOD	Number > SAL	Number <= SAL	Number <LOD & LOD>SAL	Number w/ NO SAL	DISP
109	Methylphenol [4-]	30	0	.	.	400.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
110	Naphthalene	30	0	.	.	3200.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
111	Nickel	32	31	2.0000	260.00	1600.00	MG/KG	1	2.000	2.000	0	32	0	0	NO CONCERN
112	Nitroaniline [2-]	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
113	Nitroaniline [3-]	30	0	.	.	240.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
114	Nitroaniline [4-]	30	0	.	.	240.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
115	Nitrobenzene	30	0	.	.	5.30	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
116	Nitrophenol [2-]	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
117	Nitrophenol [4-]	30	0	.	.	5000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
118	Nitrosodi-n-propylamine [N-]	30	0	.	.	0.10	MG/KG	30	0.330	0.330	0	0	30	0	SPECIAL CASE
119	Nitrosodimethylamine [N-]	30	0	.	.	0.01	MG/KG	30	0.330	0.330	0	0	30	0	SPECIAL CASE
120	Nitrosodiphenylamine [N-]	30	0	.	.	140.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
121	Pentachlorophenol	30	0	.	.	5.80	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
122	Phenanthrene	30	2	0.4000	0.59	.	MG/KG	28	0.330	0.330	0	0	0	30	FURTHER EVAL
123	Phenol	30	0	.	.	48000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
124	Potassium	32	32	77.0000	1600.00	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
125	Propylbenzene	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
126	Pyrene	30	8	0.3600	4.10	2400.00	MG/KG	22	0.330	0.330	0	30	0	0	NO CONCERN
127	Selenium	32	20	0.4000	1.70	400.00	MG/KG	12	0.300	0.300	0	32	0	0	NO CONCERN
128	Silver	32	16	2.6000	200.00	400.00	MG/KG	16	2.000	2.000	0	32	0	0	NO CONCERN
129	Sodium	32	32	63.0000	3000.00	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
130	Styrene	18	0	.	.	3300.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
131	Tetrachloroethane [1,1,1,2-]	18	0	.	.	270.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
132	Tetrachloroethane [1,1,2,2-]	18	0	.	.	3.90	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
133	Tetrachloroethylene	18	0	.	.	5.90	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
134	Thallium	32	27	0.2000	2.40	6.40	MG/KG	5	0.100	0.100	0	32	0	0	NO CONCERN
135	Toluene	18	12	0.0096	0.03	910.00	MG/KG	6	0.005	0.005	0	18	0	0	NO CONCERN
136	Trichloro-1,2,2-trifluoroethane [1,1,2-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
137	Trichlorobenzene [1,2,4-]	30	0	.	.	160.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
138	Trichloroethane [1,1,1-]	18	0	.	.	1000.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
139	Trichloroethane [1,1,2-]	18	0	.	.	6.30	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
140	Trichloroethene	18	0	.	.	3.20	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
141	Trichlorofluoromethane	18	0	.	.	24000.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
142	Trichlorophenol [2,4,5-]	30	0	.	.	8000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
143	Trichlorophenol [2,4,6-]	30	0	.	.	64.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
144	Trichloropropane [1,2,3-]	18	0	.	.	480.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
145	Trimethylbenzene [1,2,4-]	18	0	.	.	40.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
146	Trimethylbenzene [1,3,5-]	18	0	.	.	32.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
147	Vanadium	32	32	3.3000	59.00	560.00	MG/KG	0	.	.	0	32	0	0	NO CONCERN
148	Vinyl chloride	18	0	.	.	0.01	MG/KG	18	0.010	0.010	0	18	0	0	NO CONCERN
149	Xylenes (o + m + p) [Mixed-]	18	6	0.0095	0.04	160000.00	MG/KG	12	0.005	0.005	0	18	0	0	NO CONCERN
150	Zinc	32	32	28.0000	320.00	24000.00	MG/KG	0	.	.	0	32	0	0	NO CONCERN

TA-32 Data Summary
Data Extracted from FIMAD on October 5, 1994

DISP=EXCEEDS SAL

OBS	ANALYTE	Total	Number >= LOD	Min Value	Max Value	SAL	UNITS	Number < LOD	Min LOD	Max LOD	Number > SAL	Number <= SAL	Number <LOD & LOD>SAL	Number w/ NO SAL	DISP
1	Benzo[a]anthracene	30	1	1.80	1.8	1.0	MG/KG	29	0.33	0.33	1	29	0	0	EXCEEDS SAL
2	Benzo[a]pyrene	30	1	2.00	2.0	0.1	MG/KG	29	0.33	0.33	1	0	29	0	EXCEEDS SAL
3	Benzo[b]fluoranthene	30	8	0.36	3.1	1.0	MG/KG	22	0.33	0.33	1	29	0	0	EXCEEDS SAL
4	Indeno[1,2,3-cd]pyrene	30	1	1.20	1.2	1.0	MG/KG	29	0.33	0.33	1	29	0	0	EXCEEDS SAL
5	Lead	32	32	11.00	1600.0	400.0	MG/KG	0	.	.	3	29	0	0	EXCEEDS SAL
6	Mercury	90	55	0.10	420.0	24.0	MG/KG	35	0.10	0.10	9	81	0	0	EXCEEDS SAL

DISP=FURTHER EVAL

OBS	ANALYTE	Total	Number >= LOD	Min Value	Max Value	SAL	UNITS	Number < LOD	Min LOD	Max LOD	Number > SAL	Number <= SAL	Number <LOD & LOD>SAL	Number w/ NO SAL	DISP
7	Aluminium	32	32	6.70	11000.00	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
8	Arsenic	32	32	1.10	25.00	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
9	Benzo[g,h,i]perylene	30	1	1.30	1.30	.	MG/KG	29	0.33	0.33	0	0	0	30	FURTHER EVAL
10	Beryllium	32	32	0.31	130.00	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
11	Calcium	32	32	310.00	8500.00	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
12	Chromium	32	32	1.00	440.00	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
13	Cobalt	31	30	0.52	430.00	.	MG/KG	1	0.50	0.50	0	0	0	31	FURTHER EVAL
14	Iron	32	32	300.00	62000.00	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
15	Magnesium	32	32	220.00	2000.00	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
16	Phenanthrene	30	2	0.40	0.59	.	MG/KG	28	0.33	0.33	0	0	0	30	FURTHER EVAL
17	Potassium	32	32	77.00	1600.00	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL
18	Sodium	32	32	63.00	3000.00	.	MG/KG	0	.	.	0	0	0	32	FURTHER EVAL

DISP=NO CONCERN

OBS	ANALYTE	Total	Number >= LOD	Min Value	Max Value	SAL	UNITS	Number < LOD	Min LOD	Max LOD	Number > SAL	Number <= SAL	Number <LOD & LOD>SAL	Number w/ NO SAL	DISP
19	Acenaphthene	30	0	.	.	4800.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
20	Acetone	18	6	0.025	0.046	8000.00	MG/KG	12	0.020	0.020	0	18	0	0	NO CONCERN
21	Aniline	30	0	.	.	120.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
22	Anthracene	30	0	.	.	24000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
23	Antimony	32	0	.	.	32.00	MG/KG	32	0.100	0.100	0	32	0	0	NO CONCERN
24	Azobenzene	30	0	.	.	6.40	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
25	Barium	32	32	16.000	920.000	5600.00	MG/KG	0	.	.	0	32	0	0	NO CONCERN
26	Benzene	18	1	0.010	0.010	0.67	MG/KG	17	0.005	0.005	0	18	0	0	NO CONCERN
27	Benzo[k]fluoranthene	30	1	0.770	0.770	1.00	MG/KG	29	0.330	0.330	0	30	0	0	NO CONCERN
28	Benzoic acid	30	0	.	.	320000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
29	Benzyl alcohol	30	0	.	.	24000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
30	Bis(2-chloroisopropyl)ether	30	0	.	.	100.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
31	Bis(2-ethylhexyl)phthalate	30	2	1.400	5.500	50.00	MG/KG	28	0.330	0.330	0	30	0	0	NO CONCERN
32	Bromodichloromethane	18	0	.	.	11.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
33	Bromoform	18	0	.	.	89.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
34	Bromomethane	18	0	.	.	0.43	MG/KG	18	0.010	0.010	0	18	0	0	NO CONCERN
35	Butanone [2-]	18	0	.	.	4000.00	MG/KG	18	0.020	0.020	0	18	0	0	NO CONCERN
36	Butyl benzyl phthalate	30	1	1.100	1.100	16000.00	MG/KG	29	0.330	0.330	0	30	0	0	NO CONCERN
37	Cadmium	32	16	0.400	19.000	80.00	MG/KG	16	0.400	0.400	0	32	0	0	NO CONCERN
38	Carbon disulfide	18	0	.	.	7.40	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN

DISP=NO CONCERN
(continued)

OBS	ANALYTE	Total	Number >= LOD	Min Value	Max Value	SAL	UNITS	Number < LOD	Min LOD	Max LOD	Number > SAL	Number <= SAL	Number <LOD & LOD>SAL	Number w/ NO SAL	DISP
39	Carbon tetrachloride	18	0	.	.	0.21	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
40	Chloro-3-methylphenol [4-]	30	0	.	.	16000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
41	Chloroaniline [4-]	30	0	.	.	320.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
42	Chlorobenzene	18	0	.	.	67.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
43	Chlorodibromomethane	18	0	.	.	83.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
44	Chloroethane	18	0	.	.	2900.00	MG/KG	18	0.010	0.010	0	18	0	0	NO CONCERN
45	Chloroform	18	0	.	.	0.21	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
46	Chloromethane	18	0	.	.	6.40	MG/KG	18	0.010	0.010	0	18	0	0	NO CONCERN
47	Chloronaphthalene [2-]	30	0	.	.	6400.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
48	Chlorophenol [o-]	30	0	.	.	400.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
49	Chlorotoluene [o-]	18	0	.	.	1600.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
50	Chrysene	30	3	0.36	2.0	96.00	MG/KG	27	0.330	0.330	0	30	0	0	NO CONCERN
51	Copper	32	32	1.30	170.0	3000.00	MG/KG	0	.	.	0	32	0	0	NO CONCERN
52	Di-n-butyl phthalate	30	11	0.46	3.5	8000.00	MG/KG	19	0.330	0.330	0	30	0	0	NO CONCERN
53	Di-n-octyl phthalate	30	0	.	.	1600.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
54	Dibromo-3-chloropropane [1,2-]	18	0	.	.	0.50	MG/KG	18	0.010	0.010	0	18	0	0	NO CONCERN
55	Dibromomethane	18	0	.	.	0.01	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
56	Dichlorobenzene (1,2) [o-]	48	0	.	.	1600.00	MG/KG	48	0.005	0.330	0	48	0	0	NO CONCERN
57	Dichlorobenzene (1,3) [m-]	48	0	.	.	7200.00	MG/KG	48	0.005	0.330	0	48	0	0	NO CONCERN
58	Dichlorobenzene (1,4) [p-]	48	0	.	.	29.00	MG/KG	48	0.005	0.330	0	48	0	0	NO CONCERN
59	Dichlorobenzidine [3,3'-]	30	0	.	.	1.60	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
60	Dichlorodifluoromethane	18	0	.	.	16000.00	MG/KG	18	0.010	0.010	0	18	0	0	NO CONCERN
61	Dichloroethane [1,1-]	18	0	.	.	410.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
62	Dichloroethane [1,2-]	18	0	.	.	0.20	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
63	Dichloroethene [1,1-]	18	0	.	.	0.40	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
64	Dichloroethene [trans-1,2-]	18	0	.	.	1600.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
65	Dichloroethylene [cis-1,2-]	18	0	.	.	800.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
66	Dichlorophenol [2,4-]	30	0	.	.	240.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
67	Dichloropropane [1,2-]	18	0	.	.	6.50	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
68	Dichloropropene [cis-1,3-]	18	0	.	.	0.17	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
69	Dichloropropene [trans-1,3-]	18	0	.	.	0.17	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
70	Diethyl phthalate	30	0	.	.	64000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
71	Dimethyl phthalate	30	0	.	.	800000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
72	Dimethylphenol [2,4-]	30	0	.	.	1600.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
73	Dinitrophenol [2,4-]	30	0	.	.	160.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
74	Dinitrotoluene [2,4-]	30	0	.	.	1.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
75	Dinitrotoluene [2,6-]	30	0	.	.	1.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
76	Ethylbenzene	18	0	.	.	3100.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
77	Fluoranthene	30	5	0.42	2.2	3200.00	MG/KG	25	0.330	0.330	0	30	0	0	NO CONCERN
78	Fluorene	30	0	.	.	3200.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
79	Hexachlorobenzene	30	0	.	.	0.44	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
80	Hexachlorobutadiene	30	0	.	.	90.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
81	Hexachlorocyclopentadiene	30	0	.	.	560.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
82	Hexachloroethane	30	0	.	.	80.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
83	Isophorone	30	0	.	.	7400.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
84	Isopropylbenzene	18	0	.	.	3200.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
85	Manganese	32	32	150.00	1600.0	11000.00	MG/KG	0	.	.	0	32	0	0	NO CONCERN
86	Methyl-2-pentanone [4-]	18	0	.	.	510.00	MG/KG	18	0.020	0.020	0	18	0	0	NO CONCERN
87	Methylene chloride	18	0	.	.	5.60	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
88	Methylphenol [2-]	30	0	.	.	4000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
89	Methylphenol [4-]	30	0	.	.	400.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN

DISP=NO CONCERN
(continued)

OBS	ANALYTE	Total	Number >= LOD	Min Value	Max Value	SAL	UNITS	Number < LOD	Min LOD	Max LOD	Number > SAL	Number <= SAL	Number <LOD & LOD>SAL	Number w/ NO SAL	DISP
90	Naphthalene	30	0	.	.	3200.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
91	Nickel	32	31	2.0000	260.000	1600.00	MG/KG	1	2.000	2.000	0	32	0	0	NO CONCERN
92	Nitroaniline [3-]	30	0	.	.	240.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
93	Nitroaniline [4-]	30	0	.	.	240.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
94	Nitrobenzene	30	0	.	.	5.30	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
95	Nitrophenol [4-]	30	0	.	.	5000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
96	Nitrosodiphenylamine [N-]	30	0	.	.	140.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
97	Pentachlorophenol	30	0	.	.	5.80	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
98	Phenol	30	0	.	.	48000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
99	Pyrene	30	8	0.3600	4.100	2400.00	MG/KG	22	0.330	0.330	0	30	0	0	NO CONCERN
100	Selenium	32	20	0.4000	1.700	400.00	MG/KG	12	0.300	0.300	0	32	0	0	NO CONCERN
101	Silver	32	16	2.6000	200.000	400.00	MG/KG	16	2.000	2.000	0	32	0	0	NO CONCERN
102	Styrene	18	0	.	.	3300.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
103	Tetrachloroethane [1,1,1,2-]	18	0	.	.	270.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
104	Tetrachloroethane [1,1,2,2-]	18	0	.	.	3.90	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
105	Tetrachloroethylene	18	0	.	.	5.90	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
106	Thallium	32	27	0.2000	2.400	6.40	MG/KG	5	0.100	0.100	0	32	0	0	NO CONCERN
107	Toluene	18	12	0.0096	0.029	910.00	MG/KG	6	0.005	0.005	0	18	0	0	NO CONCERN
108	Trichlorobenzene [1,2,4-]	30	0	.	.	160.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
109	Trichloroethane [1,1,1-]	18	0	.	.	1000.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
110	Trichloroethane [1,1,2-]	18	0	.	.	6.30	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
111	Trichloroethene	18	0	.	.	3.20	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
112	Trichlorofluoromethane	18	0	.	.	24000.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
113	Trichlorophenol [2,4,5-]	30	0	.	.	8000.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
114	Trichlorophenol [2,4,6-]	30	0	.	.	64.00	MG/KG	30	0.330	0.330	0	30	0	0	NO CONCERN
115	Trichloropropane [1,2,3-]	18	0	.	.	480.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
116	Trimethylbenzene [1,2,4-]	18	0	.	.	40.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
117	Trimethylbenzene [1,3,5-]	18	0	.	.	32.00	MG/KG	18	0.005	0.005	0	18	0	0	NO CONCERN
118	Vanadium	32	32	3.3000	59.000	560.00	MG/KG	0	.	.	0	32	0	0	NO CONCERN
119	Vinyl chloride	18	0	.	.	0.01	MG/KG	18	0.010	0.010	0	18	0	0	NO CONCERN
120	Xylenes (o + m + p) [Mixed-]	18	6	0.0095	0.039	160000.00	MG/KG	12	0.005	0.005	0	18	0	0	NO CONCERN
121	Zinc	32	32	28.0000	320.000	24000.00	MG/KG	0	.	.	0	32	0	0	NO CONCERN

DISP=NULL CASE

OBS	ANALYTE	Total	Number >= LOD	Min Value	Max Value	SAL	UNITS	Number < LOD	Min LOD	Max LOD	Number > SAL	Number <= SAL	Number <LOD & LOD>SAL	Number w/ NO SAL	DISP
122	Acenaphthylene	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
123	Bis(2-chloroethoxy)methane	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
124	Bromobenzene	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
125	Bromochloromethane	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
126	Bromophenylphenyl ether [4-]	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
127	Butylbenzene [n-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
128	Butylbenzene [sec-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
129	Butylbenzene [tert-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
130	Chlorophenylphenyl ether [4-]	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
131	Chlorotoluene [p-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
132	Dibenzofuran	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
133	Dibromoethane [1,2-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE

DISP=NULL CASE
(continued)

OBS	ANALYTE	Total	Number >= LOD	Min Value	Max Value	SAL	UNITS	Number < LOD	Min LOD	Max LOD	Number > SAL	Number <= SAL	Number <LOD & LOD>SAL	Number w/ NO SAL	DISP
134	Dichloropropane [1,3-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
135	Dichloropropane [2,2-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
136	Dichloropropene [1,1-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
137	Hexanone [2-]	18	0	.	.	.	MG/KG	18	0.020	0.020	0	0	0	18	NULL CASE
138	Isopropyltoluene [4-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
139	Methyl iodide	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
140	Methyl-4,6-dinitrophenol [2-]	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
141	Methylnaphthalene [2-]	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
142	Nitroaniline [2-]	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
143	Nitrophenol [2-]	30	0	.	.	.	MG/KG	30	0.330	0.330	0	0	0	30	NULL CASE
144	Propylbenzene	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE
145	Trichloro-1,2,2-trifluoroethane [1,1,2-]	18	0	.	.	.	MG/KG	18	0.005	0.005	0	0	0	18	NULL CASE

DISP=SPECIAL CASE

OBS	ANALYTE	Total	Number >= LOD	Min Value	Max Value	SAL	UNITS	Number < LOD	Min LOD	Max LOD	Number > SAL	Number <= SAL	Number <LOD & LOD>SAL	Number w/ NO SAL	DISP
146	Benzidine [m-]	30	0	.	.	0.003	MG/KG	30	0.33	0.33	0	0	30	0	SPECIAL CASE
147	Bis(2-chloroethyl)ether	30	0	.	.	0.120	MG/KG	30	0.33	0.33	0	0	30	0	SPECIAL CASE
148	Dibenzo[a,h]anthracene	30	0	.	.	0.100	MG/KG	30	0.33	0.33	0	0	30	0	SPECIAL CASE
149	Nitrosodi-n-propylamine [N-]	30	0	.	.	0.100	MG/KG	30	0.33	0.33	0	0	30	0	SPECIAL CASE
150	Nitrosodimethylamine [N-]	30	0	.	.	0.014	MG/KG	30	0.33	0.33	0	0	30	0	SPECIAL CASE

APPENDIX C: Anthropomorphic Background Comparison

Polycyclic Aromatic Hydrocarbons (PAHs) are the product of incomplete combustion of organic material (e.g. coal, wood, oil, gas, garbage, tobacco). They occur in nature from forest fires and volcanoes. They are also a byproduct of civilization found in asphalt paving, vehicle exhaust, coal tarring activities, and municipal trash incinerators. The source of the PAHs measured in soil at TA-32 is unclear: their presence may be due to particulate matter from the diesel engines of the County of Los Alamos trucks, from normal runoff from the asphalt parking lot and streets, and/or from local forest fires and wood burning stoves.

The U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry (ATSDR) has published background soil concentrations of PAHs in the Draft Toxicological Profile for Polycyclic Aromatic Hydrocarbons, October 1993. This information is a compilation of seven different studies. Data from "Background Levels of Polycyclic Aromatic Hydrocarbons (PAHs) and Selected Metals in New England Urban Soils," by L. Bradley (in press, Journal for Soil Contamination, December 1994, 1144), was added to the ATSDR data in order to provide background ranges for a more complete list of PAHs.

However, prior to stating that PAHs are of no concern because their concentrations fall within normal urban levels, we need to determine if the data used in ATSDR/Bradley reports are applicable to Los Alamos and are comparable to TA-32 data. PAHs are coupled with many issues and concerns which have not been previously addressed. The studies which comprise the ATSDR/Bradley background are being appraised for applicability. If the studies are not comparable to the TA-32 data, then the feasibility of developing PAH background data from the Los Alamos area will be evaluated. As these issues and concerns are resolved, we will be more able to determine if levels of PAHs at TA-32 are of concern or actually warrant no further investigation.

APPENDIX D: Ecological Setting, Threatened and Endangered Species

TA-32 is located within the Los Alamos town site on East Mesa outside the current operating boundary of the Laboratory. East Mesa is bounded by Pueblo Canyon to the north, Los Alamos Canyon to the south and DP Canyon on the southeastern edge. The former TA-1 site (OU1078) lies to the west of TA-32. The topography varies from gently sloping mesa tops to steep canyon walls or cliffs. The pre urban natural overstory for the mesa was a ponderosa pine community. The understory on the mesa top (Bennett 1992, XXXX, Biggs 1993, XXXX) currently is comprised of grasses and forbs commonly found in disturbed soils (western wheat grass, Canada bluegrass, bottlebrush squirreltail, cheat grass, sand dropseed, summer cypress, prickly lettuce, and horseweed)

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Threatened and Endangered Species

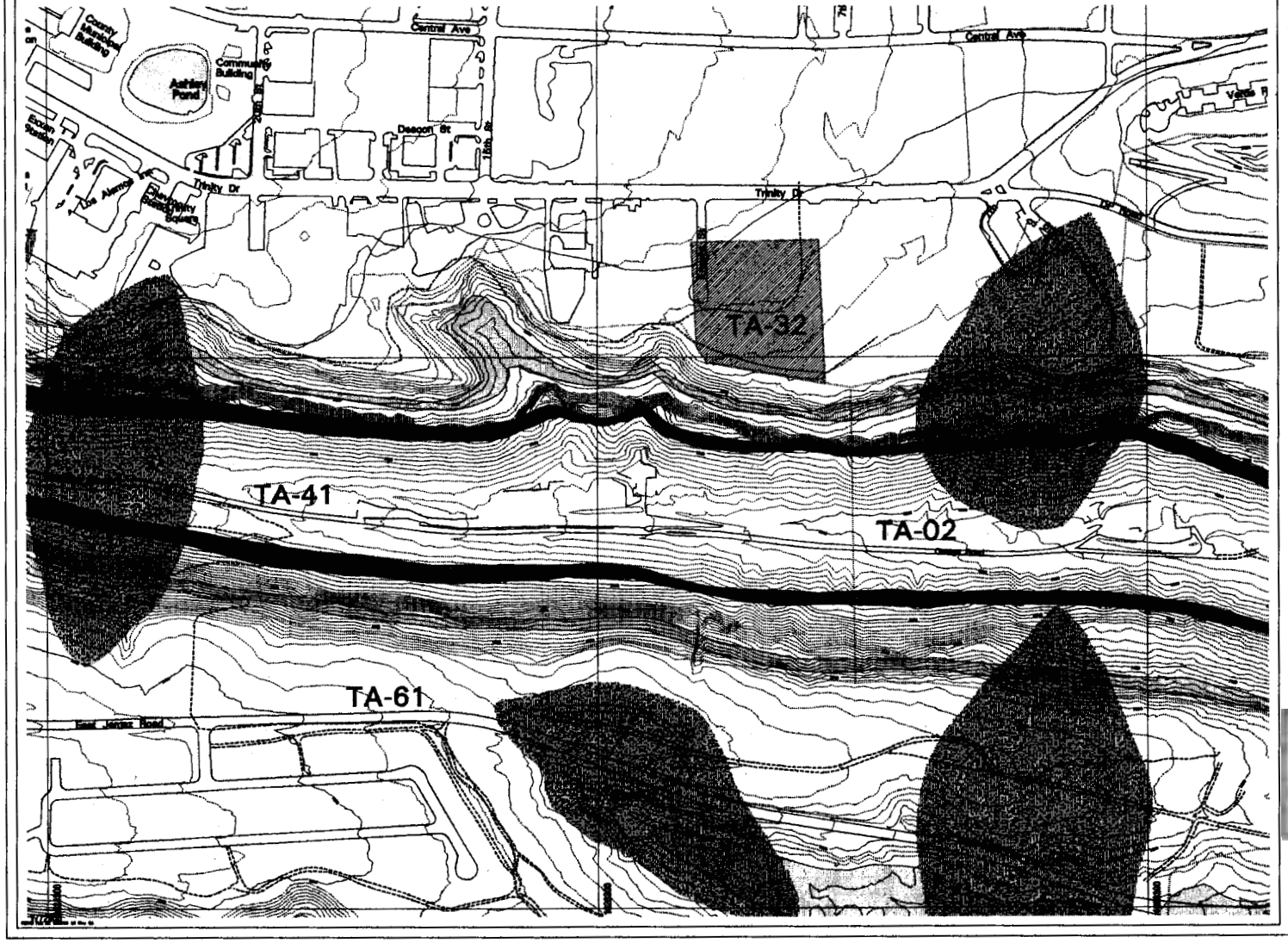
Biological surveys (Bennett 1992, XXXX, Biggs 1993, XXXX) did not find any threatened and endangered plant or animal species within the hillside areas or along Los Alamos canyon. The Jemez salamander (Plethodon neomexicanus-a NM State protected as an endangered species) has been found on the north facing slope of Los Alamos canyon just below the bridge but the habitats on the south facing "hillside areas" are not suitable. The spotted bat (Euderma maculatum- a Federal C2 Candidate and NM State protected endangered species) may use the rocky cliffs as a roosting area; but contaminants in the loose soil in the drainages are not expected to impact any of the cliff face habitat areas where this animal might roost. Since large areas along the slope are not impacted then this highly mobile species could easily adjust to any localized disturbance. Portions of the upper canyon bottom habitats may be suitable for the meadow jumping mouse (Zapus hudsonius-Federal C2 Candidate and NM State protected as threatened); but the disturbed canyon bottom with the intermittent stream below the hillside is considered marginal habitat for the jumping mouse. Lower Los Alamos Canyon offers some suitable habitats for raptor nesting and feeding . Cooper's and Red -tailed hawks have been found nesting in the lower canyon. Portions of the canyons may be suitable for nesting and feeding for the northern goshawk (Accipiter gentilis-Federal C2 Candidate) and peregrine falcon (Falco peregrinus -Federally endangered and NM State protected as endangered). All of these predators have large feeding ranges and great mobility.

APPENDIX E: PCB GUIDANCE

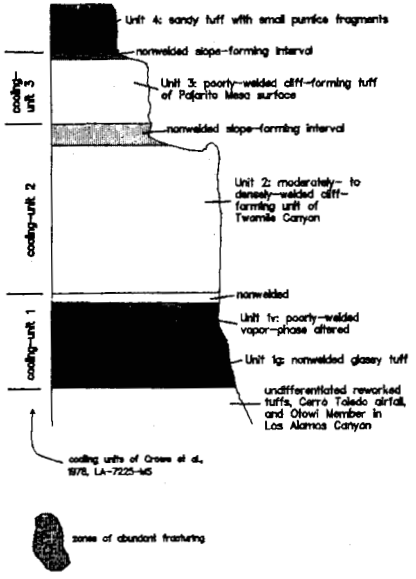
Aroclor 1260. Aroclor 1260 is a polychlorinated biphenyl (PCB). The EPA's "Guidance on Remedial Actions for Superfund Sites with PCB Contamination" contains applicable guidance on preliminary remediation goals for residential areas. This guidance states that based on the standard exposure assumptions associated with residential land use, concentrations of .1 mg/kg to 10 mg/kg PCBs will generally fall within the protective range of 10^{-4} to 10^{-6} individual excess cancer risk (EPA, 1990, XXXX). The concentrations of 2 mg/kg at the former incinerator location, and 1 mg/kg in trench 1 both fall at the 10^{-5} excess cancer risk, within the protective range.

Because the concentration of aroclor 1260 at these two locations at the site falls within protective guidelines, and there is no historical information indicating that there was ever a PCB spill at the site, aroclor 1260 is eliminated as a COPC for the former incinerator location and trench 1.

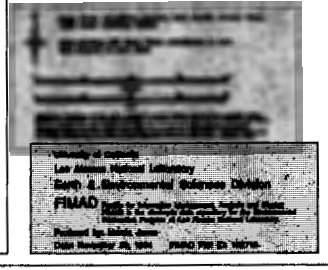
RECONNAISSANCE GEOLOGY OF TA-32 AREA



SCHEMATIC STRATIGRAPHIC SECTION



Geology by David Vaniman and Kenneth Wohletz



Color Plate 1.