Volume 59

Department of Energy

Field Office, Albuquerque
Los Alamos Area Office
Los Alamos, New Mexico 87544

OCT 07 1994

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TA-3

Mr. William Honker, Chief
RCRA Permits Branch
U. S. Environmental Protection Agency
Region 6
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Dallas, Texas 75202-2733

RE: Phase II Sampling and Analysis Plan for Mercury
SWMU 3-010(a), OU 1114

Dear Mr. Honker:

Enclosed is the Phase II Sampling and Analysis Plan for SWMU 3-010(a). This plan has been developed to respond to the detection of unanticipated contamination below depths planned for excavation while pursuing the Voluntary Corrective Action (VCA) at SWMU 3-010(a) in May 1994. A summary of the results of the VCA activities are incorporated into this document.

Should you have any questions, please feel free to call me at (505) 665-7203, or Bonnie Koch, Scientech, at (505) 665-7202.

Sincerely,

Theodore J. Taylor
Program Manager
Environmental Restoration
Program

LAAMEP:2TT-023

Enclosure

cc:
See page 2

5445

OCT 0 7 1994

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CERTIFICATION

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

Document Title:

Draft Phase II Sampling and Analysis Plan for PRS 3-010(a) for Operable Unit 1114

Name: _____ Date: September 29, 1994

Dennis Erickson, Environment, Safety, and Health Division
Los Alamos National Laboratory

Name: _____ Date: 10/5/94

Joseph Vozella, Acting Assistant Area Manager for the Office of Environment and Project
DOE-Los Alamos Area Office

PHASE II RFI WORK PLAN

FOR SWMU 3-010(a), MERCURY CLEANUP

OU 1114 ENVIRONMENTAL RESTORATION PROJECT

• September 29, 1994 •

Prepared for:
Los Alamos National Laboratory
Environmental Restoration Program
Los Alamos, New Mexico

Prepared by:
ERM Program Management Company
and
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Los Alamos, New Mexico

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1.0 Introduction

1.1 Purpose of this Document

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report and Phase II Sampling Plan is prepared in response to unanticipated soil contamination discovered during the implementation of a voluntary correction action (VCA) at the location of a mercury cleanup site, SWMU 3-010(a). The VCA at this site was undertaken by the Los Alamos National Laboratory's (LANL) Environmental Restoration (ER) Program and implemented according to the Sampling and Remediation Plan (ICF Kaiser, 1992) and the Field Implementation Plan (ERM/Golder, April 1994). The information collected during the VCA is considered to substantially fulfill the requirements of a Phase I investigation. During the VCA specific constituents were found at concentrations above the screening action levels (SALs), indicating that further investigation was required. This sampling plan outlines the Phase II investigation that will be performed in response to these unanticipated conditions, maximizing the amount of site-specific information that can be collected during the remaining 1994 field season. The data collected during the implementation of this sampling plan will be presented in a subsequent RFI report along with alternatives and recommendations for corrective action.

1.2 Summary of Updates to the June 1993 RFI Work Plan

SWMU 3-010(a) is addressed as a VCA site in the Executive Summary and Chapters 2, 4, 5, and 6 of the RFI Work Plan (LANL 1993, 1090). This document provides detailed information as to the VCA results, and what led to the preparation of a subsequent Phase II sampling plan described in the following Subsection 6.0. The conceptual exposure model for the mercury site which would have appeared along with the other models presented in Figures 4-3 through 4-5 in Chapter 4 (LANL 1993, 1090) is presented in Subsection 6.1. The remainder of this report is structured to accommodate the VCA reporting requirements along with the Phase II RFI Work Plan.

2.0 Site Background

2.1 Site History

SWMU 3-010(a) was used from 1950 to 1957 for the disposal of vacuum pump oil from the pump repair area within TA-3-30. The site is approximately 40 ft long by 15 ft wide, located on a moderately steep hillside on the western margin of OU 1114. As shown on Figure 1, the site is bounded on the east by building SM-30, on the west by a primitive road (currently used as a recreational footpath), and on the north and south by small thickets of piñon pine, juniper, and scrub brush. A natural surface water drainage transects the lower quarter of the site and flows down to the eastern edge of Twomile Canyon, which drains west-southwest to the Rio Grande.

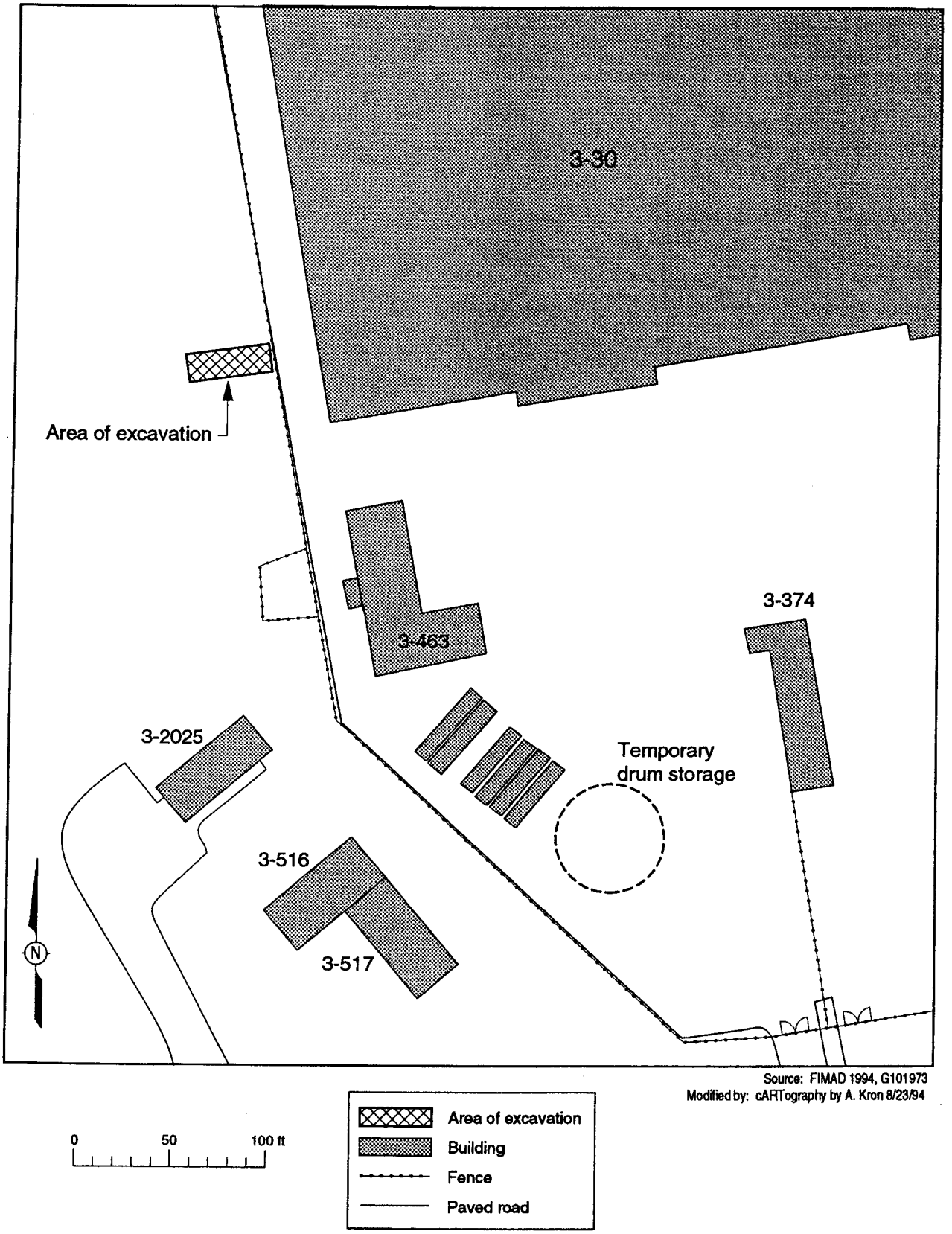

Fig. A. Site location map.

Perched groundwater is believed to seep into this drainage pathway approximately 300 ft downstream, at a level approximately 50 ft below the site.

2.2 Description of Initial Investigatory Sampling

One sample was collected in 1992 from within the SWMU boundary that contained visible mercury at the soil surface, and analyzed for a full range of contaminants. This sample was used to determine what analytes to look for in the pending sampling campaign (summer 1993) which was intended to delineate the concentration of analytes. The initial 1992 sample revealed one spike of 1,1,1-TCA of 160 ppb concentration out of the 63 constituents in the VOA suite and indicated the presence of metals and radionuclides including elemental mercury, lead, plutonium, cesium, and tritium, as well as TPH in surface and subsurface soils. The results confirmed that mercury was the contaminant of principal concern at the site. Organics and PCBs were below ER Program screening action levels (SALs), therefore, were omitted from the 1993 sampling campaign's analyte list.

2.3 Results of the 1993 Sampling Campaign

The metals were not found to exist in the soils in leachable concentrations that exceed the United States Environmental Protection Agency (US EPA) Toxicity Characteristics Leaching Procedure (TCLP) limits and therefore, the soils were not considered characteristically hazardous under RCRA. However, because the radioactive constituents detected were above background, all the materials to be excavated and removed from the site would be considered low-level radioactive waste. The waste stream generated at the site was not considered to be mixed waste because the combination of the aforementioned metals and low level radioactive waste does not constitute mixed waste. All of the radioactive constituents at the site existed at concentrations less than the ER Project SALs. The one volatile sample analyses from 1992 was not thought to be included in the waste stream characterization because it was below SALs and thus eliminated as a constituent that may potentially pose a risk to the environment or employee health and safety.

LANL and the New Mexico Environment Department (NMED) Surface Water Quality Bureau of the Water Quality Control Commission entered into an agreement to remove all mercury-contaminated soils to a level of 20 ppm and TPH soils to a level of 100 ppm.

3.0 Description of VCA

3.1 Summary of VCA Plan Implementation

The VCA at the mercury site consisted of the removal of three lifts of contaminated soil and/or engineered fill which was placed during the construction of building SM-30. The removal of the soils in separate lifts was intended to segregate specific contaminants, thereby minimizing the

quantities of waste soils having special disposal needs. The first lift targeted soil that had the highest concentrations of elemental mercury. This amount was determined visually and with prior sampling analyses from 1993. The second lift targeted the remainder of the soils containing low-level radioactive constituents determined by prior and current sampling analyses. The third lift targeted soils that exceeded the 100 ppm cleanup level for total petroleum hydrocarbons (TPH) determined by field lab analyses. Schematic drawings of the lift excavations are presented in Figures 2 through 4.

3.2 Description of Remediation

The excavation resulted in a trench incised into the hillside west of building SM-30. The excavation tapered from 15 ft in depth at the uphill (east) end to 1 ft in depth at the lower (west) end. The floor of the trench is nearly level, and has been excavated approximately 0.5 to 1 ft into the volcanic tuff that underlies the site. The completed trench dimensions are approximately 40 ft long by 15 ft wide. Following excavation, a wooden framework was constructed to support a weather-resistant cover constructed of clear polyethylene sheeting. This cover was erected to prevent infiltration or accumulation of storm water within the excavated area.

3.3 Waste Treatment, Storage, and Disposal

The total amount of material removed from all three lifts during the VCA was approximately 120 cubic yards. All soils were removed to TA-54, Area G-low level radioactive landfill, except for the first 19 drums of soil which were stored at TA 54, Area L, mixed waste dome, as low level radioactive waste, until future treatment to extract the mercury. Confirmatory sampling revealed the trace presence of the solvents, indicating that the waste stream potentially could be classified as mixed wastes. This discovery of the trace presence of solvents created two significant problems. First, the presence of spent solvents could involve a listed hazardous waste, thereby potentially changing the classification of the soil we had already disposed at TA-54 from rad waste to mixed waste. The situation has been reported to the State and is currently under discussion concerning appropriate actions to be taken. The soil that had been discarded at TA-54, Area G, Pit 37, and had not been spread as fill was removed to bins and stored in Area L mixed waste dome pending discussions with the State. Samples have been collected from the bins and drums to fulfill a portion of the Waste Acceptance Criteria (WAC) for disposing of the waste stream at Envirocare Landfill in Salt Lake City, Utah. The anticipated date for the waste to be shipped offsite is late October or November of this year.

4.0 Results of Post-VCA Verification

Soil samples were collected during and after the excavation for qualitative and quantitative analysis. Qualitative sample analysis for mercury and TPH was performed using field test kits.

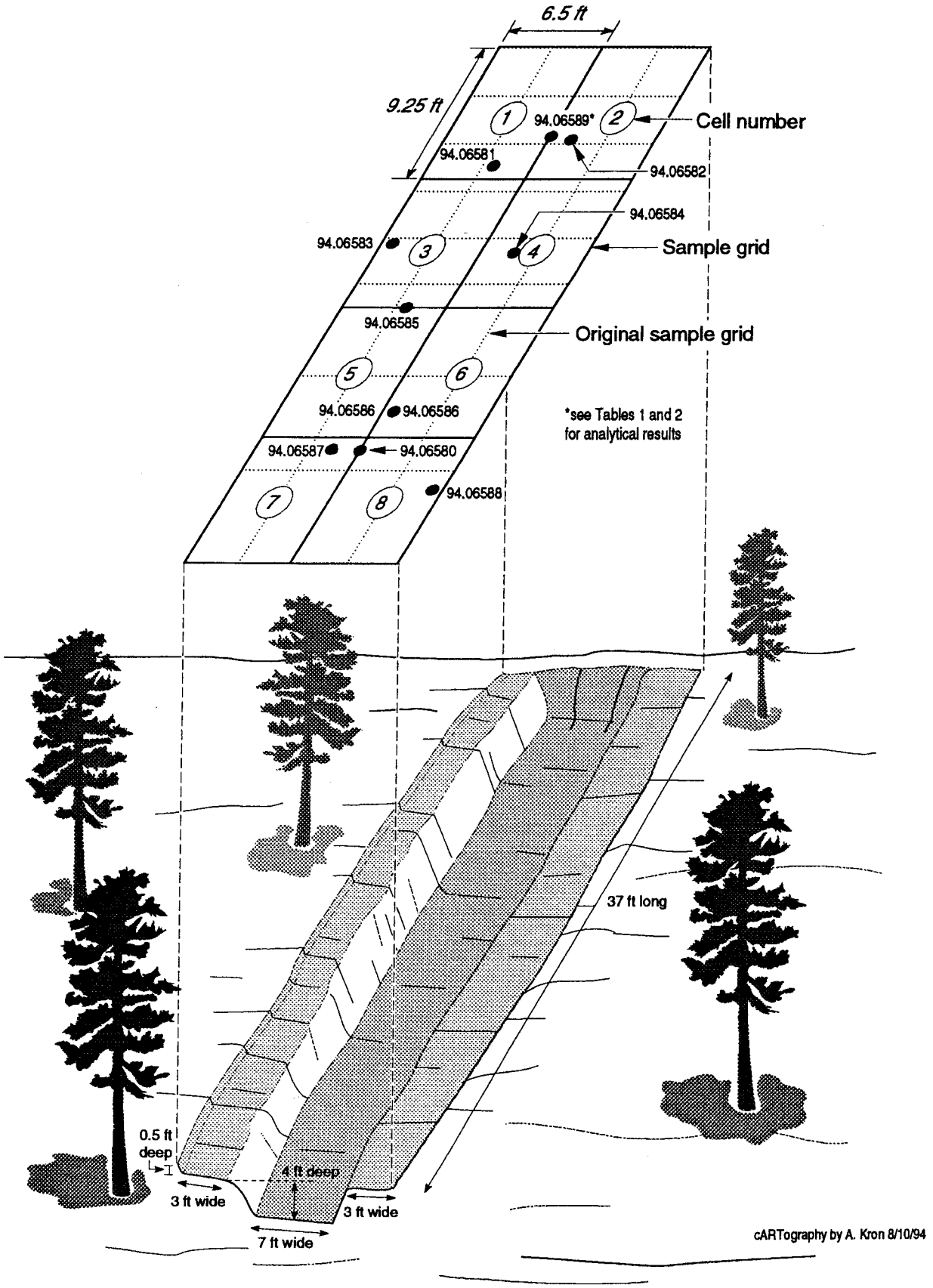

Figure 2. Lift 2 sample locations.

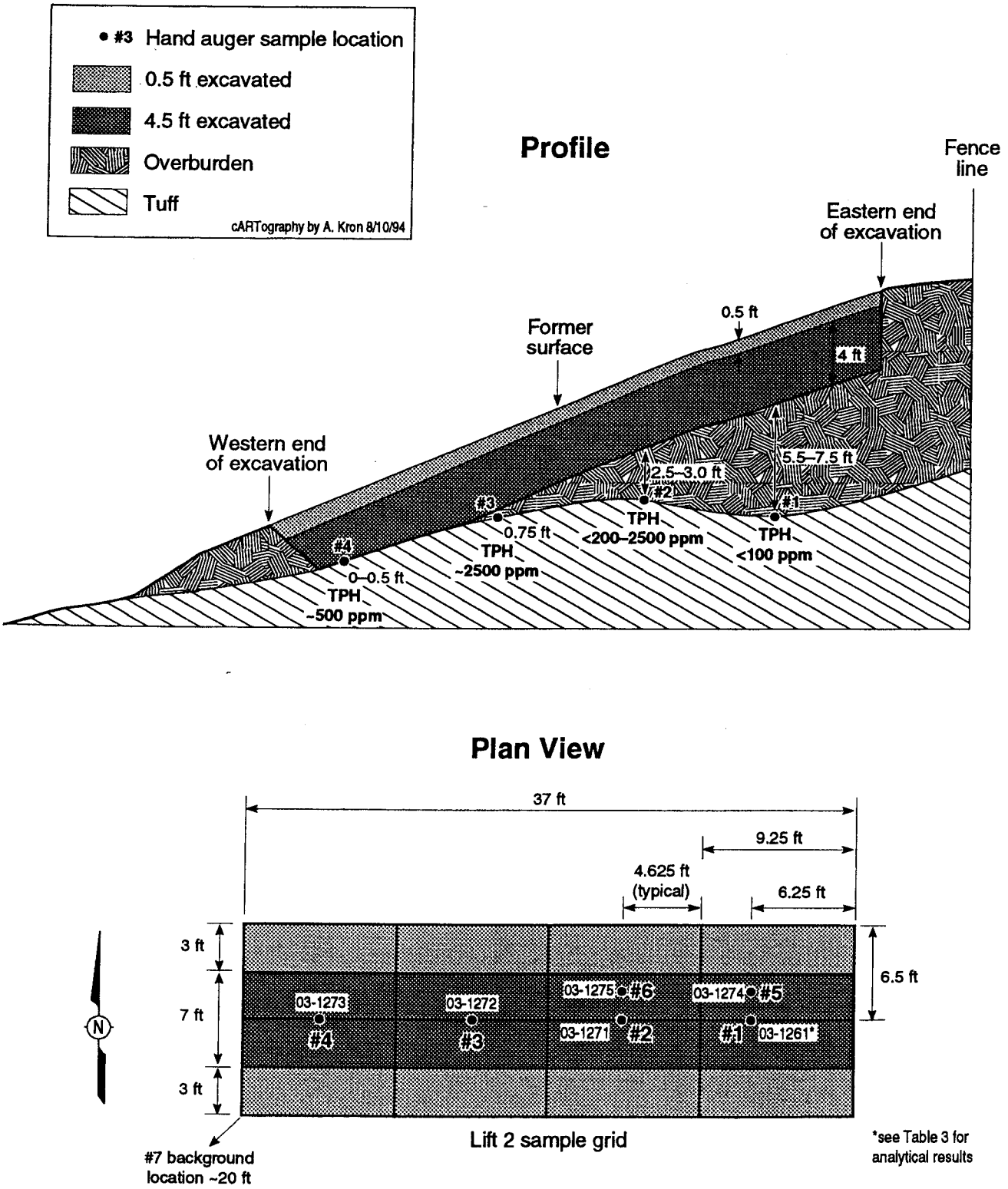

Figure 3. Hand auger sample locations, tuff interface, and TPH field test kit results.

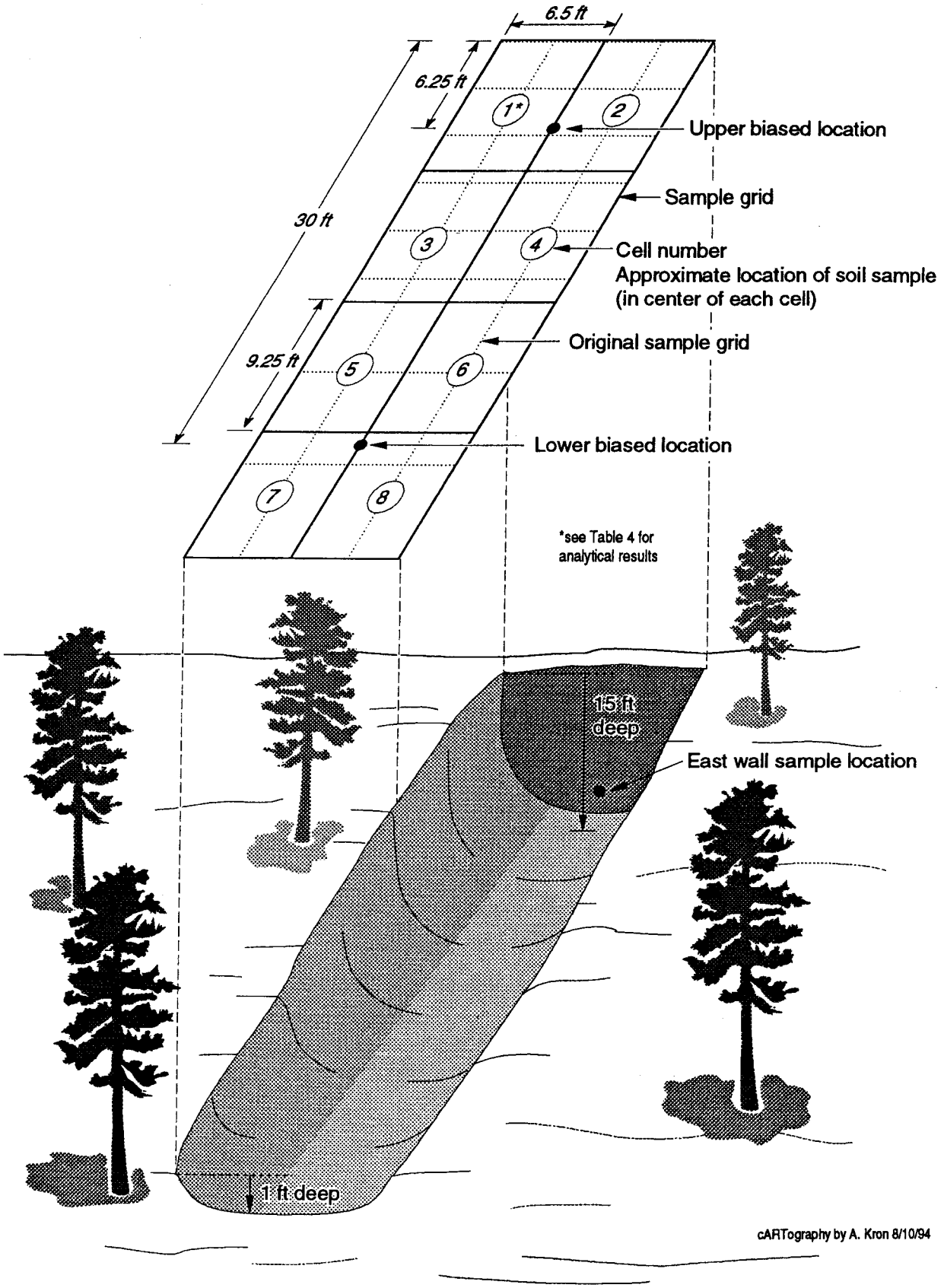

Figure 4. Sample locations after excavation of Lift 3.

BiMelyze® field test kits having a detection limit of 1 ppm were used for mercury analysis of the overburden and tuff samples; the TPH concentration was measured using the HNU-Hanby field test kits which have a detection limit of about 100 ppm. TPH was also measured quantitatively on site using the Model 404 Total Hydrocarbon Analyzer infrared instrument from Buck Scientific with a 5 cm cell, which has a detection limit of about 1 ppm.

Soil samples were collected from the trench after the removal of Lift 2 to confirm that all the soils containing levels of radioactivity above background had been removed. Random sample locations were generated within eight equal area cells as shown on Figure 2. Two additional samples within the excavation were collected at biased locations where the highest radioactivity had been found in previous sampling. The results of the analyses of these samples are shown in Table 1. The plutonium results indicate that only three of the ten samples collected after the removal of the second lift were above the background level of 0.025 pCi/g. Thus, the removal of the third lift should have removed any residual elevated plutonium levels that remained in the soils. Confirmation samples for plutonium analysis are planned as discussed in more detail in Subsection 6.4.2.1.

TABLE 1

RADIONUCLIDE LABORATORY ANALYSES OF SAMPLES COLLECTED AFTER THE REMOVAL OF LIFT 2

SAMPLE ID#	CELL LOCATION	TRITIUM** (pCi/ml)	PLUTONIUM-238 (pCi/g OF DRY SOIL)	PLUTONIUM-239 (pCi/g OF DRY SOIL)	CESIUM-137 GAMMA SPECTROSCOPY (pCi/g OF DRY SOIL)
94.06580	lower biased	42.91	0.010	0.589	<1.19
94.06581	#1	59.22	0.003	0.020	<1.26
94.06582	#2	85.44	0.003	0.011	<1.1
94.06583	#3	9.72	0.005	0.118	<0.72
94.06584	#4	43.71	0.001	0.020	<0.78
94.06584	#5	90.42	0.003	0.017	<0.98
94.06586	#6	93.76	0.002	0.013	<0.78
94.06587	#7	44.23	0.004	0.189	<0.83
94.06588	#8	0.56	0.001	0.005	1.00
94.06589	Upper biased	44.29	0.001	0.010	1.76
94.06579*	Upper biased duplicate	NA	0.003	0.007	<1.03
Screening action level		20 pCi/ml	20 pCi/g	18 pCi/g	4 pCi/g

NA = Not applicable
* Lab results require confirmation
** Tritium analytical method is liquid scintillation. Tritium SAL is reported in pCi/g of dry soil. See Table 2 for more detail.

The samples collected from the locations shown on Figure 2 were also analyzed to measure the tritium concentration in the TPH extracted from the soil using EPA Method 3550. The results of

this analysis are presented on Table 2. The results indicate that the tritium associated with the TPH (bound to the oil) is about 80% of the total tritium concentration in soil. The soil moisture contains the remaining 20% of the tritium. The total tritium concentration in dry soil remains below the SAL [Table J-1 and J-2 in the Installation Work Plan (LANL 1993, 1017)].

To determine the amount of TPH-affected soils remaining after removal of Lift 2, soil samples were also collected below Lift 2 using hand augers. These samples were analyzed using TPH field test kits. The hand auger locations are shown in Figure 3. The qualitative analysis of the hand auger samples is listed in Table 3. The results indicate that, although the TPH levels were less than 100 ppm at the soil/tuff interface for the eastern most section of the excavation, the remaining 30 ft of excavation at the soil/tuff interface revealed concentrations above 100 ppm.

Additional samples were collected for TPH on-site infrared analysis during the removal of Lift 3. The approximate locations where the samples were collected are shown on Figure 4. The TPH field infrared results are listed in Table 4. Analysis of these samples indicates that the concentration of TPH did not decrease with depth as expected. On the contrary, the concentrations varied with depth, suggesting that distribution of TPH in the subsurface may be associated with discrete features such as fractures in the tuff. Field analysis of samples taken in the sidewalls of the excavation indicates that lateral migration has been limited. The highest concentration of TPH is 15 000 ppm, which is well above the 100 ppm cleanup level agreed to in the original VCA work plan. However, continuing to excavate into fractured tuff when the only remaining constituents are TPH (essentially mineral oil) and low levels of tritium is not prudent, therefore an alternate plan was developed. The plan involved capping the excavation with a bentonite layer to provide an impermeable layer and then backfilling with clean topsoil.

After the third lift was excavated, several soil [tuff] samples were collected from the bottom of the excavation at the locations shown on Figure 4. These samples were collected to confirm that the mercury was below 20 ppm and that the remaining mineral oil did not contain BETX (benzene, ethylbenze, toluene, and xylene) constituents. The results of the mercury analyses are presented in Table 5. A total volatile organic compounds analyses was performed instead of the BETX analysis. The results are presented in Table 6.

TABLE 2

DISTRIBUTION OF TRITIUM BETWEEN THE WATER AND TPH IN SOIL SAMPLES COLLECTED AFTER THE REMOVAL OF LIFT 2***

SAMPLE ID#	CELL LOCATION	TRITIUM (pCi/ml)	SOIL MOISTURE	TRITIUM IN TPH (pCi/g OF DRY SOIL)	TOTAL TRITIUM IN SOIL MOISTURE (pCi/g OF SOIL)	TOTAL TRITIUM (pCi/g OF SOIL)*	TOTAL TRITIUM (mCi/m^3)	% TOTAL TRITIUM IN WATER	% TOTAL TRITIUM IN TPH
94.06580	Lower biased	42.91	14.0%	84.82	6.0	90.8	0.182	7%	93%
94.06581	#1	59.22	15.5%	18.74	9.2	27.9	0.056	33%	67%
94.06582	#2	85.44	15.9%	66.46	13.6	80.0	0.160	17%	83%
94.06583	#3	9.72	15.1%	6.24	1.5	7.7	0.015	19%	81%
94.06584	#4	43.71	11.3%	2.46	4.9	7.4	0.015	67%	33%
94.06585	#5	90.42	14.8%	32.28	13.4	45.7	0.091	29%	71%
94.06586	#6	93.76	12.2%	31.55	11.4	43.0	0.086	27%	73%
94.06587	#7	44.23	12.3%	72.24	5.4	77.7	0.155	7%	93%
94.06588	#8	0.56	16.9%	0.28	0.1	0.4	0.001	25%	75%
94.06589	Upper biased	44.29	17.2%	24.02	7.6	31.6	0.063	24%	76%
94.06579	Upper biased duplicate	**	**	38.86	**	**	**	**	**

*Screening action level for tritium is 810 pCi/g of dry soil
**Lab results require confirmation
***Tritium analytical method is liquid scintillation. TPH is extracted from the soil using EPA Method 3550 followed by liquid scintillation for tritium in the TPH.

TABLE 3

TPH FIELD TEST KIT RESULTS FOR SAMPLES COLLECTED BELOW LIFT 2

SAMPLE LOCATION (FIMAD NO.)	DEPTH BELOW LIFT 2 (FT)	CONCENTRATION (ppm)
#1 (03-1261)	2	<500
#1 (03-1261)	4	2 500
#1 (03-1261)	5.5	<100
#2 (03-1271)	2	10 000
#2 (03-1271)	3	2 500
#3 (03-1272)	0.75	2 500
#4 (03-1273)	0 - 0.5	500
#5 (03-1274)	7.5	<100
#6 (03-1275)	2.5	<200
#7 - outside the contaminant reduction zone*	0 - 0.5	<100

* Sample collected to determine background concentration.

TABLE 4

TPH ON-SITE INFRARED RESULTS FOR SAMPLES COLLECTED DURING THE REMOVAL OF LIFT 3

LOCATION	TPH AT 12 FT BLS* (ppm)	TPH AT 13 FT BLS* (ppm)	TPH AT 14 FT BLS* (ppm)	TPH AT 15 FT BLS* (ppm)
Center of Cell 1	N/A	240	210	830
Center of Cell 2	N/A	6 500	144	4 400
Center of Cell 3	N/A	4 200	2 582	2 200
Center of Cell 4	N/A	7 000	7 671	12 000
Center of Cell 5	1 200	1 500	8 114	5 700
Center of Cell 6	16	7 700	9 205	7 700
Center of Cell 7	150	460	1 031	210
Center of Cell 8	750	130	15	10
Upper biased	N/A	N/A	N/A	15 000
Lower biased	N/A	N/A	N/A	2 000
East vertical wall	N/A	N/A	N/A	10

N/A = Not applicable; sample not taken at this location.
* BLS = below land surface as measured based on the elevation at the east end of excavation site; base of excavation is nearly level.

TABLE 5

MERCURY ANALYTICAL RESULTS FOR SAMPLES COLLECTED AFTER THE REMOVAL OF LIFT 3

LOCATION	ANALYTICAL RESULTS FROM FIELD TEST KITS	CONFIRMATION RESULTS FROM FIXED LABORATORY ANALYSIS
Center of Cell 1	<1.0	N/A
Center of Cell 2	3.6	N/A
Center of Cell 3	5.0	N/A
Center of Cell 4	4.1	N/A
Center of Cell 5	3.9	N/A
Center of Cell 6	<1.0	N/A
Center of Cell 7	3.6	N/A
Center of Cell 8	<1.0	N/A
Upper biased	6.4	0.90
Lower biased	3.7	6.9
East vertical wall	<1.0	ND (0.11*)

N/A - Not applicable; sample not taken at this location for confirmation purposes.
ND - Not detected
*Concentrations in ppm; number in parentheses is the detection limit.

Results of this confirmation sampling showed that the mercury concentration at the bottom of the excavation is below its respective SAL (20 ppm). The volatile samples showed that there was no BETX as expected; however, the full analytical suite showed the unexpected presence of 1,1-dichloroethene at 60 mg/kg, 1,2-dichloroethane at 0.9 mg/kg, and trichloroethene at 8.6 mg/kg, all other volatile organic compounds (VOCs) were well below the associated SALs. Twelve other VOCs were also detected in the upper biased sample and three VOCs were detected in the east vertical wall sample, all at concentrations below their respective SALs. The alternate capping plan was abandoned at this point and further investigations were initiated

The laboratory data sheets that were used in developing Tables 1 through 6 are in Appendix A.

5.0 Effectiveness of the VCA

The analysis of the confirmation samples taken from the base of the VCA excavation indicated that the VCA could not be implemented as originally conceived, and that further investigation was warranted. The Phase II RCRA Facility Investigation Work Plan presented in the following section is designed to provide the information necessary to perform a baseline risk assessment and a corrective measures study or another VCA.

TABLE 6

VOLATILE ORGANIC COMPOUNDS DETECTED IN SAMPLES COLLECTED AFTER REMOVAL OF LIFT 3 (ALL CONCENTRATIONS ARE IN mg/kg)

ANALYTE	UPPER BIASED SAMPLE*	LOWER BIASED SAMPLE	EAST VERTICAL WALL SAMPLE	SOIL SCREENING ACTION LEVELS
Chloromethane	0.13	ND (0.012)	ND (0.012)	6.40
**1,1-Dichloroethene	60.00	0.04	0.003[J]	0.59
1,1-Dichloroethane	0.21	ND (0.006)	ND (0.006)	410.00
Chloroform	0.07	ND (0.006)	ND (0.006)	0.21
1,1,1-Trichloroethane	820.00	0.51	0.30	1 000.00
**1,2-Dichloroethane	0.90	ND (0.006)	ND (0.006)	0.20
Benzene	0.38	ND (0.006)	ND (0.006)	0.67
**Trichloroethene	8.60	0.004[J]	ND (0.006)	3.20
cis-1,3-Dichloropropene	0.06	ND (0.006)	ND (0.006)	0.17
1,1,2-Trichloroethane	0.14	ND (0.006)	ND (0.006)	6.30
1,1,2,2-Tetrachloroethane	0.02[J]	ND (0.006)	ND (0.006)	3.90
Ethylbenzene	0.025[J]	ND (0.006)	ND (0.006)	3 100.00
Isoproplybenzene	0.05	ND (0.006)	ND (0.006)	3 200.00
1,3,5-Trimethylbenzene	0.015[J]	ND (0.006)	ND (0.006)	32.00
1,2,4-Trimethylbenzene	0.02[J]	ND (0.006)	ND (0.006)	40.00

[J] = Result is an estimate below the method quantitation limit
ND(##) = Result is not detected; value in parentheses is the quantitation limit
* Results for the upper biased sample are from several different analyses in order to get the appropriate dilution for all analytes in the sample
** Compound of risk concern

6.0 Phase II RFI Work Plan

6.1 Conceptual Exposure Model

The general conceptual exposure model developed for OU 1114 has been revised for the mercury site to identify potential constituent migration pathways and human receptors based on RFI and VCA data. The conceptual exposure model is used to assist in identifying the location and magnitude of additional sampling needed to accurately characterize the nature and extent of contamination. The conceptual exposure model includes four elements:

- Identification of potential contaminants of concern;
- Characterization of the releases of contaminants of concern;
- Determination of migration pathways; and

- Identification of human receptors.

Figure 5 of this document presents the conceptual exposure model for the mercury site. The contaminants of concern include 1,1-dichloroethane, 1,2-dichloroethane, 1,1,1-trichloroethane, trichloroethene, TPH, and tritium. Potential current sources of contamination include subsurface soil and sediment, perched groundwater, and surface water. Contaminated surface soil that was present on site has been removed as a result of a VCA and no longer represents a source of contamination.

6.1.1 Potential Environmental Pathways

Liquid chemical contaminants and tritium are known to have been released at the site via the process of draining and cleaning vacuum pumps. After these liquid contaminants were released into the environment, they could potentially migrate via four pathways:

- Liquid infiltration into near-surface or subsurface soils, with subsequent migration to perched groundwater and potential seepage of contaminated groundwater to surface water;
- Volatilization from soil or perched groundwater into soil pore spaces and ultimately into ambient air;
- Wind entrainment of contaminated dust; and
- Surface water overflow and then runoff resulting in the contamination of sediment in drainage channels.

Based on historical information and data obtained to date in the RFI, the potential major migration pathways and relevant environmental media through which human exposure to residual contaminants could occur are summarized in Table 7. Surface soil no longer represents a potential medium of concern, since surface soil was removed during the VCA at the site.

6.1.2 Potential Human Exposure

Potential human exposure is estimated through a model of the reasonably maximum exposed (RME) individual who is defined through assumptions of current and future land use (EPA 1989, 1991, 1992). The following general land use categories for LANL have been identified:

- Continued LANL operations,
- Recreational land use, and
- Residential land use.

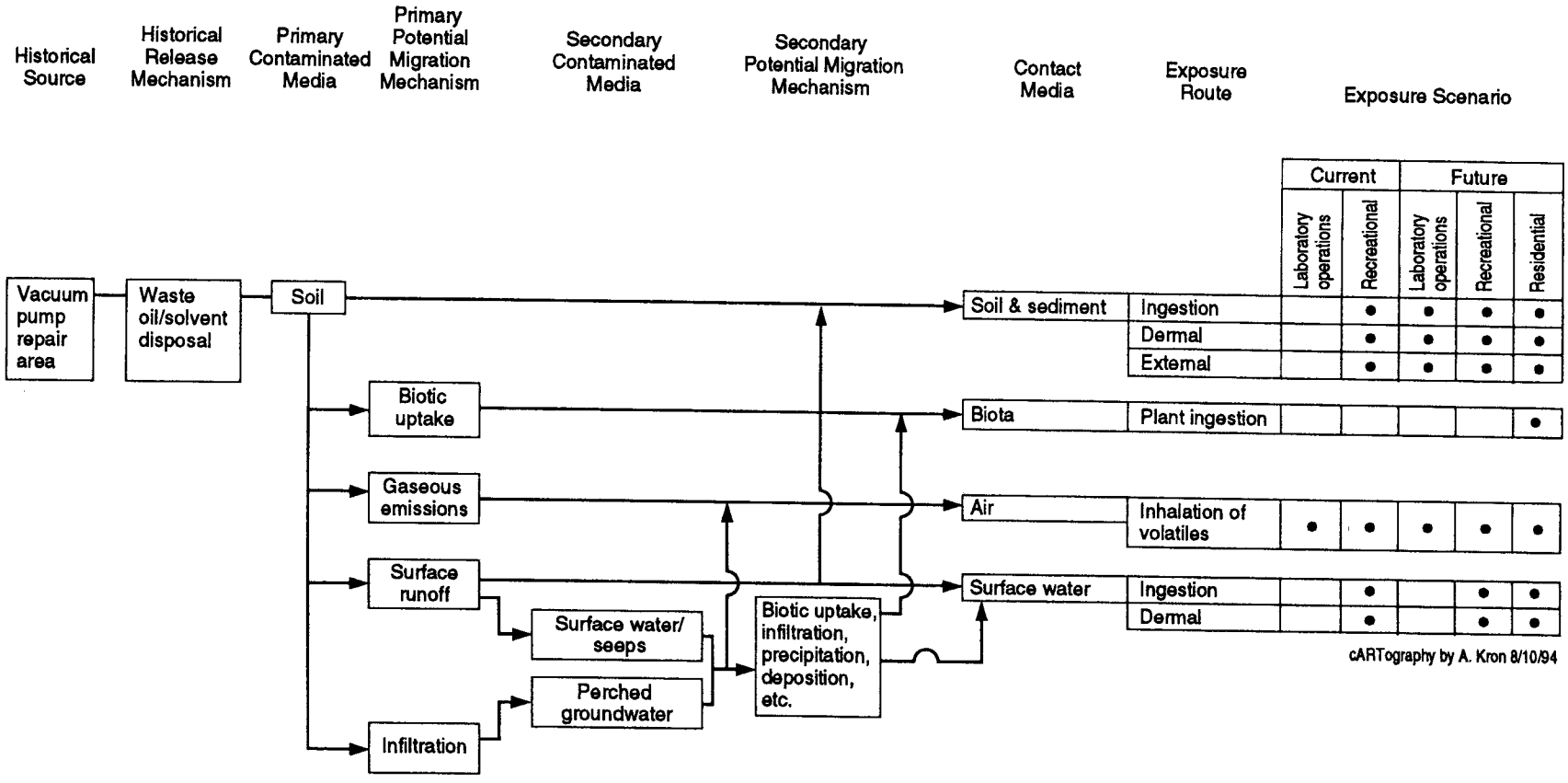

Figure 5. Conceptual exposure model for the Mercury SWMU, OU 1114.

TABLE 7

SUMMARY OF MAJOR MIGRATION PATHWAYS, CONTACT MEDIA, AND RESULTING POTENTIAL HUMAN EXPOSURE RATES

MIGRATION PATHWAYS	CONTACT MEDIA	RESULTING POTENTIAL HUMAN EXPOSURE ROUTE
A. Contaminant infiltration into subsurface soils (surface soil contamination removed during VCA)	1. Contaminants in subsurface soil	1. None, unless subsurface soil is exposed during future development of the site (then refer to exposure rules for D)
B. Migration of volatilized contaminants exposed to ground surface	1. Contaminants in ambient air	1. Inhalation of volatile compounds
C. Contaminant infiltration through soil to perched groundwater and subsequent discharge via surface water seeps	1. Contaminants in surface water. 2. Contaminants in sediment	1. Ingestion of surface water and dermal contact with surface water 2. Ingestion of sediments and dermal contact with sediments
D. Soil excavation exposing subsurface contaminated soil to the surface	1. Contaminants in exposed subsurface soil 2. Releases volatilized contaminants to ambient air (B) 3. Releases to surface water and sediments	1. Ingestion of soil, dermal contact with soil, and ingestion of plants 2. Refer to exposure routes for B and C

The mercury site is currently used for LANL operations, and the risk assessment will evaluate the potential exposure of site personnel (occupants of building SM-30) to residual contaminants. Since the mercury site is not permanently fenced, it is potentially available to occasional recreational use. This exposure scenario will also be examined in the risk assessment.

Proposed RCRA Subpart S supports application of plausible assumptions on future patterns of land use, providing that institutional controls such as deed restrictions guide future use as necessary (EPA 1990). The mercury site is located on the top edge of Twomile Canyon on a 30 degree slope. Considering the local terrain limitations, the site is not likely to be further developed for future Laboratory operations, or as a residential property. However, any further development of the site would involve potentially intrusive work by on-site construction workers. The most plausible future uses of the site are recreational and continued use by the Laboratory in the present state of development. As previously stated, the risk assessment for the site will evaluate the potential exposure of Laboratory personnel and recreational users. Although future

residential use is unlikely, residential use is considered the most conservative land use scenario for the site. Therefore, the risk assessment will evaluate the potential future risk for residents.

6.2 Remediation Decisions and Investigation Objectives

The intent of the Phase II field effort described in this subsection is to determine whether the contaminants of concern (COCs) present at the site pose an acceptable or an unacceptable risk to the potential receptors via any of the pathways described above. Figure 6 presents the decision logic developed to outline the sampling strategy that will determine the nature of the risks present at the site and if regulations applicable to LANL are being addressed. The following subsections outline the data needed to characterize the site to support risk-based decisions.

6.3 Data Needs and Data Quality Objectives

The extent of subsurface soil contamination needs to be accurately characterized for two purposes. The primary purpose is to assess current and potential future human health risks associated with this site. The potential volatilization of halogenated volatile organic compounds from the soil into the surrounding air spaces, whether the air spaces are naturally occurring in the subsurface or are created through construction of a home under a future residential use scenario, will be measured to evaluate the level of risk via the inhalation pathway. Soil samples and downhole vapor samples will be analyzed to determine the impact that the soil contamination may have had on the perched groundwater and surface water seeps.

The second purpose of characterizing the extent of contamination is to address the applicable regulations that have been identified for this site, including the NMED regulations prohibiting refuse in a water course. Previously, LANL and NMED agreed to interpret refuse in the water course as the TPH and mercury contaminated soils. Since the VCA activities discovered traces of VOCs in the subsurface soils, the VOCs will also be considered as contaminants of concern that may affect the surface and subsurface water quality. Surface water quality regulations may be of concern as a result of water percolating through the affected soils remaining at the site and potentially surfacing in the form of seeps in the drainage downstream of the site. The seeps will be sampled to determine if any of the contaminants at this site are contributing to degradation of the surface water quality.

6.3.1 Data Needs for Evaluating Health and Safety Risks

The nature and extent of chemical contamination, specifically halogenated volatile organic compounds in the overburden soils and potentially into the underlying tuff, is required to determine the human health risk associated with the residual contamination. Additional information is also needed on the environmental setting to identify potential current and future receptor populations that may be impacted.

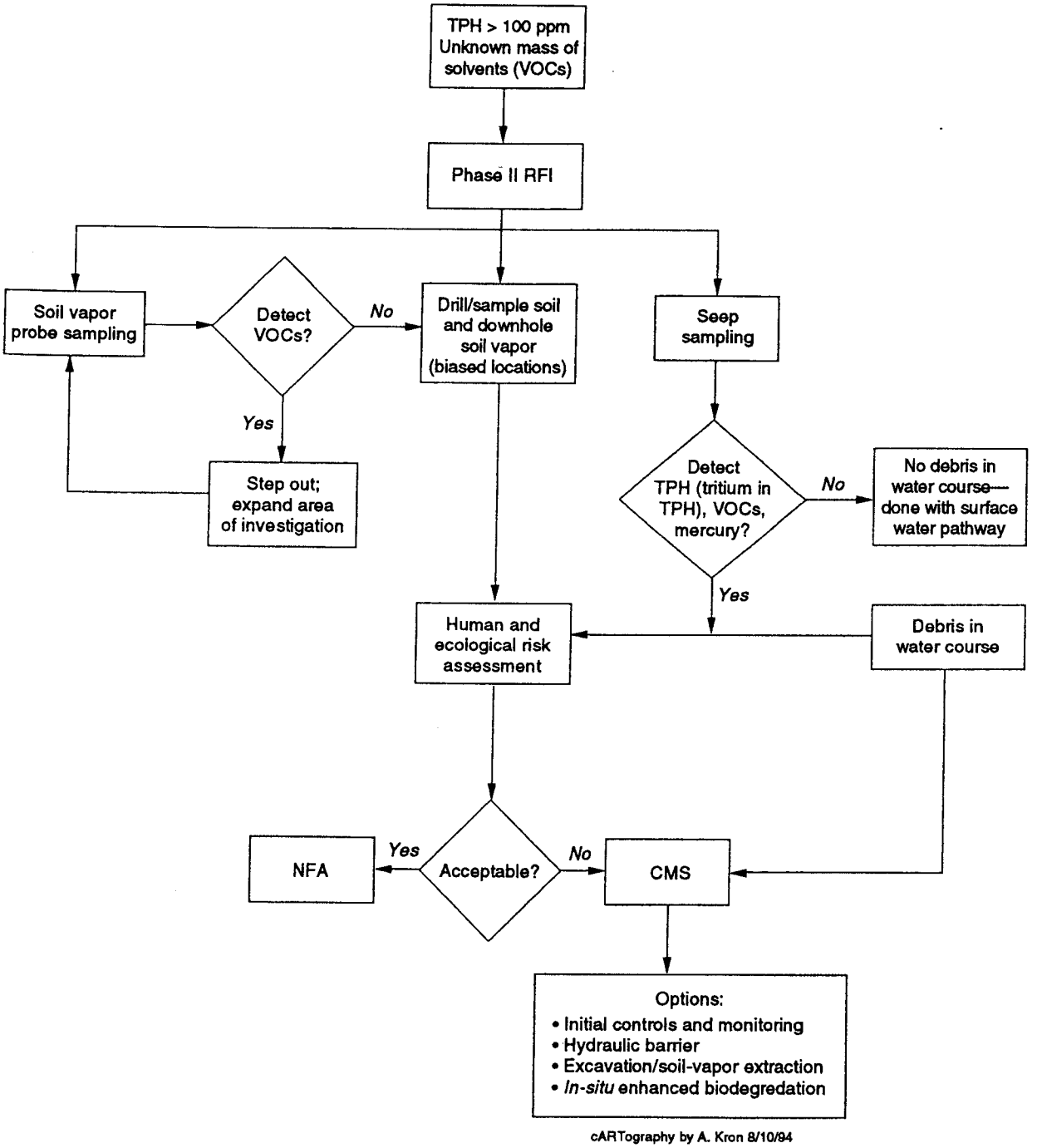

Figure 6. Decision logic.

This investigation will address all identified exposure pathways. Direct contact exposure scenarios may be modeled for any foreseeable construction, recreational, or residential activities at the site if the depth and concentrations of contaminants are defined. Fugitive emissions may likewise be modeled once the depth of contamination, concentration of contaminants, and physical parameters of the source matrix are known. Potential contamination of perched groundwater, which may emerge as a downstream seep, will also be characterized as a result of this investigation since the borehole samples will be located to intercept any potential contaminant sources or pathways for the seep.

Potential contamination of the regional aquifer is not considered to be a major risk at this site, since the aquifer is more than 800 ft below the ground surface.

6.3.1.1 Source Characterization

Characterization will be performed at the SWMU within a nominal 5 000 square foot area as dictated by the risk assessment future residential use scenario. The dimensions and configuration of the study area are indicated on Figure 7. Given that the horizontal extent of the excavation is 40 ft long by 15 ft wide, a single residential lot (assumed to be 5 000 square ft in area) is expected at this time to encompass the entire remaining soil and soil vapor contamination associated with this SWMU. The sampling program presented in this subsection is based on a grid intended to fall within this 5 000 square foot area. However, the field investigation is designed to continue until the nature and extent of the VOCs from this site have been determined.

The Phase II sampling program includes:

- Soil sampling to confirm removal of plutonium and cesium;
- Soil vapor probe survey;
- Drilling for soil sampling and downhole soil vapor sampling; and
- Seep sampling.

The existing excavation will be backfilled prior to initiating the soil vapor probe survey. A two-foot-thick layer of bentonite-amended crushed tuff will be placed in the bottom of the excavation prior to backfilling to prevent future percolation through the site. A temporary access road will be graded across the site to support the drilling equipment.

The soil vapor probe survey will be conducted in the overburden soils. The migration pathway and infiltration of the pump oil and solvents through the overburden and into the tuff is unknown at this time. Because of the fractured and variable lithologic nature of the tuff in the Los Alamos area, the pathway may be highly unpredictable. The soil vapor will be screened for VOCs in an effort to

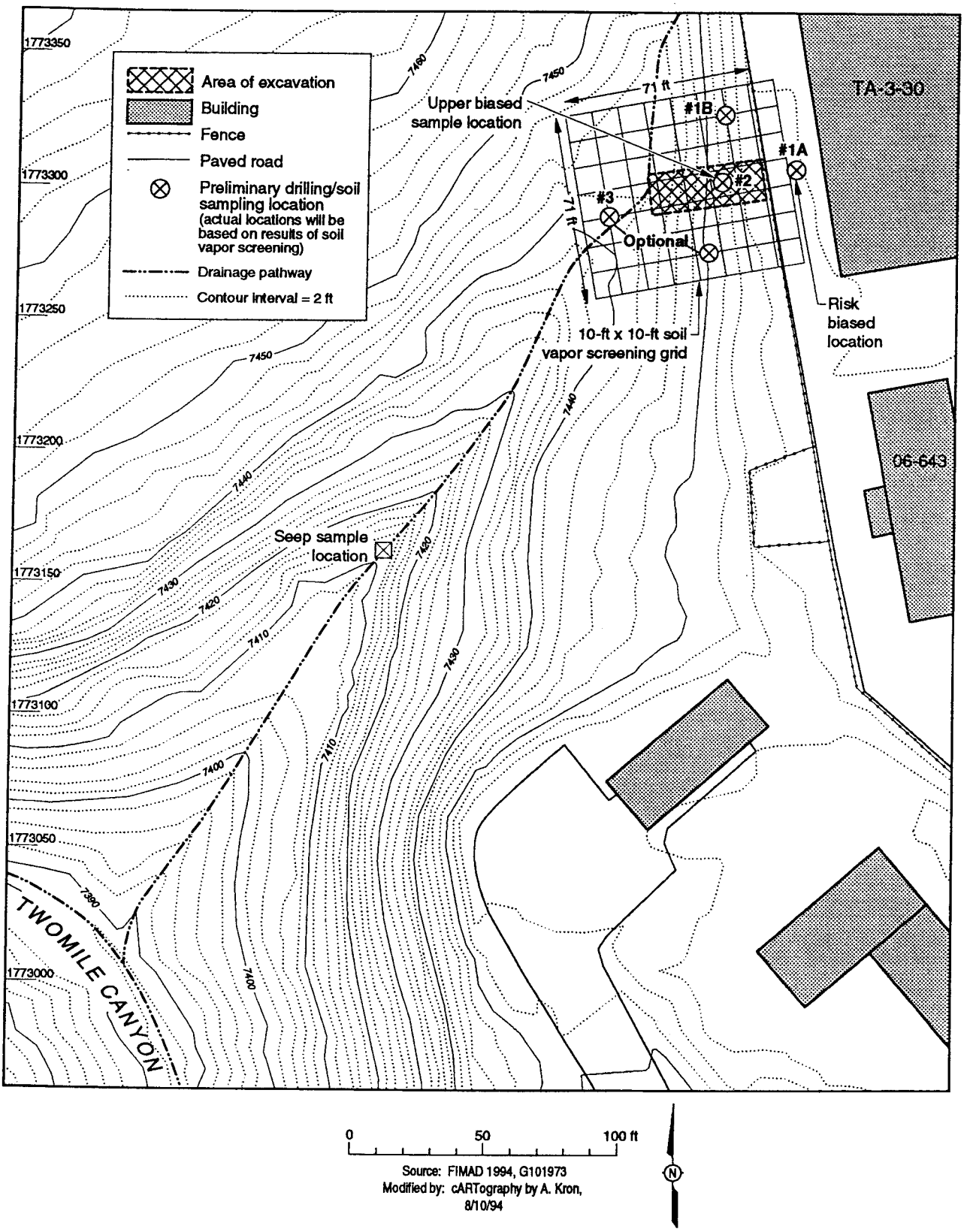

Figure 7. Preliminary screening and sampling locations.

determine the horizontal extent of the solvent-affected soils. This survey will be used as a screening tool to select drilling locations in either highly contaminated areas or for confirmation sampling in uncontaminated areas.

The drilling program will provide soil samples for analysis to determine the concentrations of halogenated volatile organic compounds, TPH, and entrained tritium that may be available for further migration into the surrounding environment. In addition, downhole soil vapor sampling will be conducted to provide measurements of soil vapor concentrations for the COCs that pose a risk to the RME individual.

6.3.1.2 Potential Receptors

Current potential receptors include LANL personnel and recreational users of the canyon. These are also the most plausible future receptors. Less likely future receptors include construction workers and site residents.

LANL personnel (e.g., maintenance workers, office workers) could potentially be exposed to volatile contaminants that exist in subsurface soil and may migrate into existing buildings adjacent to the site. Since surface soil contamination has been removed in the 4 x 13 meter SWMU boundary, direct contact with contaminated soil is not expected unless further site development was to occur that would expose contaminated subsurface soil. Therefore, the only exposure pathway relevant to current LANL personnel is inhalation of volatile constituents that may migrate into existing building spaces from contaminated subsurface soil.

A recreational user could potentially be exposed to contaminants volatilizing from subsurface soil. Additionally, the recreational user may also ingest surface water that contains site contaminants through surface water runoff or groundwater seeps.

If the site was to be further developed in the future for LANL use or as a residential property, and contaminated subsurface soil was exposed, construction workers, site workers, or residents could potentially come in contact with soil contamination through the following exposure pathways:

- Incidental ingestion of contaminated soil;
- Dermal contact with contaminated soil;
- External radiation; and
- Inhalation of volatile constituents that volatilize from soil.

Residents may also be exposed to subsurface contaminants that are brought to the surface during development if they grow food crops that accumulate contaminants from the soil.

6.3.2 Data Needs for Evaluating Other Impacts

Data will also be needed to evaluate the impact of site contaminants on ecological receptors. Ecological risk assessment methodology for the ER Project is currently under development and a complete summary of data that will be needed to support this effort cannot be identified at this time. However, LANL-established environmental criteria may be used for evaluating ecological risk at the site. Evaluation of these established criteria relative to the site may include:

- Comparison of groundwater and surface water chemical concentrations to federal and state water quality criteria;
- Identification of any of state or federal sensitive, threatened, or endangered plant or animal species on the site;
- Identification of sensitive areas such as floodplains or wetlands; and
- Identification of onsite habitat types.

It is unlikely that exposure pathways for site plants and animals and contaminant uptake will be more significant than exposure pathways identified for humans. However, characterization of on-site ecological receptors will be required to make this determination.

6.4 Summary of Fieldwork

6.4.1 Site Preparation and Backfilling

An engineered hydraulic barrier will be installed across the bottom of the current excavation to reduce the permeability of the backfill materials. The barrier will have a reduced permeability of at least two orders of magnitude below the native fill and will be a minimum of 18-in. thick. The barrier will be made of a mixture of bentonite powder blended with graded tuff mixed to an optimal moisture and compacted to 95% of maximum density. The site will be backfilled on top of the hydraulic barrier with clean soils and wheel rolled for compaction using a loader and a backhoe.

6.4.2 Sampling and Analysis Plan

Figure 7 shows the proposed soil vapor probe survey grid, borehole locations, and the approximate location where seep sampling will be attempted.

6.4.2.1 Soil Sampling

The sampling and analysis in 1992 and 1993 showed a limited horizontal and vertical extent of plutonium and cesium contamination and while additional material was removed from the excavation after Lift 2. Confirmation sampling will provide a higher degree of confidence that these radionuclides have been completely removed. Although the plutonium and cesium sampling and analysis after the removal of Lift 2 showed concentrations only slightly above

background, two confirmation soil samples will be collected prior to backfilling one from the upper biased location and one from cell #7 in the bottom of the excavation for plutonium analysis. The samples will be collected from the bucket of the backhoe to preclude personnel entry into the excavation. The sampling team will follow LANL-ER-SOP-6.09 for collecting these samples.

6.4.2.2 Soil Vapor Probe Survey

Soil vapor sampling will be conducted in the overburden soils surrounding the existing excavation in order to evaluate the potential for lateral migration of VOCs from the former oil and solvent disposal area. Data generated from this task will be used to determine the number of boreholes that will be drilled, as well as guide the final selection of borehole locations.

Initially, approximately 14 shallow soil vapor probes will be installed to depths ranging from 3 to 14 ft, adjacent to and downslope from the existing excavation. The vapor stream from the probes will be screened for the contaminants of concern using a photoionization detector (PID). The PID will be equipped with an 11.7 eV bulb in order to be able to detect the VOCs of concern. The survey grid for the soil vapor probe locations is shown on Figure 7. Actual field locations may be modified at the field team leader's discretion to avoid areas where soil vapor probes cannot be advanced without excessive effort. The probes are intended to measure VOCs concentrations in the soil vapor just above the tuff and therefore, will not be advanced into the tuff.

The soil vapor probe survey locations will step out horizontally approximately 10 ft until no VOCs are detected. If the soil vapor probe survey data are highly variable, then sampling on a closer grid may be appropriate to provide adequate resolution of the vapor plume.

The PID screening results from the soil vapor probe samples will be used to appropriately place drilling locations for collecting soil samples to confirm the horizontal and vertical extent of significantly affected soils and to determine the magnitude of the VOCs remaining in the soils and the tuff.

A soil vapor probe kit will be purchased for this field effort. All probes should be thoroughly cleaned and decontaminated prior to use and between sampling points by steam cleaning, followed by tap water, methanol, and deionized water rinses.

The probe may be driven by a hydraulic or pneumatic driver, or by hand using a steel fence post driver. Probes will be driven vertically to the depth of the tuff. The probe should then be retracted approximately 1 to 2 in. to allow soil vapor to enter the tubing. The base of the probe should be sealed with modeling clay or a stiff bentonite slurry where the probe enters the soil column, to avoid the surface atmosphere entering the soil vapor sample.

Following installation of the probes, a disposable Teflon® tee-valve will be fitted to the top end of each probe. The tee-valve will permit purging, field screening, and sampling of the probe. A PID or equivalent field instrument will be attached to the tee-valve with a short length of Teflon® tubing, and approximately five headspace volumes of air should be purged from the system. The sampler should then observe and note PID readings for soil vapor. The draft soil vapor sampling and analysis standard operating procedure is provided as Appendix B.

6.4.2.3 Drilling and Downhole Soil Vapor Sampling

Drilling will be conducted in order to obtain soil and downhole soil vapor samples to confirm the data from the soil vapor probe survey pertaining to the lateral extent of contamination and to evaluate the depth of contamination at the site. Borehole locations will provide information regarding the depth of contamination, lateral dispersion, and contaminant concentrations. This drilling investigation may not be able to determine the extent of contamination if COCs are found to follow fractures into the tuff; however, a risk assessment will be performed using the data from the investigation to help determine what subsequent actions should be instituted.

Although VOC analysis of the soil sample taken from the east sidewall of the excavation showed no detectable levels of VOCs, at least one boring location will be placed between the building and the excavation in order to assess the potential current occupational exposure through vapor migration and subsequent inhalation. This borehole location on the east side of the site will extend through the asphalt paving.

A minimum of four boreholes is anticipated at this time. The anticipated maximum depth for any borehole is one hundred feet. The actual number and depths of boreholes will be modified on the basis of field data gathered during the soil vapor probe survey. The variability and distribution of the downhole soil vapor will be used as a guide for determining if more than planned sampling and analysis is warranted. Proposed locations for boreholes are depicted on Figure 7. The initial boreholes will be drilled on the basis of the following criteria:

Borehole #1A: Location designed to determine current occupational exposure, borehole located between the excavation and TA-3-30;

Borehole #1B: Upgradient from excavation, borehole located north of excavation;

Borehole #2: Upper biased location, borehole located within the excavation;

Borehole #3: Downgradient location, borehole located west of the excavation.

If no contamination is found in Borehole 1A, the location could be interpreted as upgradient and eliminate the need for Borehole 1B. If VOCs are found at borehole location 1A, then borehole location 1B will be required to determine the limit of affected soils to the north of the current

excavation. If VOCs are detected during the soil vapor probe survey outside of the current 5 000 square foot investigation boundary, then optional boreholes may be drilled. Highly variable data or new hot spots identified during the soil vapor probe survey may indicate that additional boreholes are necessary to investigate other areas of VOC concentrations.

Soil samples will be obtained during drilling using a split-spoon core barrel sampler lined with brass sleeves or Shelby® tubes. Soil vapor samples will be collected from the advancing bottom of the borehole at five-foot intervals during drilling. The downhole soil vapor samples will be collected in syringes or Tedlar® bags and will be analyzed for VOCs and tritium using the on-site analytical laboratory. All drilled samples will be field screened with a PID for the presence of VOCs. Field screening with the PID will consist of monitoring the space between each liner in each run of the split spoon. The uppermost sleeve where the highest PID reading is found will be extruded into a sealable clear plastic bag and another PID reading will be taken after the VOCs have been allowed to volatilize into the headspace of the bag and reach steady state. The adjacent lower sleeve will be capped and retained for potential analysis.

All of the boreholes will be advanced a minimum of ten feet into the tuff bedrock. This is expected to yield a 25 ft borehole run. Downhole soil vapor sampling will be performed during the drilling process to assist in decision-making regarding the ultimate depth of each borehole. If VOCs are detected at a given interval, or if visual examination or field screening of soil/rock samples indicates the presence of TPH, then the borehole will be extended for another five feet. If VOCs are not detected, no visual staining is observed, and field screening does not reveal TPH within two successive five-foot intervals, then the borehole will be terminated.

Drilling is not anticipated to be required deeper than 100 ft, however, the drill rig used on site will have sufficient capacity to drill beyond the 100 ft depth if required. A waste management plan has been developed under LANL's new Administrative Requirements to handle the drill cuttings and other investigation-derived wastes produced during the implementation of this work plan. The drill cuttings will be placed back in the hole in the same order they were removed.

It is not anticipated that any borehole will encounter free water or perched water tables. In the event that perched water is encountered within 10 ft below the deepest detectable contamination, the borehole will be extended 5 ft beyond the saturated zone and will be completed as a monitoring well. Specific work and implementation plans will be developed to address sampling requirements if this situation is encountered.

Boreholes 1A, 1B, and 3 are located in areas that are selected outside of the suspected VOC plume and, as such, are designed to obtain and confirm uncontaminated materials. Two samples

will be collected from all uncontaminated drilling locations and will be submitted for confirmation analysis at a fixed laboratory. These samples will consist of:

- The portion of the core that represents the soil-tuff interface; and
- A sample that is 10 ft below the soil-tuff interface.

If the downhole soil vapor from Boreholes 1A, 1B, and 3 detects VOCs, then additional boreholes will be drilled further away from the excavation and the samples submitted for laboratory analysis from these locations will follow the sample selection scheme for uncontaminated boreholes.

Borehole 2 is designed to be located over the hot spot of VOC contamination found in the bottom of the excavation. A minimum of three samples from this borehole and all contaminated boreholes will be submitted for laboratory analysis. However, if contamination is not detected in Borehole 2, two samples will be collected and will be submitted for confirmation analysis at a fixed laboratory. If VOCs are detected only within the first 25 ft of the borehole, the minimum three samples will consist of:

- The deepest sample where the presence of detectable VOCs is indicated from headspace field screening of the upper adjacent sleeve;
- A sample collected from 5 ft below the deepest sample with field detectable VOCs to confirm that the contamination does not extend deeper; and
- The sample from which the headspace field screening indicates the highest concentration of VOCs.

If VOCs are detected deeper than 25 ft below land surface (BLS) in any contaminated borehole, then the number of samples submitted for laboratory analysis will be based on the coefficient of variation of the downhole soil vapor measurements taken at each 5-ft-depth interval in the borehole. Two samples will be collected from the following locations:

- The deepest sample where the presence of detectable VOCs is indicated from headspace field screening of the upper adjacent sleeve; and
- A sample collected from 5 ft below the deepest sample with field detectable VOCs to confirm that the contamination does not extend deeper.

The number of additional samples submitted for laboratory analysis will be based on the variability of the VOCs detected in the soil vapor of the borehole. The variability will be determined based on the coefficient of variation (cv) which is calculated using the downhole soil vapor measurements in the following equation:

$$cv = \frac{s}{\bar{x}} \text{ where } s \text{ is the standard deviation } = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

$$\text{and } \bar{x} \text{ is the arithmetic average } = \frac{1}{n}\sum_{i=1}^{n} x_i .$$

Table 8 presents the number of samples to be submitted for analysis based on the coefficient of variation of the downhole soil vapor measurements. A small variability (i.e., cv ≤ 21 %) in the data will indicate one additional sample for a total of 4 samples from the borehole. A large variability (i.e., cv > 30%) in the downhole soil vapor data will indicate 4 additional samples for a maximum total of 7 samples from a borehole. The appropriate number of sample(s) will be collected from the interval(s) where the headspace reading indicates the highest concentration(s) of VOCs.

TABLE 8

NUMBER OF ADDITIONAL SAMPLES PER BOREHOLE

COEFFICIENT OF VARIATION OF THE DOWNHOLE SOIL VAPOR MEASUREMENTS	NUMBER OF SAMPLES SUBMITTED FOR LABORATORY ANALYSIS*
≤21%	1
>21% and ≤25%	2
>25% and ≤30%	3
>30%	4

* Readers interested in more details are referred to Gilbert (1987, 0312) pages 33-34.

Drilling will be accomplished with a Central Mining Equipment (CME) -750 high-torque drilling rig, or equivalent, with the capability to drill to the anticipated depth of 100 ft in moderately indurated tuff. The rig will be mounted on an all-wheel-drive truck chassis or all-terrain vehicle to ensure that the rig may be successfully positioned at the desired borehole locations.

Standard 8.25-in. outside diameter (nominal) hollow stem continuous flight augers, with an approximate inside diameter of 4 in. will be used to complete the boreholes. The boreholes will be continuously sampled within 5-ft intervals using a Central Mining Equipment continuous sampler or equivalent, utilizing 3-in. outside diameter (O.D.) stainless steel split tubes. Core runs will be adjusted in length to optimize recovery; however, it is expected that average run length will be approximately 2.5 ft. The sampler will be latched within the lead auger/drill head of the drill string. A wireline or similar system will be used for retrieving the core barrel in order to avoid the necessity to trip out repeatedly to retrieve samples and conduct soil vapor testing.

Drilling method

Boreholes will be advanced using 8-in. (nominal O.D.) continuous flight augers, equipped with a continuous sampling system composed of a removable core barrel, a latching mechanism, and a

wireline retrieval system. Continuous samples will be collected in split tubes with liners and environmental and geotechnical samples will be collected from the continuous samples, as described in the previous subsection. Soil vapor samples will also be collected from the interior of the borehole at 5-ft intervals. This task will include installation of a pneumatic packer through the auger string to the bottom of the hole, inflation of the packer, purging of non-representative soil vapor, and collection and analysis of the vapor sample, as described earlier in this subsection.

The order of sampling activities will be as follows:

- Commence drilling with continuous sampler. Core barrel shoe should be adjusted out to lead the auger bit a short distance to enhance recovery and provide a sub-diameter hole in which to seat the packer. The sample barrel will be tripped out for soil/bedrock sample collection as needed to facilitate borehole advancement.
- Drill 5 ft: IMPORTANT - the hole should not be cleaned out at this point. The auger cuttings should remain in place to seal the borehole annulus until after the soil vapor sample has been recovered.
- Remove core barrel, collect laboratory and geotechnical samples, and log core
- Pull back augers approximately one inch
- Install deflated pneumatic packer inside hollow stem augers to seat against core barrel landing ring.
- Inflate packer with compressed nitrogen
- Attach tee-valve and calibrated air sampling pump to sampling line and purge five headspace volumes of air
- Connect PID to sampling line and monitor to determine if VOCs are present. If VOCs are present, then borehole will be continued.
- Collect Tedlar® bag sample for gas chromatography/mass spectrometry (GC/MS) analysis (every five ft interval)
- Deflate and remove packer
- Trip in core barrel, re-advance auger string to bottom of hole
- Add additional auger flights, as needed
- Continue drilling and soil sampling

This process will be repeated until:

- The borehole is terminated using the criteria established in Subsection 6.4

- A depth of 100 ft is reached
- Auger refusal is reached

Auger cuttings will be contained in 55-gal. disposal drums for temporary containment until the cuttings are characterized for final disposal, per the waste management plan.

Soil/Rock Sampling Method

When drilling and sampling the boreholes at SWMU 3-010(a), all core and sample handling activities will be performed within the exclusion zone. If the screening levels of the core indicate the absence of radioactive contamination above background levels or organic contamination at elevated concentrations, the collected samples shall be properly stored in appropriate sample containers for testing or analysis. Unused portions of the core shall be discarded in waste drums with the drill cuttings. All core that exceeds the Sample Management Facility (SMF) acceptance criteria for radiological and non-radiological contaminants (as indicated in LANL-ER-SOP-12.02, Table 1) will be stored in a limited access SMF box (a "core coffin") located in the exclusion zone.

Core and sample handling procedures for SWMU 3-010(a) include the following:

1. Prior to initiating drilling of each borehole, the subsurface sampler/field geologist will ensure that all labels/sample documentation have been generated for the samples to be collected for that borehole.
2. Drilling rig personnel will remove the split-barrel sampler from the borehole via a wireline system and will place the unopened split barrel on a work bench in the exclusion zone. The field geologist will obtain drilling interval information from the driller and place this information on the core sample log. The field geologist is responsible for ensuring that there is no confusion on the orientation of the core (i.e., top versus bottom). Sampling team personnel handling the core samples will use new clean latex gloves each time a core barrel is handled.
3. The split-barrel sampler will be opened by the subsurface sampler/field geologist and the designated radiation safety personnel will screen the entire length of the core for radiological constituents. Field screening for VOCs will be accomplished by separating the split tube liners and placing the PID probe at available freshly exposed surfaces of the sampled soil. Field screening results will be entered in the core sample log by the field geologist. Core intervals with above-background radioactivity or organics at elevated concentrations based on field screening shall be pointed out to the field geologist/subsurface sampler so that samples may be collected from those intervals.
4. The field geologist will measure the core run for recovery to the nearest 0.1 ft, and enter the information on the core sample log. The top of the run shall be the starting point for

measurement. If the top is angled across a fracture and does not match the previous run, the starting point shall be the midpoint of the fracture. Core loss will also be determined by the field geologist and recorded on the core sample log. The location ID, run number, current depth of hole, and cored interval will be written on a core run card. This card will be displayed beside the core, contained within the split tube, and the card and core will be photographed.

5. The subsurface sampler will collect samples for analysis of VOCs at the bottom of each core run interval and at any interval showing elevated concentrations of volatile organics based on field screening. Care will be taken to minimize disturbance of the core while placing samples in the sample vials to reduce volatilization of any organic constituents. The depth interval of the volatile organics sample shall be determined by the field geologist and recorded on the sample vials. The location ID and concentration of the organics on field screening shall also be recorded on the sample vials. The sample vials shall be placed into a plastic Ziploc® bag and stored in a sample cooler with Blue Ice®.

6. Sample numbers and depth intervals will be recorded on the core sample log. Sampling requirements include:

   a. Sample material particle size reduction if intact tuff material is encountered to the extent necessary for placement of the sample into sample containers. However, excessive handling or disturbance of the sample should be avoided to avoid loss of volatile constituents.

   b. Environmental sample material will be transferred to the appropriate sample containers with a decontaminated stainless steel or disposable scoop. A sample ID number will be assigned to the sample, and a sample ID sticker will be placed on the tops of all sample containers. Environmental sample containers will be placed into a large Ziploc® bag and a label will be placed on the bag with the location ID, sample depth for that sample suite, and a sample ID sticker will be placed on the outside of the bag. The bagged sample suite will be placed into a sample cooler with blue ice.

   c. Intact cores selected for geotechnical analysis will be left within the core barrel liners and sealed with plastic end caps. The orientation of the sample will be marked in indelible marker on the sample itself and on the exterior of the preserved sample. Geotechnical samples will be taken from each borehole to provide representative coverage of all geological units encountered; however, a minimum of two samples will be taken from each borehole.

d. The subsurface sampler will complete the sample labels, chain-of-custody, and will sign and place the labels on the appropriate sample containers. The chain-of-custody will be initialed and the sample collection log will be signed. The sampler and field team leader (FTL) will also perform a quality assurance (QA) check of the sample documentation at this time to ensure all information is accurate for the sample suite.

e. The subsurface sampler will maintain custody of the sample suites until they are screened by the radiation screening personnel to be released from the exclusion zone.

f. Samples will be analyzed using analytical methods outlined in Subsection 6.4.2.

7. The field geologist will log the run on the core sample log. It is not anticipated that cleaning of the core will be necessary because of the drilling and sampling methods to be performed during this investigation. If, during the course of the drilling operation, the field geologist recognizes a need to clean the core, the field team leader will be consulted for approval.

8. The remaining core material will be placed in core boxes by the field geologist. Non-cohesive core material should be placed into small Ziploc® bags. Core run information shall be marked on a polystyrene foam marker at the top of each run in the core box. Core losses will also be marked on polystyrene foam markers and placed at the appropriate depth intervals in the core box. Intervals where samples have been removed for environmental or geotechnical analysis shall also be indicated on appropriately marked polystyrene foam marker and placed at the intervals from which the samples were collected. The marker should indicate the sampled interval and corresponding sample number(s).

9. When core boxes are filled, the field geologist shall label bottom right hand corners of the top and bottom of the core box with the borehole ID, depth interval of core in the box, and the box number for that borehole using a black felt-tipped marking pen.

11. As time permits, the core shall subsequently be prepared for archiving according to LANL-ER-SOP-12.01 by the field geologist. This may be done immediately after core material is placed in core boxes or, to avoid delay of drilling operations, this may be done during drilling downtimes or at the end of the day. Final core curation includes:

a. Parallel orientation stripes will be placed on the liners using red and blue permanent markers; red on the right, from top to bottom.

b. After all analytical samples have been collected from the core, and the core has been properly marked, the appropriate content information for the core box (i.e., depth interval and box number for that borehole) will be entered on two adhesive labels. These labels also have a separate box numbering system (field container number) for

the sample management facility. The completed labels will be affixed on the left-hand corner of the downhole end of the lid and body of the core box.

c. When all core markers are positioned, the core sections (core, polystyrene core tray, and cardboard divider) will be placed into plastic sleeves. For unconsolidated core material that cannot be written on (step 2 above), the parallel orientation stripes will be placed on the plastic sleeves.

d. When all core curation is complete, the box information will be entered in the core inventory, and the core boxes will be taped shut to help assure integrity of the core if the core boxes are disturbed.

e. The boxed core material will be properly segregated and maintained in the exclusion zone by the field geologist until such time as it is screened and released to the support zone. The field geologist/sample coordinator will be responsible for its inventory and temporary storage.

Downhole Soil Vapor Sampling Method

After the core barrel has been retrieved from a specific borehole interval, soil vapor sampling will be performed. Soil vapor samples will be acquired in accordance with the procedures outlined in the following paragraphs.

After the core barrel has been removed from the drill string, the driller will pull back the auger string approximately one inch. The driller should take care to not clean the hole prior to performing the soil vapor sampling task so that the auger flights will remain full of borehole cuttings and assure that the borehole annulus is sealed. The packer will be inserted into the auger string, and will be seated against the sampler landing ring within the auger bit. Following insertion, the packer will be inflated using compressed air or nitrogen. This will seal the interior of the auger string from the external atmosphere.

The field sampler will connect a calibrated soil vapor sampling pump to the downhole sampling tube with a length of Teflon® tubing and a tee-valve. The valve will be located between the pump and the downhole sampling tube. After attaching the pump, the sampler will purge a total of five headspace volumes from the hole. After five volumes have been purged, the sampler will attach a PID to the second position of the tee-valve, turn off the sampling pump, switch the valve to the PID, and note the instrument readings. When the instrument readings have stabilized a Tedlar® bag will be attached to the tee-valve in the position previously occupied by the air sampling pump, the valve will be switched again, and a sample will be collected for analysis by GC/MS. The time of sampling, ambient air temperature, and total volume purged shall be noted for inclusion in the

sample record. The draft soil vapor sampling and analysis standard operating procedure is provided as Appendix B.

Borehole abandonment

Following recovery of the final samples, all boreholes will be backfilled with a cement/bentonite slurry. The slurry will be placed by tremie pipe, which will be lowered to the bottom of the hole and retrieved as the hole is backfilled.

Core Archival Procedures

The following documentation is required under LANL-ER-SOP-12.01:

- Core sample log
- Field analytical sample removal checklist
- Field photographic log
- Core run markers, core loss markers, and sample markers

All forms and markers for each borehole will be prepared by the field geologist completing the borehole. The field geologist shall submit these forms at the conclusion of the day to the field team leader for review and signature. An inventory of filled or partially filled core boxes shall be kept by the field geologist and shall contain detailed information about each core box, including run numbers, depth interval, sampled intervals, sample IDs and specimen IDs, and field container box numbers.

Additionally, LANL-ER-SOP-4.01, Drilling Methods and Drill Site Management, requires completion of a daily drilling summary form. The field geologist will be responsible for completing this form daily and submitting this form to the field team leader for review and signature.

6.4.2.4 Seep Sampling

Water seepage has been observed in the surface drainage that passes the northwest corner of the site and extends into Twomile Canyon. The approximate location of this seep varies from occurrence to occurrence, but the general location is shown on Figure 7. The seepage in the drainage produces varying amounts of water and, in mid-June 1994, was a slight trickle approximately 300 ft downstream of the current excavation. The surface moisture dried up within a few hundred feet. This seepage may have some hydraulic connection to the remaining contamination at the mercury site.

Seep sampling will be performed by excavating a 6-in.-deep depression or catchment basin at the seep location. Groundwater will be permitted to fill the basin and the sampler will allow the water to flow through the basin until excessive turbidity is no longer present. A flexible Teflon® hose will

be placed in the upstream section of the basin and flow will be directed into the sample bottle via the hose. Seep samples will be analyzed for TPH and tritium. The seep will be visually monitored by the field team and NMED Agreement in Principle (AIP) Water Quality personnel to determine if suitable flow volume exists to collect a sample for volatile organic compound analysis (EPA Method 8260). The presence of contaminants in the surface water will be carefully evaluated to help determine if there is a hydraulic connection to the mercury site. TPH in the seep samples could be a result of a direct connection to the mercury site or of runoff from the parking area around building SM-30. The presence of tritium in any perched water below the site would be a strong indication of a direct connection between the mercury site and the surface water. Also, the sampling data will be used to support the risk assessment surface water pathway analysis.

The field geologist or sampler shall follow LANL-ER-SOP-06.13 for surface water sampling. The method for grab samples shall be used in this investigation. Following sample collection, bottles shall be labeled and chain-of-custody and other documentation completed as required. The bottles shall then be placed into a cooler held at 4° C for storage and transport to the laboratory.

6.4.3 Analytical Support

A combination of on-site and fixed laboratory analyses are proposed to support this investigation. On-site analyses for VOCs and TPH are proposed in order to measure sample concentrations in a timely manner and to minimize the potential of collecting insufficient information to support risk-based and regulatory-driven decisions. On-site soil vapor screening will allow the drilling locations to be more accurately located and will provide qualitative data for use in risk-based decisions. On-site vapor screening of soil samples will guide the appropriate selection of confirmation samples to be sent to a fixed laboratory, thereby minimizing the fixed analytical costs for the Phase II investigation and the associated delays.

Soil and soil vapor samples will be screened using an organic vapor survey instrument employing a portable photoionization detector to determine the general magnitude of the total VOC concentrations in the samples. The PID analyses will provide information for selecting appropriate samples for fixed laboratory analysis, as well as the depth of completion for the boreholes.

The proposed on-site laboratory consists of a chemical van equipped with an infrared spectrophotometer for TPH analysis and a GC/MS for the analysis of VOCs. Detection limits for VOCs are based partially on the soil vapor sample size. Approximate anticipated detection limits by sample volume are listed below:

Vapor Sample Volume	VOC Detection Limit
1 L	0.5 ppb
500 ml	1 ppb
100 ml	5 ppb

The actual detection limit achieved is dependent on the compound of interest as well as sample size and assume that there will not be gross matrix interferences. A GC/MS instrument was selected based on its ability to quantitatively identify the VOCs in soil vapor, soil, and water.

An in-line tritium monitor will be used to screen the vapors entering the on-site analytical laboratory. This analytical device will be used to measure the tritium concentrations in the soil vapor. These concentrations are expected to remain below SALs, but may be above background levels. Further corrective action taken at this site, if any, will be affected by the expected tritium concentrations. Therefore, tritium concentrations should be measured in all media including soil vapor, soil moisture, and entrained in the TPH.

Downhole soil vapor samples will be screened for tritium and then analyzed at the site using an infrared spectrophotometer to provide screening level contaminant concentrations. After screening, analyses of duplicate samples will be conducted using the onsite GS/MS.

Rock and soil samples will be analyzed for TPH using the fixed laboratory infrared, as well as for the tritium entrained in the TPH, using sonication extraction by EPA SW-846 Method 3550, followed by TPH analysis using EPA Method 418.1, and tritium analysis using liquid scintillation on any oil extracts obtained from the soil or rock samples. Analysis for VOCs will be completed using EPA Method 8260, a GC/MS procedure. Intact rock specimens will be retained for optional geotechnical testing for grain size distribution and permeability. The orientation and integrity of these samples will be preserved as described in the LANL SOPs.

Water samples from the groundwater seep will be analyzed for TPH using an on-site or fixed laboratory infrared, for VOCs using EPA Method 8260, and tritium using liquid scintillation.

Table 9 summarizes the Phase II sampling plan including the approximately 10% duplicate or collocated samples to be collected for data validation and quality control. Additional measures will be taken in the field for quality assurance and quality control, such as daily calibration on all instruments and use of prescribed analytical standards.

6.4.3.1 Equipment Decontamination

All augers and sampling equipment will be steam cleaned or pressure washed prior to setup at the site and between boreholes, following the procedures described below. A primary decontamination site will be established prior to drilling, in compliance with the waste management plan. This site will be used for decontamination of augers and drilling equipment before commencing drilling, between boreholes, and prior to demobilization from the site. Secondary decontamination areas will be established at each of the boreholes for decontamination of split spoons, packers, or other downhole equipment that must be reintroduced into the borehole several times during the drilling process.

TABLE 9

SAMPLING PLAN SUMMARY

SAMPLE MATRIX	MINIMUM NO. OF SAMPLES	FIELD SCREENING			ON-SITE ANALYSIS	FIXED LABORATORY ANALYSIS		
		PID	Tritium in vapor	VOCs by GC/MS	TPH by infrared	Tritium in soil moisture	Tritium in TPH	Plutonium-238 and cesium-137
EPA METHODS				8260	418.1	Liquid scin-tillation	3550 extraction; liquid scintillation	Alpha and gamma spectroscopy
Soil vapor probe	18	18						
Equipment blanks	1	1						
Downhole soil vapor	25		25	25				
Equipment blanks	2		2	2				
Soil borings	12	12		12	12	12	12	
Collocated samples	1			1	1	1	1	
Field duplicates	1			1	1	1	1	
Equipment blanks	1	1		1	1	1	1	
Soil samples	2							2
Field duplicates								1
Seep samples	1			1	1	1	1	
Field duplicates	1			1	1	1	1	
Equipment blanks	1			1	1	1	1	

Before mobilizing to the site, the drill crew will provide the field team leaders/field coordinators with radiological screening results from HS-1 for the drilling rig, augers, and all downhole tooling from the most recent drilling site in which radiological constituents may have been present.

Subsequent to the completion of each soil boring, the rig, augers, and downhole tooling will be screened for radiological contamination by the on-site health physicist or radiation screening personnel. Detected contamination shall be removed using paper towels and Fantastik® cleaner (or equivalent). Equipment will be screened again by the health physicist/radiation screening personnel and decontaminated again, if necessary. Following release by the health physicist/radiation screening personnel, the augers and downhole tooling shall be steam-cleaned. All clean augers and tooling will be wrapped in clean plastic sheeting until use.

If radioactive contamination is detected during sample screening, the associated split-spoon sample barrel will be screened for radiological contamination by the on-site health physicist/radiation screening personnel by collecting a swipe sample of the equipment. The Waste Management Plan (currently in review) describes the method by which the swipe will be analyzed. Detected contamination shall be removed using paper towels and Fantastik® cleaner (or equivalent). Barrels will be rechecked by the health physicist/radiation screening personnel and decontaminated again, if necessary.

Sample barrels released by the health physicist/radiation screening personnel and all sample barrels not suspected to be radioactively contaminated based on sample material screening, shall be cleaned using an Alconox®/potable water wash and methanol/deionized water rinse, and allowed to air dry if time permits, otherwise barrels will be wiped dry using a clean Chemwipe® towel. Clean barrels shall be wrapped in clean plastic sheeting until use. Clean latex gloves will be worn when handling decontaminated barrel samplers.

Prior to leaving the site, the drill rig, augers, tooling, and sample barrels will be swiped for radiological contamination. Equipment shall be cleaned using Fantastik® and clean paper towels if swipe results indicate the presence of radiological contamination, and subsequently re-swiped. The rig and downhole tooling will then be re-cleaned if swipe results indicate further presence of radiological contamination. If swipe results are negative, the rig and downhole tooling will be steam cleaned. The rig and equipment shall not be released from the site until swipe sample analyses have been received and results have indicated the absence of radiological contamination.

6.4.4 Waste Management

The on-site waste manager shall be responsible for completing all forms in accordance with the site-specific waste management plan. The on-site waste manager is also responsible for ensuring that all waste containers are labeled in accordance with the site-specific waste management plan.

6.4.5 Health and Safety

Health and safety personnel will be responsible for completing all health and safety forms as required in the site-specific health and safety plan.

6.4.6 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

- Master collection logs
- Chain-of-custody/request for analysis forms
- Custody seals

Sample information shall be collected and entered on the forms and subsequently initialed and signed by the subsurface sampler, field geologist, or the field team leader. All forms shall be completed following LANL-ER-SOP-1.04, R1.

Daily Activities

The laboratory's procedure for Sample Control and Field Documentation (LANL-ER-SOP-1.04, R1) specifies that a field logbook will be used for detailed summaries of information pertaining to the field investigation and for recording field data. The field geologist will be responsible for making these entries into the field logbook. The field logbook shall have pages that are consecutively numbered and will fulfill all requirements cited in the SOP including the time, depth interval, and recovery of each core run.

In addition, a daily drilling and 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 drilling and sampling activities and will be submitted in electronic format when feasible. 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.

6.4.7 Site Restoration

After the Phase II sampling has been completed, stabilization of the site will include site grading, replacement of topsoil, revegetation, and erosion control during the revegetation process. The site will be graded to approximately its original surface contours. The top one foot of the backfilled excavation will be backfilled with topsoil, hydro-seeded with native plants, and covered with straw mats to minimize soil erosion. The site will be watered once a week until plants are established.

A sandbag diversion will be constructed at the top of the site if erosion problems develop from surface runoff from the parking lot of TA-3-30. The security fence will be repaired to its original condition.

References:

EPA (US Environmental Protection Agency), July 27, 1990. "Corrective Action for Solid Waste Management Units (SWMUs) at Hazardous Waste Management Facilities," proposed rule, Title 40 Parts 264, 265, 270, and 271, *Federal Register*, Vol. 55., pp. 30798-30884. **(EPA 1990, 0432)**

EPA (US Environmental Protection Agency), December 1991. "Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals)," Interim, EPA/540/R-92-003, Publication 9285.7-01B, Office of Research and Development, Washington, DC. **(EPA 1991, 0302)**

EPA (US Environmental Protection Agency), September 16, 1992. "The Data Quality Objectives Process for Environmental Decisions," draft, Quality Assurance Management Staff, Washington, DC. **(EPA 1992, 0981)**

ERM/Golder, April 1994, Field Implementation Plan.

Gilbert, R.O. 1987. *Statistical Methods for Environmental Pollution Monitoring,* Van Nostrand Reinhold, New York, New York. **(Gilbert 1987, 0312)**

ICF Kaiser, *Sampling and Remediation Plan*, 1992, Contract No. 9-XS-2-Y5348-1)

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

LANL (Los Alamos National Laboratory), July 1993. RFI Work Plan for Operable Unit 1114, Los Alamos National Laboratory Report LA-UR-93-1000, Los Alamos, New Mexico. **(LANL 1993, 1090)**

APPENDIX A
LABORATORY DATA SHEETS

QUALITY ASSURANCE

DATA VALIDATION REPORT

ORGANIC GCMS VOLATILE

Prepared by

Los Alamos National Laboratory
Environmental Chemistry Group (CST-9)
Quality Assurance and Data Management Section
Los Alamos, NM 87545

Prepared for

Data Users
Los Alamos National Laboratory
Los Alamos, NM 87545

Laboratory	Maxwell, S-cubed
Request No.	17398
Review Level	2
Analytical Method	SW836 METHOD 8240
Date of Review	July 5,1994
Customer	Garry Allen

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Attachment - Laboratory Final Reports with Applied Qualifiers
Note: Not applicable to level 1 validation reports.

A. Introduction

1. Data Review Criteria.

The review of this sample and quality control data was performed in accordance with any or all of the following documents:

a. USEPA SW-846 Methodologies;

b. USEPA CLP SOW Methodologies;

c. Non-USEPA Methodologies, where approved by the Los Alamos National Laboratory, CST-9 Quality Assurance Section;

d. Los Alamos National Laboratory, Analytical Services Requirements Document;

e. USEPA Functional Guidelines for Evaluating Inorganic/Organic Analyses.

2. Report Purpose.

The Quality Assurance Data Validation Report (QADVR) is suggested for use in conjunction with the original data produced from the laboratory, if verification or greater detail of reported data is required of data users or the responding laboratory. The purpose of the QADVR is to alert data users to failed quality-control criteria, method noncompliance, and qualification or requalification of data. Data users should consider this report final but subject to revisions when data usability can be improved through resolution, clarification, addition, and/or requalification of data.

3. Volatile Organic Data Qualifying Codes

Should the data reviewers deem it necessary to qualify or requalify sample and/or qualify control data due to failed quality control and/or non-compliance of method applications, the following codes will be applied to any analyte(s) in the samples found in the Attachment.

Code	Description
U	The material was analyzed for, but was not detected. The associated numerical value is the sample quantitation limit.
J	The associated numerical value is an estimated quantity.
R	The data are unusable (compound may or may not be present). Resampling and reanalysis is necessary for verification.
N	Presumptive evidence of presence of material.
NJ	Presumptive evidence of presence of the material at an estimated quantity.
UJ	The material was analyzed for, but was not detected. Quantitation limit is an estimated quantity.

4. Data Review Report

The Data Review Report lists the data criteria which are reviewed by the data reviewer. Each element of the Data Review Report is discussed below.

a. Description of criteria reviewed column.

This column narratively describes what data criteria are being reviewed.

b. Review level column.

This column lists the numeric review level code the reviewer is working at when reviewing a particular data criteria. The cover sheet also indicates the review level. Each numeric code is followed by an alphabetic code. The data user should note that the codes change throughout the Data Review Report. Depending on the review level, not every criteria will be examined. The following table explains the meaning of the numeric and alphabetic codes.

Review level numeric	Description
1	Least stringent review of data.
2	More stringent review than level 1 but less stringent review than level 3.
3	Most stringent review of data. More stringent than levels 1 and 2.

Review level alpha	Description
f	Final laboratory reports are reviewed.
r	Raw data are reviewed.

c. Criteria met Y/N column.

If the data under review is acceptable, the data reviewer puts a yes (Y) in the column. If the data is unacceptable, the data reviewer puts a no (N) in the column.

d. Comment number and category column.

If the data reviewer comments on the acceptability or unacceptability of the data reviewed, a sequential numeric value is placed in this column. The data reviewer may comment on any data criteria which does not necessarily pertain to acceptable or unacceptable laboratory performance. The corresponding comment will be listed in Section D of the QADVR. Comments are classified as follows.

Classification Code	Description
CD	Correctable Deficiency (CD) - these are deficiencies that are correctable by the laboratory.

NCD	Noncorrectable Deficiencies (NCD) - these are deficiencies that can be addressed by the laboratory. However, corrections usually cannot be made unless reanalysis is performed.
CPD	Completeness Deficiencies (CPD) - these are deficiencies where data was not provided. Completeness deficiencies can be correctable or noncorrectable, depending on past laboratory performance.
G	General (G) - these are general comments which may or may not affect data.

5. Data Review Comments and Qualifying Statements.

As previously discussed under the Data Review Report, the data reviewer may or may not supply comments. Depending on the type of comment and the deficiency, sample and/or quality-control data can be affected. Should the sample and/or quality-control data be significantly impacted, through failed QC and/or method noncompliance, the data reviewer's comment will be followed by a data qualifying statement (DQS). The DQS informs the data user or QADVR reviewer as to what sample and/or quality-control data was affected, using a narrative discussion and qualifying codes.

6. Data Reviewer's Assessment.

The data reviewer assesses the entire data package for completeness, quality control, and contractual compliance. The data reviewer then issues an explanatory narrative assessment depicting the data package as excellent, good, average, poor, or rejected.

7. Data User's Guidance and Reviewer's Signature.

The data reviewer summarizes how the QADVR was conducted and that data qualification and/or requalification may have been performed. In addition, data users and/or QADVR reviewers are advised to understand the impact of this report on data usability from the analytical standpoint. The QADVR is then signed-off by the reviewer and peer reviewer.

8. Acronyms (partial listing).

Organic Acronyms	Description
1. GCMS	Gas Chromatography Mass Spectrometry
2. GC/ECD	Gas Chromatography/Electron Capture Detector, GC Pest/PCB
3. HPLC	High Performance Liquid Chromatography
4. GPC	Gel Permeation Chromatography, GCMS, GC
5. GC/FID	Gas Chromatography/Flame/Ionization Detector
6. MS/MSD	Matrix Spike/Matrix Spike Duplicate
7. RE	Re-extracted and/or Re-analyzed
8. DL	Secondary dilution

8. Acronyms (partial listing) (cont)

Organic Acronyms	Description
9. VBLK	Volatile Blank
10. SBLK	Semivolatile Blank
11. PBLK	Pesticide/Aroclor Blank
12. VSTD	Volatile Standard
13. SSTD	Semivolatile Standard
14. RF	Response Factor, GCMS, GC
15. CF	Calibration Factor, GC
16. SV	Semivolatile Analysis
17. VOA	Volatile Organic Analysis
18. TIC	Tentatively Identified Compound
19. CCC	Calibration Check Compound, GCMS
20. SPCC	System Performance Check Compound, GCMS
21. BFB	Bromofluorobenzene, GCMS
22. DFTPP	Decafluorotriphenylphosphine, GCMS
23. RRF	Relative Response Factor, GCMS, GC
24. TCMX	Tetrachloro-m-xylene, GC Pest/PCB
25. DCB	Decachlorobiphenyl, GC Pest/PCB
26. IS	Internal Standard, GCMS, GC
27. RT	Retention Time, GCMS, GC
28. RIC	Reconstructed Ion Chromatograph, GCMS
29. EQL	Estimated Quantitation Limit
30. SMC	System Monitoring Compound, GCMS

Common Acronyms	Description
1. SDG	Sample Delivery Group
2. SOW	Statement of Work
3. QC	Quality Control
4. COC	Chain-of-Custody
5. %D	Percent Difference
6. RSD	Relative Standard Deviation
7. RPD	Relative Percentage Difference

B. Table of Samples Reviewed

TABLE I. SAMPLES REVIEWED

	Customer Sample ID	CST-9 Sample ID	Contract Laboratory ID	Matrix
1.	AAB2015	94.08134	4339 - 01	S
2.	AAB2017	94.08135	4339 - 02	S
3.	AAB2016	94.08136	4339 - 03	S
4.	NA	94.08138 - QC	4339 - 04	S
5.	AAB2809	94.08139	4339 - 05	W
6.	NA	94.08140 - VBLK	NA	W
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				

Report Number: 25882

Matrix: (S) Soil, (W) Water

C. Review Report

	Description of Criteria Reviewed	Review Level	Criteria Met Y/N	Comment number and Category			
				CD	NCD	CPD	G
1.	Holding Time, Sample Collection to Analysis						
	a. Waters 14 days pres., 7 days unpres. (aromatics)	1fr,2fr,3fr	Y				
	b. Soils 14 days	1fr,2fr,3fr	Y				
2.	Tune						
	a. BFB	1f,2f,3fr	Y				
	b. Samples analyzed within 12 hour time?	1f,2f,3fr	Y				
3.	Initial Calibration						
	a. SPCCs and CCCs (>.3 (.25 Bromoform)) and ≤30% RSD?	1f,2f,3fr	Y				
	b. All target compounds RRF ≥0.05?	1f,2f,3fr	Y				
	c. All target compounds RRF ≤30% RSD?	1f,2f,3fr	N		1		
4.	Continuing Calibration						
	a. SPCCs and CCCs (>.3(.25 Bromoform)) and ≤25% D?	1f,2f,3fr	Y				
	b. All target compounds RRF ≥0.05?	1f,2f,3fr	Y				
	c. All target compounds ≤25% D?	1f,2f,3fr	N		2		

C. **Review Report (cont.)**

	Description of Criteria Reviewed	Review Level	Criteria Met Y/N	Comment number and Category			
				CD	NCD	CPD	G
5.	Blanks						
	a. Reported for each matrix, concentration level, GC/MS system and analytical batch?	1f,2f,3fr	Y				
	b. All blanks contain no common laboratory contaminants (acetone, butanone, methylene chloride or toluene) >5x EQL?	1f,2f,3fr	Y				
	c. All method blanks contain no other target or TIC compounds > EQL?	1f,2f,3fr	Y				
6.	Surrogates						
	a. Recoveries within control limits for samples and method blanks?	1f,2f,3fr	N		3		
7.	Matrix Spike/Matrix Spike Duplicates						
	a. MS/MSD within control limits?		NA				4
8.	Internal Standards						
	a. All samples and blanks < (±50%) a factor of 2 when compared to continuing calibration IS?	2f,3fr	N		5		
	b. All samples and blanks within 30 seconds (0.5 min) retention time when compared to continuing calibration IS?	2f,3fr	Y				

C. **Review Report (cont.)**

	Description of Criteria Reviewed	Review Level	Criteria Met Y/N	Comment number and Category			
				CD	NCD	CPD	G
9.	Sample Results						
	a. Discrete shifts in the RIC baseline are not present?	1fr,2fr,3fr	Y				
	b. High RIC background levels or RT shifts are not present?	1fr,2fr,3fr	Y				
	c. Qualitation and Quantitation correct?	1fr,2fr,3fr	Y				6
10.	Tentatively Identified Compounds (TICs)						
	a. Were TICs requested?	3fr	N				
	b. Were TICs library searched and compared two best 3 matches?	3fr	NA				
11.	QC Blind Sample						
	a. Are the results of the QC blind sample within limits?	1fr,2fr,3fr	Y				

D. Data Review Comments and Qualifying Statements

Comment number	Comment
1	The soil initial calibration analyzed on 5/10/94 had a % RSD > 30% for the following compounds: * 2-Butanone had a % RSD of 35.1%. * Acetone had a % RSD of 47%. Since the client was not interested in acetone or 2-butanone the sample data were not qualified due to the high % RSD. However, acetone was detected in sample 94.08134 and will be qualified as stated in comment 6. The water initial calibration analyzed on 5/10/94 had a % RSD of 34.1% for acetone. Since the sensitivity of acetone was not in question and it was not detected in water sample 94.08139, the sample data were not qualified.
2	The soil continuing calibration analyzed on 5/12/94 had a % D > 25% for the following compounds: * 2,2-Dichloropropane had a % D of 27.7%. * Bromoform had a % D of 30.6%. Since the client was not interested in 2,2-dichloropropane or bromoform the sample data were not qualified due to the high % D. The soil continuing calibration analyzed on 5/16/94 had a % D of 37% for 2,2-dichloropropane. Since the client was not interested in 2,2-dichloropropane, the sample data were not qualified.
3	For sample 94.08134, the % recovery 1,2-dichloroethane-d4 was above the upper control limit at 129% with a control limit of 121%. The sample was analyzed a second time at a dilution due to several target compounds being above the instruments linear range. The % recovery for 1,2-dichloroethane-d4 was within the control limits for the diluted analyses of sample 94.08134. The sample data were not qualified due to the high % recovery of the surrogate.
4	Rather than performing an MS/MSD, the laboratory chose to do a Laboratory Control Sample (LCS) for each matrices. The % recovery of all the spiked components were within the control limits for both LCSs.

D. Data Review Comments and Qualifying Statements - cont.

Comment number	Comment
5	The area count of the last internal standard, 1,4-dichlorobenzene-d4 was below the acceptance limit for the initial analysis of sample 94.08134. As previously mentioned in comment 3, the sample was analyzed a second time at a dilution in order to obtain target compound results within the instruments linear range. The area count for 1,4-dichlorobenzene-d4 was within the acceptance limit for the diluted analyses of sample 94.08134. Since target compounds reported from the initial analysis were not associated with 1,4-dichlorobenzene-d4 and the area count was within the acceptance limit for the diluted analysis, the sample data were not qualified.
6	Several target compounds were reported above the instruments linear range for sample 94.08134. The sample was analyzed a second time at a dilution in order to obtain a result for 1,1,1-trichloroethane within the instruments linear range. Due to the high concentration of 1,1,1-trichloroethane, several target compounds detected in the initial analysis were diluted out in the diluted analysis of sample 94.08134. Therefore, acetone, benzene, 1,2-dichloroethane, 1,1-dichloroethene, and toluene were qualified with a "J" in sample 94.08134. Ethylbenzene was qualified with a "J" since it was detected below the EQL.,

E. Data Reviewer's Assessment

Even though benzene, toluene, ethylbenzene, and mixed xylenes were the only volatile target compounds requested, the laboratory used the analytical method SW846 method 8240 which searched for a wider range of target compounds. All volatile target compounds were reported.

With the exception of those items mentioned in section D, the QC criteria was met in the analytical process of this request. The data package is accurate and complete. Based on the acceptable QC requirements the data package has been rated as **EXCELLENT**.

F. Data Users Guidance Criteria and Reviewer's Signature

This quality assurance data review was conducted under the guidelines as specified in the introduction section of this report. The data reviewer has reviewed the sample and quality control analyses and documented the findings in an attempt to assist data users with the assessment, completeness and accuracy of this original data package. Data qualification and/or requalification may have been performed, see Appendix 1, Data Reviewer's comments, and qualifying statements.

Report prepared and reviewed by

Laura Kelly — 7/5/94 (Date)

- [x] Laura Kelly ph. (505) 665-4993
- [ ] Donivan Porterfield ph. (505) 667-4710
- [ ] Victor Weiss ph. (505) 665-4101

Quality Assurance/Data Assessment, CST-9
Los Alamos National Laboratory

Report peer reviewed by

Victor A. Weiss — 7-5-94 (Date)

- [ ] Laura Kelly ph. (505) 665-4993
- [ ] Donivan Porterfield ph. (505) 667-4710
- [x] Victor Weiss ph. (505) 665-4101

Quality Assurance/Data Assessment, CST-9
Los Alamos National Laboratory

ATTACHMENT

Laboratory Final Reports with Applied Qualifiers
Note: Not applicable to level 1 validation reports.

REPORT NUMBER: 25882

********** EM-9 ANALYTICAL REPORT **********

EPA VOLATILES Prepared by: LAK on 5-Jul-1994

REQUEST NUMBER: 17398 MATRIX: SS ANALYST: 206 PROGRAM CODE: M76B NOTEBOOK: 0 PAGE:

OWNER: Garry Allen GROUP: CST-6 MAIL-STOP: E525 PHONE: 7-3394 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 94.08134 Date Collected: Date Received: Date Extracted: Date Analyzed:

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
AAB2015	94.08134	67641	250.	75.	UG/KG	6/30/94	J	Acetone
AAB2015	94.08134	71432	380.	114.	UG/KG	6/30/94	J	Benzene
AAB2015	94.08134	108861	< 29.		UG/KG	6/30/94		Bromobenzene
AAB2015	94.08134	74975	< 29.		UG/KG	6/30/94		Bromochloromethane
AAB2015	94.08134	75274	< 29.		UG/KG	6/30/94		Bromodichloromethane
AAB2015	94.08134	75252	< 29.		UG/KG	6/30/94		Bromoform
AAB2015	94.08134	74839	< 57.		UG/KG	6/30/94		Bromomethane
AAB2015	94.08134	78933	< 110.		UG/KG	6/30/94		2-Butanone
AAB2015	94.08134	104518	< 29.		UG/KG	6/30/94		n-Butylbenzene
AAB2015	94.08134	135988	< 29.		UG/KG	6/30/94		sec-Butylbenzene
AAB2015	94.08134	98066	< 29.		UG/KG	6/30/94		tert-Butylbenzene
AAB2015	94.08134	75150	< 29.		UG/KG	6/30/94		Carbon disulfide
AAB2015	94.08134	56235	< 29.		UG/KG	6/30/94		Carbon tetrachloride
AAB2015	94.08134	108907	< 29.		UG/KG	6/30/94		Chlorobenzene
AAB2015	94.08134	124481	< 29.		UG/KG	6/30/94		Chlorodibromomethane
AAB2015	94.08134	75003	< 57.		UG/KG	6/30/94		Chloroethane
AAB2015	94.08134	67663	69.	20.7	UG/KG	6/30/94		Chloroform
AAB2015	94.08134	74873	130.	39.	UG/KG	6/30/94		Chloromethane
AAB2015	94.08134	95498	< 29.		UG/KG	6/30/94		o-Chlorotoluene
AAB2015	94.08134	106434	< 29.		UG/KG	6/30/94		p-Chlorotoluene
AAB2015	94.08134	96128	< 57.		UG/KG	6/30/94		1,2-Dibromo-3-chloropropane
AAB2015	94.08134	74953	< 29.		UG/KG	6/30/94		Dibromomethane
AAB2015	94.08134	95501	< 29.		UG/KG	6/30/94		o-Dichlorobenzene (1,2)
AAB2015	94.08134	541731	< 29.		UG/KG	6/30/94		m-Dichlorobenzene (1,3)
AAB2015	94.08134	106467	< 29.		UG/KG	6/30/94		p-Dichlorobenzene (1,4)
AAB2015	94.08134	75718	< 57.		UG/KG	6/30/94		Dichlorodifluoromethane

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
AAB2015	94.08134	75343	200.	60.	UG/KG	6/30/94		1,1-Dichloroethane
AAB2015	94.08134	107062	910.	273.	UG/KG	6/30/94	J	1,2-Dichloroethane
AAB2015	94.08134	75354	29000.	8700.	UG/KG	6/30/94	J	1,1-Dichloroethene
AAB2015	94.08134	156605	< 29.		UG/KG	6/30/94		trans-1,2-Dichloroethene
AAB2015	94.08134	156592	< 29.		UG/KG	6/30/94		cis-1,2-Dichloroethylene
AAB2015	94.08134	78875	< 29.		UG/KG	6/30/94		1,2-Dichloropropane
AAB2015	94.08134	142289	< 29.		UG/KG	6/30/94		1,3-Dichloropropane
AAB2015	94.08134	594207	< 29.		UG/KG	6/30/94		2,2-Dichloropropane
AAB2015	94.08134	563586	< 29.		UG/KG	6/30/94		1,1-Dichloropropene
AAB2015	94.08134	10061015	54.	16.2	UG/KG	6/30/94		cis-1,3-Dichloropropene
AAB2015	94.08134	10061026	< 29.		UG/KG	6/30/94		trans-1,3-Dichloropropene
AAB2015	94.08134	100414	23.	6.9	UG/KG	6/30/94	J	Ethylbenzene
AAB2015	94.08134	106934	< 29.		UG/KG	6/30/94		Ethylene dibromide
AAB2015	94.08134	591786	< 110.		UG/KG	6/30/94		2-Hexanone
AAB2015	94.08134	98828	< 29.		UG/KG	6/30/94		Isopropylbenzene
AAB2015	94.08134	99876	< 29.		UG/KG	6/30/94		4-Isopropyltoluene
AAB2015	94.08134	74884	< 29.		UG/KG	6/30/94		Methyl iodide
AAB2015	94.08134	108101	< 110.		UG/KG	6/30/94		4-Methyl-2-pentanone
AAB2015	94.08134	75092	< 29.		UG/KG	6/30/94		Methylene chloride
AAB2015	94.08134	103651	< 29.		UG/KG	6/30/94		Propylbenzene
AAB2015	94.08134	100425	< 29.		UG/KG	6/30/94		Styrene
AAB2015	94.08134	630206	< 29.		UG/KG	6/30/94		1,1,1,2-Tetrachloroethane
AAB2015	94.08134	79345	< 29.		UG/KG	6/30/94		1,1,2,2-Tetrachloroethane
AAB2015	94.08134	127184	< 29.		UG/KG	6/30/94		Tetrachloroethylene
AAB2015	94.08134	108883	280.	84.	UG/KG	6/30/94	J	Toluene
AAB2015	94.08134	76131	< 29.		UG/KG	6/30/94		1,1,2-Trichloro-1,2,2-trifluoroethane
AAB2015	94.08134	71556	100000.	30000.	UG/KG	6/30/94		1,1,1-Trichloroethane
AAB2015	94.08134	79005	< 29.		UG/KG	6/30/94		1,1,2-Trichloroethane
AAB2015	94.08134	79016	< 29.		UG/KG	6/30/94		Trichloroethene
AAB2015	94.08134	75694	< 57.		UG/KG	6/30/94		Trichlorofluoromethane
AAB2015	94.08134	96184	< 29.		UG/KG	6/30/94		1,2,3-Trichloropropane
AAB2015	94.08134	95636	< 29.		UG/KG	6/30/94		1,2,4-Trimethylbenzene
AAB2015	94.08134	108678	< 29.		UG/KG	6/30/94		1,3,5-Trimethylbenzene
AAB2015	94.08134	75014	< 57.		UG/KG	6/30/94		Vinyl chloride
AAB2015	94.08134	1330207	29.	8.7	UG/KG	6/30/94		Mixed-Xylenes (o ± m ± p)

Tentatively Identified Compounds in Customer Sample # 94.08134

none

********** EM-9 ANALYTICAL REPORT **********

EPA VOLATILES Prepared by: LAK on 5-Jul-1994

REQUEST NUMBER: 17398 MATRIX: SS ANALYST: 206 PROGRAM CODE: M76B NOTEBOOK: 0 PAGE:

OWNER: Garry Allen GROUP: CST-6 MAIL-STOP: E525 PHONE: 7-3394 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 94.08135 Date Collected: Date Received: Date Extracted: Date Analyzed:

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
AAB2017	94.08135	67641	< 24.		UG/KG	6/30/94		Acetone
AAB2017	94.08135	71432	< 6.		UG/KG	6/30/94		Benzene
AAB2017	94.08135	108861	< 6.		UG/KG	6/30/94		Bromobenzene
AAB2017	94.08135	74975	< 6.		UG/KG	6/30/94		Bromochloromethane
AAB2017	94.08135	75274	< 6.		UG/KG	6/30/94		Bromodichloromethane
AAB2017	94.08135	75252	< 6.		UG/KG	6/30/94		Bromoform
AAB2017	94.08135	74839	< 12.		UG/KG	6/30/94		Bromomethane
AAB2017	94.08135	78933	< 24.		UG/KG	6/30/94		2-Butanone
AAB2017	94.08135	104518	< 6.		UG/KG	6/30/94		n-Butylbenzene
AAB2017	94.08135	135988	< 6.		UG/KG	6/30/94		sec-Butylbenzene
AAB2017	94.08135	98066	< 6.		UG/KG	6/30/94		tert-Butylbenzene
AAB2017	94.08135	75150	< 6.		UG/KG	6/30/94		Carbon disulfide
AAB2017	94.08135	56235	< 6.		UG/KG	6/30/94		Carbon tetrachloride
AAB2017	94.08135	108907	< 6.		UG/KG	6/30/94		Chlorobenzene
AAB2017	94.08135	124481	< 6.		UG/KG	6/30/94		Chlorodibromomethane
AAB2017	94.08135	75003	< 12.		UG/KG	6/30/94		Chloroethane
AAB2017	94.08135	67663	< 6.		UG/KG	6/30/94		Chloroform
AAB2017	94.08135	74873	< 12.		UG/KG	6/30/94		Chloromethane
AAB2017	94.08135	95498	< 6.		UG/KG	6/30/94		o-Chlorotoluene
AAB2017	94.08135	106434	< 6.		UG/KG	6/30/94		p-Chlorotoluene
AAB2017	94.08135	96128	< 12.		UG/KG	6/30/94		1,2-Dibromo-3-chloropropane
AAB2017	94.08135	74953	< 6.		UG/KG	6/30/94		Dibromomethane
AAB2017	94.08135	95501	< 6.		UG/KG	6/30/94		o-Dichlorobenzene (1,2)
AAB2017	94.08135	541731	< 6.		UG/KG	6/30/94		m-Dichlorobenzene (1,3)
AAB2017	94.08135	106467	< 6.		UG/KG	6/30/94		p-Dichlorobenzene (1,4)
AAB2017	94.08135	75718	< 12.		UG/KG	6/30/94		Dichlorodifluoromethane

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
AAB2017	94.08135	75343	< 6.		UG/KG	6/30/94		1,1-Dichloroethane
AAB2017	94.08135	107062	< 6.		UG/KG	6/30/94		1,2-Dichloroethane
AAB2017	94.08135	75354	< 6.		UG/KG	6/30/94		1,1-Dichloroethene
AAB2017	94.08135	156605	< 6.		UG/KG	6/30/94		trans-1,2-Dichloroethene
AAB2017	94.08135	156592	< 6.		UG/KG	6/30/94		cis-1,2-Dichloroethylene
AAB2017	94.08135	78875	< 6.		UG/KG	6/30/94		1,2-Dichloropropane
AAB2017	94.08135	142289	< 6.		UG/KG	6/30/94		1,3-Dichloropropane
AAB2017	94.08135	594207	< 6.		UG/KG	6/30/94		2,2-Dichloropropane
AAB2017	94.08135	563586	< 6.		UG/KG	6/30/94		1,1-Dichloropropene
AAB2017	94.08135	10061015	< 6.		UG/KG	6/30/94		cis-1,3-Dichloropropene
AAB2017	94.08135	10061026	< 6.		UG/KG	6/30/94		trans-1,3-Dichloropropene
AAB2017	94.08135	100414	< 6.		UG/KG	6/30/94		Ethylbenzene
AAB2017	94.08135	106934	< 6.		UG/KG	6/30/94		Ethylene dibromide
AAB2017	94.08135	591786	< 24.		UG/KG	6/30/94		2-Hexanone
AAB2017	94.08135	98828	< 6.		UG/KG	6/30/94		Isopropylbenzene
AAB2017	94.08135	99876	< 6.		UG/KG	6/30/94		4-Isopropyltoluene
AAB2017	94.08135	74884	< 6.		UG/KG	6/30/94		Methyl iodide
AAB2017	94.08135	108101	< 24.		UG/KG	6/30/94		4-Methyl-2-pentanone
AAB2017	94.08135	75092	< 6.		UG/KG	6/30/94		Methylene chloride
AAB2017	94.08135	103651	< 6.		UG/KG	6/30/94		Propylbenzene
AAB2017	94.08135	100425	< 6.		UG/KG	6/30/94		Styrene
AAB2017	94.08135	630206	< 6.		UG/KG	6/30/94		1,1,1,2-Tetrachloroethane
AAB2017	94.08135	79345	< 6.		UG/KG	6/30/94		1,1,2,2-Tetrachloroethane
AAB2017	94.08135	127184	< 6.		UG/KG	6/30/94		Tetrachloroethylene
AAB2017	94.08135	108883	< 6.		UG/KG	6/30/94		Toluene
AAB2017	94.08135	76131	< 6.		UG/KG	6/30/94		1,1,2-Trichloro-1,2,2-trifluoroethane
AAB2017	94.08135	71556	30.	9.	UG/KG	6/30/94		1,1,1-Trichloroethane
AAB2017	94.08135	79005	< 6.		UG/KG	6/30/94		1,1,2-Trichloroethane
AAB2017	94.08135	79016	< 6.		UG/KG	6/30/94		Trichloroethene
AAB2017	94.08135	75694	< 12.		UG/KG	6/30/94		Trichlorofluoromethane
AAB2017	94.08135	96184	< 6.		UG/KG	6/30/94		1,2,3-Trichloropropane
AAB2017	94.08135	95636	< 6.		UG/KG	6/30/94		1,2,4-Trimethylbenzene
AAB2017	94.08135	108678	< 6.		UG/KG	6/30/94		1,3,5-Trimethylbenzene
AAB2017	94.08135	75014	< 12.		UG/KG	6/30/94		Vinyl chloride
AAB2017	94.08135	1330207	< 6.		UG/KG	6/30/94		Mixed-Xylenes (o ± m ± p)

Tentatively Identified Compounds in Customer Sample # 94.08135

none

********** EM-9 ANALYTICAL REPORT **********

EPA VOLATILES Prepared by: LAK on 5-Jul-1994

REQUEST NUMBER: 17398 MATRIX: SS ANALYST: 206 PROGRAM CODE: M76B NOTEBOOK: 0 PAGE:

OWNER: Garry Allen GROUP: CST-6 MAIL-STOP: E525 PHONE: 7-3394 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 94.08136 Date Collected: Date Received: Date Extracted: Date Analyzed:

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
AAB2016	94.08136	67641	< 24.		UG/KG	6/30/94		Acetone
AAB2016	94.08136	71432	< 6.		UG/KG	6/30/94		Benzene
AAB2016	94.08136	108861	< 6.		UG/KG	6/30/94		Bromobenzene
AAB2016	94.08136	74975	< 6.		UG/KG	6/30/94		Bromochloromethane
AAB2016	94.08136	75274	< 6.		UG/KG	6/30/94		Bromodichloromethane
AAB2016	94.08136	75252	< 6.		UG/KG	6/30/94		Bromoform
AAB2016	94.08136	74839	< 12.		UG/KG	6/30/94		Bromomethane
AAB2016	94.08136	78933	< 24.		UG/KG	6/30/94		2-Butanone
AAB2016	94.08136	104518	< 6.		UG/KG	6/30/94		n-Butylbenzene
AAB2016	94.08136	135988	< 6.		UG/KG	6/30/94		sec-Butylbenzene
AAB2016	94.08136	98066	< 6.		UG/KG	6/30/94		tert-Butylbenzene
AAB2016	94.08136	75150	< 6.		UG/KG	6/30/94		Carbon disulfide
AAB2016	94.08136	56235	< 6.		UG/KG	6/30/94		Carbon tetrachloride
AAB2016	94.08136	108907	< 6.		UG/KG	6/30/94		Chlorobenzene
AAB2016	94.08136	124481	< 6.		UG/KG	6/30/94		Chlorodibromomethane
AAB2016	94.08136	75003	< 12.		UG/KG	6/30/94		Chloroethane
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AAB2016	94.08136	106434	< 6.		UG/KG	6/30/94		p-Chlorotoluene
AAB2016	94.08136	96128	< 12.		UG/KG	6/30/94		1,2-Dibromo-3-chloropropane
AAB2016	94.08136	74953	< 6.		UG/KG	6/30/94		Dibromomethane
AAB2016	94.08136	95501	< 6.		UG/KG	6/30/94		o-Dichlorobenzene (1,2)
AAB2016	94.08136	541731	< 6.		UG/KG	6/30/94		m-Dichlorobenzene (1,3)
AAB2016	94.08136	106467	< 6.		UG/KG	6/30/94		p-Dichlorobenzene (1,4)
AAB2016	94.08136	75718	< 12.		UG/KG	6/30/94		Dichlorodifluoromethane

********** EM-9 ANALYTICAL REPORT **********

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AAB2016	94.08136	75354	44.	13.2	UG/KG	6/30/94		1,1-Dichloroethene
AAB2016	94.08136	156605	< 6.		UG/KG	6/30/94		trans-1,2-Dichloroethene
AAB2016	94.08136	156592	< 6.		UG/KG	6/30/94		cis-1,2-Dichloroethylene
AAB2016	94.08136	78875	< 6.		UG/KG	6/30/94		1,2-Dichloropropane
AAB2016	94.08136	142289	< 6.		UG/KG	6/30/94		1,3-Dichloropropane
AAB2016	94.08136	594207	< 6.		UG/KG	6/30/94		2,2-Dichloropropane
AAB2016	94.08136	563586	< 6.		UG/KG	6/30/94		1,1-Dichloropropene
AAB2016	94.08136	10061015	< 6.		UG/KG	6/30/94		cis-1,3-Dichloropropene
AAB2016	94.08136	10061026	< 6.		UG/KG	6/30/94		trans-1,3-Dichloropropene
AAB2016	94.08136	100414	< 6.		UG/KG	6/30/94		Ethylbenzene
AAB2016	94.08136	106934	< 6.		UG/KG	6/30/94		Ethylene dibromide
AAB2016	94.08136	591786	< 24.		UG/KG	6/30/94		2-Hexanone
AAB2016	94.08136	98828	< 6.		UG/KG	6/30/94		Isopropylbenzene
AAB2016	94.08136	99876	< 6.		UG/KG	6/30/94		4-Isopropyltoluene
AAB2016	94.08136	74884	< 6.		UG/KG	6/30/94		Methyl iodide
AAB2016	94.08136	108101	< 24.		UG/KG	6/30/94		4-Methyl-2-pentanone
AAB2016	94.08136	75092	< 6.		UG/KG	6/30/94		Methylene chloride
AAB2016	94.08136	103651	< 6.		UG/KG	6/30/94		Propylbenzene
AAB2016	94.08136	100425	< 6.		UG/KG	6/30/94		Styrene
AAB2016	94.08136	630206	< 6.		UG/KG	6/30/94		1,1,1,2-Tetrachloroethane
AAB2016	94.08136	79345	< 6.		UG/KG	6/30/94		1,1,2,2-Tetrachloroethane
AAB2016	94.08136	127184	< 6.		UG/KG	6/30/94		Tetrachloroethylene
AAB2016	94.08136	108883	< 6.		UG/KG	6/30/94		Toluene
AAB2016	94.08136	76131	< 6.		UG/KG	6/30/94		1,1,2-Trichloro-1,2,2-trifluoroethane
AAB2016	94.08136	71556	1100.	330.	UG/KG	6/30/94		1,1,1-Trichloroethane
AAB2016	94.08136	79005	< 6.		UG/KG	6/30/94		1,1,2-Trichloroethane
AAB2016	94.08136	79016	< 6.		UG/KG	6/30/94		Trichloroethene
AAB2016	94.08136	75694	< 12.		UG/KG	6/30/94		Trichlorofluoromethane
AAB2016	94.08136	96184	< 6.		UG/KG	6/30/94		1,2,3-Trichloropropane
AAB2016	94.08136	95636	< 6.		UG/KG	6/30/94		1,2,4-Trimethylbenzene
AAB2016	94.08136	108678	< 6.		UG/KG	6/30/94		1,3,5-Trimethylbenzene
AAB2016	94.08136	75014	< 12.		UG/KG	6/30/94		Vinyl chloride
AAB2016	94.08136	1330207	< 6.		UG/KG	6/30/94		Mixed-Xylenes (o ± m ± p)

Tentatively Identified Compounds in Customer Sample # 94.08136

none

********** EM-9 ANALYTICAL REPORT **********

EPA VOLATILES Prepared by: LAK on 5-Jul-1994

REQUEST NUMBER: 17398 MATRIX: SS ANALYST: 206 PROGRAM CODE: M76B NOTEBOOK: 0 PAGE:

OWNER: Garry Allen GROUP: CST-6 MAIL-STOP: E525 PHONE: 7-3394 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 94.08139 Date Collected: 5/06/94 Date Received: 5/09/94 Date Extracted: 5/10/94 Date Analyzed: 5/10/94

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
AAB2809	94.08139	67641	< 20.		UG/L	6/23/94		Acetone
AAB2809	94.08139	71432	< 5.		UG/L	6/23/94		Benzene
AAB2809	94.08139	108861	< 5.		UG/L	6/23/94		Bromobenzene
AAB2809	94.08139	74975	< 5.		UG/L	6/23/94		Bromochloromethane
AAB2809	94.08139	75274	< 5.		UG/L	6/23/94		Bromodichloromethane
AAB2809	94.08139	75252	< 5.		UG/L	6/23/94		Bromoform
AAB2809	94.08139	74839	< 10.		UG/L	6/23/94		Bromomethane
AAB2809	94.08139	78933	< 20.		UG/L	6/23/94		2-Butanone
AAB2809	94.08139	104518	< 5.		UG/L	6/23/94		n-Butylbenzene
AAB2809	94.08139	135988	< 5.		UG/L	6/23/94		sec-Butylbenzene
AAB2809	94.08139	98066	< 5.		UG/L	6/23/94		tert-Butylbenzene
AAB2809	94.08139	75150	< 5.		UG/L	6/23/94		Carbon disulfide
AAB2809	94.08139	56235	< 5.		UG/L	6/23/94		Carbon tetrachloride
AAB2809	94.08139	108907	< 5.		UG/L	6/23/94		Chlorobenzene
AAB2809	94.08139	124481	< 5.		UG/L	6/23/94		Chlorodibromomethane
AAB2809	94.08139	75003	< 10.		UG/L	6/23/94		Chloroethane
AAB2809	94.08139	67663	< 5.		UG/L	6/23/94		Chloroform
AAB2809	94.08139	74873	< 10.		UG/L	6/23/94		Chloromethane
AAB2809	94.08139	95498	< 5.		UG/L	6/23/94		o-Chlorotoluene
AAB2809	94.08139	106434	< 5.		UG/L	6/23/94		p-Chlorotoluene
AAB2809	94.08139	96128	< 10.		UG/L	6/23/94		1,2-Dibromo-3-chloropropane
AAB2809	94.08139	74953	< 5.		UG/L	6/23/94		Dibromomethane
AAB2809	94.08139	95501	< 5.		UG/L	6/23/94		o-Dichlorobenzene (1,2)
AAB2809	94.08139	541731	< 5.		UG/L	6/23/94		m-Dichlorobenzene (1,3)
AAB2809	94.08139	106467	< 5.		UG/L	6/23/94		p-Dichlorobenzene (1,4)
AAB2809	94.08139	75718	< 10.		UG/L	6/23/94		Dichlorodifluoromethane

********** EM-9 ANALYTICAL REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
AAB2809	94.08139	75343	< 5.		UG/L	6/23/94		1,1-Dichloroethane
AAB2809	94.08139	107062	< 5.		UG/L	6/23/94		1,2-Dichloroethane
AAB2809	94.08139	75354	< 5.		UG/L	6/23/94		1,1-Dichloroethene
AAB2809	94.08139	156605	< 5.		UG/L	6/23/94		trans-1,2-Dichloroethene
AAB2809	94.08139	156592	< 5.		UG/L	6/23/94		cis-1,2-Dichloroethylene
AAB2809	94.08139	78875	< 5.		UG/L	6/23/94		1,2-Dichloropropane
AAB2809	94.08139	142289	< 5.		UG/L	6/23/94		1,3-Dichloropropane
AAB2809	94.08139	594207	< 5.		UG/L	6/23/94		2,2-Dichloropropane
AAB2809	94.08139	563586	< 5.		UG/L	6/23/94		1,1-Dichloropropene
AAB2809	94.08139	10061015	< 5.		UG/L	6/23/94		cis-1,3-Dichloropropene
AAB2809	94.08139	10061026	< 5.		UG/L	6/23/94		trans-1,3-Dichloropropene
AAB2809	94.08139	100414	< 5.		UG/L	6/23/94		Ethylbenzene
AAB2809	94.08139	106934	< 5.		UG/L	6/23/94		Ethylene dibromide
AAB2809	94.08139	591786	< 20.		UG/L	6/23/94		2-Hexanone
AAB2809	94.08139	98828	< 5.		UG/L	6/23/94		Isopropylbenzene
AAB2809	94.08139	99876	< 5.		UG/L	6/23/94		4-Isopropyltoluene
AAB2809	94.08139	74884	< 5.		UG/L	6/23/94		Methyl iodide
AAB2809	94.08139	108101	< 20.		UG/L	6/23/94		4-Methyl-2-pentanone
AAB2809	94.08139	75092	< 5.		UG/L	6/23/94		Methylene chloride
AAB2809	94.08139	103651	< 5.		UG/L	6/23/94		Propylbenzene
AAB2809	94.08139	100425	< 5.		UG/L	6/23/94		Styrene
AAB2809	94.08139	630206	< 5.		UG/L	6/23/94		1,1,1,2-Tetrachloroethane
AAB2809	94.08139	79345	< 5.		UG/L	6/23/94		1,1,2,2-Tetrachloroethane
AAB2809	94.08139	127184	< 5.		UG/L	6/23/94		Tetrachloroethylene
AAB2809	94.08139	108883	< 5.		UG/L	6/23/94		Toluene
AAB2809	94.08139	76131	< 5.		UG/L	6/23/94		1,1,2-Trichloro-1,2,2-trifluoroethane
AAB2809	94.08139	71556	< 5.		UG/L	6/23/94		1,1,1-Trichloroethane
AAB2809	94.08139	79005	< 5.		UG/L	6/23/94		1,1,2-Trichloroethane
AAB2809	94.08139	79016	< 5.		UG/L	6/23/94		Trichloroethene
AAB2809	94.08139	75694	< 10.		UG/L	6/23/94		Trichlorofluoromethane
AAB2809	94.08139	96184	< 5.		UG/L	6/23/94		1,2,3-Trichloropropane
AAB2809	94.08139	95636	< 5.		UG/L	6/23/94		1,2,4-Trimethylbenzene
AAB2809	94.08139	108678	< 5.		UG/L	6/23/94		1,3,5-Trimethylbenzene
AAB2809	94.08139	75014	< 10.		UG/L	6/23/94		Vinyl chloride
AAB2809	94.08139	1330207	< 5.		UG/L	6/23/94		Mixed-Xylenes (o ± m ± p)

Tentatively Identified Compounds in Customer Sample # 94.08139

none

********** EM-9 QUALITY ASSURANCE REPORT **********

EPA VOLATILES Prepared by: LAK on 5-Jul-1994

REQUEST NUMBER: 17398 MATRIX: SS ANALYST: 206 PROGRAM CODE: M76B NOTEBOOK: 0 PAGE:

OWNER: Garry Allen GROUP: CST-6 MAIL-STOP: E525 PHONE: 7-3394 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QA SAMPLES RUN WITH THIS BATCH

There were no open (non-blind) Quality Control materials run with the samples reported above for one of the following reasons:

____ Only qualitative data requested

____ Only Blind QC samples run with this batch.

____ No QC samples run with this sample batch.

____ No QC samples for this constituent and matrix type available within EM-9

********** EM-9 QUALITY ASSURANCE REPORT **********

SUMMARY OF CONTROL STATUS OF BLANK QC SAMPLES RUN WITH THIS BATCH

Blank Results, Sample # 94.08140 Date Collected: 5/09/94 Date Received: 5/09/94 Date Extracted: 5/11/94 Date Analyzed: 5/11/94

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.27886	94.08140	67641	< 20.		UG/L	0.0		6/23/94	UNDER CONTROL	Acetone
00.27886	94.08140	71432	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Benzene
00.27886	94.08140	108861	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Bromobenzene
00.27886	94.08140	74975	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Bromochloromethane
00.27886	94.08140	75274	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Bromodichloromethane
00.27886	94.08140	75252	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Bromoform
00.27886	94.08140	74839	< 10.		UG/L	0.0		6/23/94	UNDER CONTROL	Bromomethane
00.27886	94.08140	78933	< 20.		UG/L	0.0		6/23/94	UNDER CONTROL	2-Butanone
00.27886	94.08140	104518	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	n-Butylbenzene
00.27886	94.08140	135988	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	sec-Butylbenzene
00.27886	94.08140	98066	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	tert-Butylbenzene
00.27886	94.08140	75150	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Carbon disulfide
00.27886	94.08140	56235	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Carbon tetrachloride
00.27886	94.08140	108907	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Chlorobenzene
00.27886	94.08140	124481	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Chlorodibromomethane
00.27886	94.08140	75003	< 10.		UG/L	0.0		6/23/94	UNDER CONTROL	Chloroethane
00.27886	94.08140	67663	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Chloroform
00.27886	94.08140	74873	< 10.		UG/L	0.0		6/23/94	UNDER CONTROL	Chloromethane
00.27886	94.08140	95498	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	o-Chlorotoluene
00.27886	94.08140	106434	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	p-Chlorotoluene
00.27886	94.08140	96128	< 10.		UG/L	0.0		6/23/94	UNDER CONTROL	1,2-Dibromo-3-chloropropane

********** EM-9 QUALITY ASSURANCE REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.27886	94.08140	74953	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Dibromomethane
00.27886	94.08140	95501	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	o-Dichlorobenzene (1,2)
00.27886	94.08140	541731	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	m-Dichlorobenzene (1,3)
00.27886	94.08140	106467	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	p-Dichlorobenzene (1,4)
00.27886	94.08140	75718	< 10.		UG/L	0.0		6/23/94	UNDER CONTROL	Dichlorodifluoromethane
00.27886	94.08140	75343	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	1,1-Dichloroethane
00.27886	94.08140	107062	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	1,2-Dichloroethane
00.27886	94.08140	75354	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	1,1-Dichloroethene
00.27886	94.08140	156605	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	trans-1,2-Dichloroethene
00.27886	94.08140	156592	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	cis-1,2-Dichloroethylene
00.27886	94.08140	78875	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	1,2-Dichloropropane
00.27886	94.08140	142289	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	1,3-Dichloropropane
00.27886	94.08140	594207	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	2,2-Dichloropropane
00.27886	94.08140	563586	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	1,1-Dichloropropene
00.27886	94.08140	10061015	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	cis-1,3-Dichloropropene
00.27886	94.08140	10061026	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	trans-1,3-Dichloropropene
00.27886	94.08140	100414	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Ethylbenzene
00.27886	94.08140	106934	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Ethylene dibromide
00.27886	94.08140	591786	< 20.		UG/L	0.0		6/23/94	UNDER CONTROL	2-Hexanone
00.27886	94.08140	98828	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Isopropylbenzene
00.27886	94.08140	99876	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	4-Isopropyltoluene
00.27886	94.08140	74884	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Methyl iodide
00.27886	94.08140	108101	< 20.		UG/L	0.0		6/23/94	UNDER CONTROL	4-Methyl-2-pentanone
00.27886	94.08140	75092	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Methylene chloride
00.27886	94.08140	103651	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Propylbenzene
00.27886	94.08140	100425	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Styrene
00.27886	94.08140	630206	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	1,1,1,2-Tetrachloroethane
00.27886	94.08140	79345	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	1,1,2,2-Tetrachloroethane
00.27886	94.08140	127184	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Tetrachloroethylene
00.27886	94.08140	108883	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Toluene
00.27886	94.08140	76131	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	1,1,2-Trichloro-1,2,2-trifluoroetha
00.27886	94.08140	71556	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	1,1,1-Trichloroethane
00.27886	94.08140	79005	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	1,1,2-Trichloroethane
00.27886	94.08140	79016	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Trichloroethene
00.27886	94.08140	75694	< 10.		UG/L	0.0		6/23/94	UNDER CONTROL	Trichlorofluoromethane
00.27886	94.08140	96184	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	1,2,3-Trichloropropane

********** EM-9 QUALITY ASSURANCE REPORT **********

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.27886	94.08140	95636	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	1,2,4-Trimethylbenzene
00.27886	94.08140	108678	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	1,3,5-Trimethylbenzene
00.27886	94.08140	75014	< 10.		UG/L	0.0		6/23/94	UNDER CONTROL	Vinyl chloride
00.27886	94.08140	1330207	< 5.		UG/L	0.0		6/23/94	UNDER CONTROL	Mixed-Xylenes (o ± m ± p)

Blank Results, Sample # 94.08143 Date Collected: 5/09/94 Date Received: 5/09/94 Date Extracted: 5/11/94 Date Analyzed: 5/11/94

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.27856	94.08143	71432	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Benzene
00.27856	94.08143	100414	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Ethylbenzene
00.27856	94.08143	108883	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Toluene
00.27856	94.08143	1330207	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Mixed-Xylenes (o ± m ± p)

Blank Results, Sample # 94.08144 Date Collected: 5/09/94 Date Received: 5/09/94 Date Extracted: 5/11/94 Date Analyzed: 5/11/94

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.27856	94.08144	71432	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Benzene
00.27856	94.08144	100414	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Ethylbenzene
00.27856	94.08144	108883	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Toluene
00.27856	94.08144	1330207	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Mixed-Xylenes (o ± m ± p)

Blank Results, Sample # 94.08145 Date Collected: 5/09/94 Date Received: 5/09/94 Date Extracted: 5/11/94 Date Analyzed: 5/11/94

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.27856	94.08145	71432	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Benzene
00.27856	94.08145	100414	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Ethylbenzene
00.27856	94.08145	108883	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Toluene
00.27856	94.08145	1330207	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Mixed-Xylenes (o ± m ± p)

Blank Spike Results: none

Blank Spike Duplicate Results: none

********** EM-9 QUALITY ASSURANCE REPORT **********

SUMMARY OF CONTROL STATUS OF BLIND QA SAMPLES RUN WITH THIS BATCH

Blind QC Results, Sample # 94.08138 Date Collected: 5/09/94 Date Received: 5/09/94 Date Extracted: 5/11/94 Date Analyzed: 5/11/94

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND-NAME
94.08138	67641	< 10.		UG/KG	0.0		6/30/94	UNDER CONTROL	Acetone
94.08138	71432	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Benzene
94.08138	108861	120.	36.	UG/KG	106.	2.1	6/30/94	UNDER CONTROL	Bromobenzene
94.08138	74975	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Bromochloromethane
94.08138	75274	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Bromodichloromethane
94.08138	75252	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Bromoform
94.08138	74839	< 10.		UG/KG	0.0		6/30/94	UNDER CONTROL	Bromomethane
94.08138	78933	< 10.		UG/KG	0.0		6/30/94	UNDER CONTROL	2-Butanone
94.08138	104518	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	n-Butylbenzene
94.08138	135988	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	sec-Butylbenzene
94.08138	98066	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	tert-Butylbenzene
94.08138	75150	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Carbon disulfide
94.08138	56235	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Carbon tetrachloride
94.08138	108907	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Chlorobenzene
94.08138	124481	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Chlorodibromomethane
94.08138	75003	< 10.		UG/KG	0.0		6/30/94	UNDER CONTROL	Chloroethane
94.08138	67663	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Chloroform
94.08138	74873	< 10.		UG/KG	0.0		6/30/94	UNDER CONTROL	Chloromethane
94.08138	95498	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	o-Chlorotoluene
94.08138	106434	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	p-Chlorotoluene
94.08138	96128	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	1,2-Dibromo-3-chloropropane
94.08138	74953	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Dibromomethane
94.08138	95501	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	o-Dichlorobenzene (1,2)
94.08138	541731	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	m-Dichlorobenzene (1,3)
94.08138	106467	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	p-Dichlorobenzene (1,4)
94.08138	75718	< 10.		UG/KG	0.0		6/30/94	UNDER CONTROL	Dichlorodifluoromethane

94.08138	75343	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	1,1-Dichloroethane
94.08138	107062	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	1,2-Dichloroethane
94.08138	75354	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	1,1-Dichloroethene
94.08138	156605	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	trans-1,2-Dichloroethene
94.08138	156592	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	cis-1,2-Dichloroethylene
94.08138	78875	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	1,2-Dichloropropane
94.08138	142289	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	1,3-Dichloropropane
94.08138	594207	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	2,2-Dichloropropane
94.08138	563586	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	1,1-Dichloropropene
94.08138	10061015	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	cis-1,3-Dichloropropene
94.08138	10061026	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	trans-1,3-Dichloropropene
94.08138	100414	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Ethylbenzene
94.08138	106934	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Ethylene dibromide
94.08138	591786	< 10.		UG/KG	0.0		6/30/94	UNDER CONTROL	2-Hexanone
94.08138	98828	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Isopropylbenzene
94.08138	99876	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	4-Isopropyltoluene
94.08138	74884	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Methyl iodide
94.08138	108101	< 10.		UG/KG	0.0		6/30/94	UNDER CONTROL	4-Methyl-2-pentanone
94.08138	75092	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Methylene chloride
94.08138	103651	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Propylbenzene
94.08138	100425	120.	36.	UG/KG	96.	1.9	6/30/94	UNDER CONTROL	Styrene
94.08138	630206	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	1,1,1,2-Tetrachloroethane
94.08138	79345	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	1,1,2,2-Tetrachloroethane
94.08138	127184	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Tetrachloroethylene
94.08138	108883	110.	33.	UG/KG	103.	2.1	6/30/94	UNDER CONTROL	Toluene
94.08138	76131	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	1,1,2-Trichloro-1,2,2-trifluoroethane
94.08138	71556	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	1,1,1-Trichloroethane
94.08138	79005	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	1,1,2-Trichloroethane
94.08138	79016	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	Trichloroethene
94.08138	75694	< 10.		UG/KG	0.0		6/30/94	UNDER CONTROL	Trichlorofluoromethane
94.08138	96184	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	1,2,3-Trichloropropane
94.08138	95636	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	1,2,4-Trimethylbenzene
94.08138	108678	< 5.		UG/KG	0.0		6/30/94	UNDER CONTROL	1,3,5-Trimethylbenzene
94.08138	75014	< 10.		UG/KG	0.0		6/30/94	UNDER CONTROL	Vinyl chloride
94.08138	1330207	120.	36.	UG/KG	106.	2.1	6/30/94	UNDER CONTROL	Mixed-Xylenes (o ± m ± p)

********** EM-9 QUALITY ASSURANCE REPORT **********

SURROGATE RESULTS FOR EPA VOLATILES

Surrogate 1 = 1,2-Dichloroethane d4 (CAS # = 17060070)
Surrogate 2 = Toluene d8 (CAS # = 2037265)
Surrogate 3 = 4-Bromofluorobenzene (CAS # = 460004)
Surrogate 4 = 2-Chlorostyrene (CAS # = 2039874)
Surrogate 5 = Dibromofluoromethane (CAS # = 1868537)

SAMPLE NUMBER	UNITS	Surrogate 1	Surrogate 2	Surrogate 3	Surrogate 4	Surrogate 5	COMPLETION DATE	SAMPLE TYPE
94.08134	%	129.	112.	104.		0.0	30-Jun-1994	
94.08135	%	90.	98.	96.		0.0	30-Jun-1994	
94.08136	%	92.	89.	87.		0.0	30-Jun-1994	
94.08138	%	97.	100.	100.		0.0	30-Jun-1994	
94.08139	%	105.	100.	107.		0.0	23-Jun-1994	
94.08140	%	106.	104.	112.		0.0	23-Jun-1994	B
94.08143	%	98.	107.	108.		0.0	30-Jun-1994	B
94.08144	%	96.	96.	96.		0.0	30-Jun-1994	B
94.08145	%	96.	100.	102.		0.0	30-Jun-1994	B
EPA Limits:								
Water	%	76 - 114	88 - 110	86 - 115	86 - 115	86 - 118		
Soil	%	70 - 121	81 - 117	74 - 121	74 - 121			

REPORT NUMBER: 25882

Analyst	Reviewer	Section Leader	QA Officer
	Laura Kelly		mag
Date	7/5/94	Date	7/6/94

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in
'Quality Assurance for Health and Environmental Chemistry: 1992,' LA-12790-MS, Vol. I, pp. 19-20.

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