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TITLE: CORE ANALYSES AND OBSERVATION WELL DATA FROM MESITA DEL BUEY WASTE DISPOSAL AREAS AND IN ADJACENT CANYONS

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SUBMITTED TO: New Mexico Enviornmental Improvement Division

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ERRATA

This is a correction to page 52 of Enclosure 2 of the Laboratory's November 22, 1985 submittal to the New Mexico Environmental Improvement Division (EID) concerning the Compliance Order/Schedule dated May 7, 1985 (Docket Number 001007). Enclosure 2 was a report entitled "Core Analyses and Observation Well Data from Mesita del Buey Waste Disposal Areas and Adjacent Canyons." The correction is as follows: No data should have been reported for drill hole number LLC-85-15 for the 68-69 ft depth interval (i.e., no 1-butanol present). This sample was lost by the analytical laboratory, so no analytical results for volatile organic compounds are available for this depth interval.

Core Analyses and Observation Well Data from Mesita del Buey Waste Disposal Areas and in Adjacent Canyons

by

Micheline Devaurs

Los Alamos National Laboratory

Environmental Surveillance Group (HSE-8)

CONTENTS

EXECUTIVE SUMMARY 1

I. DESCRIPTION OF STUDY AREA 2
- A. Physical Location 2
- B. General Geology 3
- C. General Hydrology 4

II. METHODOLOGY/EXPERIMENTAL METHODS 6
- A. Canyon Observation Wells 6
  - 1. Drilling Methodology 6
  - 2. Sampling Methodology 6
    - a. Inorganic Samples 7
    - b. Volatile Organic Samples 8
  - 3. Analytical Methods 8
  - 4. Quality Assurance/Quality Control 9
- B. Test Holes 11
  - 1. Drilling Methodology 11
  - 2. Sampling Methodology 13
    - a. Inorganic Samples 14
    - b. Volatile Organic Samples 14
  - 3. Analytical Methods 15
  - 4. Quality Assurance/Quality Control 15

III. DATA 17

IV. ACKNOWLEDGEMENTS 18

V. REFERENCES 19

APPENDIX : VOLATILE ORGANIC ANALYSES

I. SAMPLE PREPARATION A-1
II. INSTRUMENTAL PARAMETERS A-3
III. RETENTION TIMES AND ESTIMATED DETECTION LIMITS A-7
IV. BLANKS, SPIKES, AND QUALITY CONTROL A-9
V. OBSERVATION WELL WATER SAMPLE RESULTS A-16

FIGURES

1. Location map of Los Alamos, New Mexico 22
2. Location of Mesita del Buey on the Pajarito Plateau . 23
3. Map of Los Alamos Area showing location of Mesita del Buey, Cañada del Buey and Pajarito Canyon 24
4. Los Alamos National Laboratory--technical areas and adjacent communities 25
5. Map of TA-54 showing Areas L and G 26
6. Planimetric map of Area G 27
7. Planimetric map of Area L 28
8. Detailed geologic section based on test holes and supply wells completed into the main aquifer 29
9. Location of observation wells 30
10. Location of test holes 31
11. Schematic of observation well construction 32
12. Chain of custody form 33

TABLES

I. Stratigraphy at Mesita del Buey 34

II. Observation well construction 35

III. Geologic Logs of Observation Wells in Cañada del Buey 36

IV. Geologic Logs of Observation Wells in Pajarito Canyon 37

V. Analysis parameters and test methods 38

VI. Characteristics of target volatile organic compounds 39

VII. Quarterly water levels for observation wells 40

VIII. Radiochemical and chemical quality of water from observation wells 41

IX. EP Toxicity Analytical Results for Core from Drill Hole Number LGC-85-09 45

X. EP Toxicity Analytical Results for Core from Drill Hole Number LGC-85-10 46

XI. EP Toxicity Analytical Results for Core from Drill Hole Number LLC-85-12 47

XII. EP Toxicity Analytical Results for Core from Drill Hole Number LLC-85-13 48

XIII. EP Toxicity Analytical Results for Core from Drill Hole Number LLC-85-14 49

XIV. EP Toxicity Analytical Results for Core from Drill Hole Number LLC-85-15 50

XV. EP Toxicity Analytical Results for Core from Drill Hole Number LLC-85-16 51

XVI. Identified Volatile Non-Target Pollutants 52

EXECUTIVE SUMMARY

This document provides the necessary information to comply with Tasks 5 and 6 of Paragraph 25 of the Compliance Order/Schedule issued to the Los Alamos National Laboratory on May 7, 1985. The Compliance Order/Schedule (Docket Number 001007) was issued by the New Mexico Environmental Improvement Division (EID) under authority of New Mexico's Hazardous Waste Management Act. Paragraph 25 requires the Laboratory to submit to the EID, by November 30, 1985, core analyses (Task 5) and analyses of perched water (Task 6). This report presents data obtained from seven test holes near waste disposal sites (Areas L and G) on Mesita del Buey and from seven observation wells in the adjacent canyons (Pajarito Canyon and Cañada del Buey).

Water from observation wells in Pajarito Canyon was analyzed for volatile organic, chemical and radiochemical constituents. No volatile organics were found. All chemical and radiochemical constituents were at concentrations below primary and secondary maximum contaminant levels specified for drinking water (US EPA, 1976; US EPA, 1979), with the exception of two manganese measurements. Radionuclides present in observation well water are naturally occurring and do not indicate radioactive contamination. Cores from seven test holes near Areas L and G were analyzed for volatile organics and Extraction Process (EP) toxicity constituents. All inorganic constituents were below the EP toxic regulatory standard [New Mexico Hazardous Waste Management Regulations (NM HWMR) 201.B.5.]. No "target" (analytical laboratory terminology defined in text) volatile organic compounds were found in the samples. However, a number of non-target volatile organic

compounds, primarily common organic solvents, were detected at low concentration in some samples.

This report provides data to further substantiate the Laboratory's ground water monitoring waiver application under New Mexico's Hazardous Waste Management Regulations Section 206.C.1.a(3). No data interpretation is provided; this is forthcoming in the March 31, 1986 submittal, required under Paragraph 25 of the Compliance Order/Schedule (Docket Number 001007).

I. DESCRIPTION OF STUDY AREA

A. Physical Location

The Los Alamos National Laboratory and the communities of Los Alamos and White Rock are located on the Pajarito Plateau, situated west of the Rio Grande on the eastern slopes of the Jemez Mountains (Fig. 1). Mesita del Buey is a narrow, southeast-trending mesa near the eastern margin of the Pajarito Plateau (Fig. 2). The mesa is bounded on the north by Cañada del Buey and on the south by Pajarito Canyon (Fig. 3).

The Laboratory's waste disposal sites are situated on Mesita del Buey in Technical Area (TA) 54, beginning at the junction of Rex Drive and Pajarito Road (Figs. 4,5). It is located at S 1/2, Section 31, T. 19 N, R7E, New Mexico Principle Meridian. The mesa is approximately 2 mi long and 0.25 mi wide.[1] Area G, comprising an area of 63 acres, is the Laboratory's site for disposal and storage of solid radioactive wastes (Fig. 6). Area L is a chemical waste disposal site (Fig. 7) and has an area of 3 acres. Wastes are placed

[1]Commonly utilized units--English units for study area description and discussion of drilling methodology, and metric units for discussion of sampling and analytical methods--are used in this report.

in shafts or pits dug into the surface of the mesa at both waste disposal sites. A more detailed description of these waste disposal facilities is in several references (Rogers, 1977; US DOE, 1979; Balo and Warren, 1984).

B. General Geology

Mesita del Buey slopes gently from an elevation of 6900 ft near its western edge to about 6600 ft near its eastern edge. Southeast-trending canyons to the north and south (Cañada del Buey and Pajarito Canyon, respectively) have cut 100 to 150 ft below the mesa surface. The mesa at Area L is at an elevation of 6800 ft, and the adjacent canyon floors are at an elevation of 6650 ft. At Area G, the elevation is 6700 ft, while the canyon floors are at 6600 ft.

Mesita del Buey is part of the Pajarito Plateau, which forms a topographic high area along the western part of the Rio Grande depression in north central New Mexico. Pajarito Plateau is formed by a series of ashfalls and ashflows (Pleistocene Age) of Bandelier Tuff. Sediments and basalts of the Santa Fe Group of middle Miocene to Pliestocene Age (Griggs, 1964) are below the volcanic tuff. At Area L there is 340 ft of unsaturated tuff underlain by 610 ft of unsaturated volcanic rock and sediments above the main aquifer. At Area G there is 220 ft of unsaturated tuff underlain by 630 ft of unsaturated volcanic rocks and sediments above the main aquifer. Formations in the Santa Fe Group, from oldest to youngest, are the Tesuque and Puye with interbedded Chino Mesa basalts. The stratigraphy of Mesita del Buey is summarized in Table I and shown in Fig. 8. A detailed geologic section based on data from

supply and test wells is shown in Fig. 8. Previous reports (Purtymun, 1966; Purtymun and Kennedy, 1971) discuss the geology in greater detail.

The uppermost layer of the Bandelier Tuff is the Tshirege member, ranging in thickness from 125 to 200 ft (Table I). The four units (2b, 2a, 1b, 1a), formed by a series of ashflows of rhyolite tuff, are a moderately welded tuff composed of quartz and sanidine crystals and crystal fragments, a few small rock fragments of latite, rhyolite, and some dark gray pumice in a matrix of light gray ash (Table I). Thickness of the units thins eastward because the ashflow dips gently to the southeast away from the source area in the Jemez Mountains to the west.

C. General Hydrology

Streamflow in Cañada del Buey, north of Areas L and G and in Pajarito Canyon south of Areas L and G, is intermittent. Intermittent streams in the canyon recharge water in the alluvium, which is perched on the underlying tuff. The alluvium in Cañada del Buey is thin and contains no perennial water due to both a small drainage area and small amount of runoff (Purtymun and Kennedy, 1971).

The intermittent stream in Pajarito Canyon recharges a body of water in the alluvium. As is typical of stream-connected aquifers, the water table is highest during the spring from snowmelt and in late summer from thundershowers. The water table declines in fall and early summer. Decline in the water table is due to high evapotranspiration, especially in areas of old gravel pits, which are near the top of the stream-connected aquifer in Pajarito Canyon (Purtymun and Kennedy, 1971).

The only aquifer in Los Alamos capable of water supply is the main aquifer. The major recharge area for the main aquifer is in intermountain basins formed by the Valles Caldera. Movement of water in the main aquifer is eastward toward the Rio Grande, where a part is discharged through springs and seeps into the river. It is estimated that the 11.5 mi reach through White Rock Canyon below Otowi Bridge receives a discharge from the aquifer of 4300 to 5500 acre-ft annually (Purtymun, 1966).

Below the mesa tops the depth to the main aquifer ranges from about 1200 ft along the western margin of the plateau to about 600 ft along the eastern part of the plateau (Kelly, 1974). The main aquifer lies at an average depth of about 950 ft at Area L and 850 ft at Area G. There are no perched aquifers on Mesita del Buey in the vicinity of Areas L and G between the mesa top and upper surface of the main aquifer. This conclusion is based on data collected during construction of two supply wells (Well Numbers PM-2, located 1 mi to the west, and PM-4, located 2 mi to the northwest) drilled into the main aquifer (Purtymun, 1984; Cooper et al, 1965). Three test holes (two in Pajarito Canyon--T-series-- and one in Area G--test hole ST-1) were completed dry into the basalts (Fig. 9) (Griggs 1964; Purtymun, 1978). Three test holes (PCM series), 60 to 127 ft deep, drilled at the flank of Pajarito Canyon were dry. These test holes document that perched water in Pajarito Canyon, adjacent to Mesita del Buey, is confined to the alluvium in the stream channel, and does not extend under the adjacent mesa.

II. METHODOLOGY/EXPERIMENTAL METHODS

A. Canyon Observation Wells

1. Drilling Methodology. Seven observation wells--four in Cañada del Buey (CDBO series, Fig. 9) and three in Pajarito Canyon (PCO series, Fig.9)--were drilled on April 16 and 17, 1985 by Los Alamos National Laboratory. The wells were augered through the alluvium into the underlying tuff using a truck-mounted Central Mine Equipment (CME) model 45 drilling rig[2] and a 7-in. auger. Wells were cased with 4-in.-diameter, schedule 40, polyvinyl chloride (PVC) casing (no glue couplings). The wells were screened with stainless steel, perforated with 0.25 in. hole wire wrap. Screens were set opposite the saturated alluvium into the top of the tuff (see Table II). The annular space between the hole wall and the casing was gravel-packed to within approximately 2.0 ft of the ground surface. The remainder of the annulus was filled to the surface with concrete. A 9-in. steel casing with a locking cap was installed. Each well was developed by jetting and pumping with a Home Lite centrifugal pump.

Details of well construction are shown in Fig. 11. The wells in Cañada del Buey were dry; those in Pajarito Canyon contained perched water. Drilling logs for the observation wells in Cañada del Buey and Pajarito Canyon are given in Tables III and IV, respectively.

2. Sampling Methodology. Water levels are recorded and well water samples are taken quarterly.

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[2]Any use of trade names and trademarks in this report is for descriptive purposes only and does not constitute endorsement by Los Alamos National Laboratory.

Water levels are measured using a weighted steel tape with measurements taken to the nearest 0.01 ft. Water samples are obtained after bailing the well dry, or at least three times, with a 2-in.-diameter, 3-ft-long brass bailer. After sampling the bailer is washed with distilled water prior to sampling the next well.

Sampling was conducted in accordance with Environmental Protection Agency (EPA) procedures (US EPA, 1985). Three water samples were taken from each well; one sample for volatile organic analyses and two samples for inorganic (i.e., chemical and radiochemical) analyses.

a. Inorganic Analyses. Water samples for inorganic analyses were collected in 4 L (for radiochemical) and 1 L (for chemical) polyethylene bottles. The 4 L bottle was acidified with 5 mL of concentrated nitric acid and returned to the laboratory within a few hours of sample collection for filtration through a 0.45 μm pore membrane filter.

Each sampling container for inorganic analyses was filled with well water, capped, given a sample label, chain of custody form (Fig. 12), and parafilm seal (intended to ensure sample integrity). The seal had to be broken to open the container. Information pertinent to sampling was recorded in a field log book. Samples were placed in boxes for transport to the laboratory. At the laboratory, sample custody was transferred to an inorganic chemist and samples were stored in a locked laboratory. A sample analysis request sheet was completed to track laboratory analysis of samples.

b. Volatile Organic Samples. Prior to sample collection, sample containers (500 mL glass wide-mouth bottles) were washed with soap and rinsed with distilled water. The jars were stored at 105°C until taken to the field for sample collection.

Sampling containers for organic analyses were filled with well water, and the jar cap sealed with teflon. Each jar had a sample label, chain of custody form and parafilm seal (intended to ensure sample integrity). The seal had to be broken to open the container. Information pertinent to sampling was recorded in a field log book. In the field, samples were stored on ice in ice chests immediately after sample collection.

Samples were transported to the laboratory in ice chests and sample custody transferred to an organic chemist. Until analyses were conducted, samples were stored in a locked refrigerator, in a locked laboratory. A sample analysis request sheet was completed to track laboratory analysis of samples.

3. Analytical Methods. The laboratory performing analyses on these samples was the Health and Environmental Chemistry Group (HSE-9) at Los Alamos National Laboratory.

Water samples were analyzed for inorganic chemical contaminants specified in EPA primary and secondary drinking water regulations (US EPA, 1976; US EPA 1979), radiochemical constituents (governed by EPA regulations contained in 40CFR141) and volatile organics (US EPA, 1985).

The samples are analyzed for the following inorganic chemical constituents: (1) Ag, As, Ba, Cd, Cr, F, Hg, Pb Se, and nitrate regulated under the primary

standards (US EPA, 1976) and (2) Ce, Cu, Fe, Mn, Zn, sulphate, total dissolved solids, and pH regulated under the secondary standards (US EPA, 1979).

The samples were analyzed radiochemically for Cs-137, Pu-238, Pu-239, Pu-240, H-3, and total U, as well as for gross alpha, gross beta, and gamma activities.

The volatile organic compounds analyzed for are given in Table VI. These compounds are referred to as "target" volatile organic compounds. This is analytical laboratory terminology; it has no regulatory significance. Other volatile organic compounds present were identified using a Gas Chromatograph/Mass Spectrometer (GC/MS) (see the Appendix for additional detail on methodology).

4. Quality Assurance/Quality Control. Documented quality assurance/quality control (QA/QC) procedures were followed (US EPA, 1985; Gautier et al, 1985). The QA program is managed by a Quality Assurance Coordinator who heads an independent Quality Assurance, Sample and Data Management Section within HSE-9. Daily QC is the responsibility of the analysts.

The QA involves concurrent analysis of matrix-based certified QA materials with every batch of samples. The laboratory maintains traceability to the National Bureau of Standards (NBS) standard reference materials (SRM) whenever matrix-based SRM's are available. When SRM's are not available, reference materials from national and international agencies (e.g., US EPA for chemical reference materials, Department of Energy Environmental Measurements Laboratory for radiochemical reference materials) are used. A QA computer database contains the following information for each sample: sample number, owner, matrix, analysis, request

number, requestor, request date, project number, analyst, technique, symbol, result, uncertainty, units, completion date, status, and analytical comment.

The QA evaluates accuracy and precision from results of analysis of reference materials. Accuracy is the degree of difference between average test results and true results, when the latter are known or assumed. Precision is the degree of mutual agreement among replicate measurements (frequently assessed by calculating the standard deviation of a set of data points).

The standard deviation is a measure of precision. Precision is a function of the concentration of analyte; that is, as the absolute concentration approaches the limit of detection, precision deteriorates. For instance, the precision for some H-3 determinations is quite large because many standards approached the limits of detection of a measurement. The laboratory addresses this by calculating a quality assurance parameter:

$$| \bar{X}_E - \bar{X}_C | < \sqrt{(S_E)^2 + (S_C)^2}$$

where $\bar{X}_E$ and $\bar{X}_C$ are experimentally determined and certified/concensus mean elemental concentrations, respectively. The S_E and S_C parameters are the standard deviations associated with $\bar{X}_E$ and $\bar{X}_C$, respectively. An analysis is considered under control when this condition is satisfied for a certain element in a given matrix.

The minimum detectable amount is the smallest amount of an analyte in a sample that will be detected with a beta probability of non-detection (Type II error) while accepting an alpha probability of erroneously detecting that analyte in an appropriate blank

sample (Type I error). The alpha and beta probabilities are commonly set at 0.05. Further details on QA are presented elsewhere (Gautier et al, 1985).

The number of QC analyses is a minimum of 10% of all analyses. The QC samples include duplicates, spikes, and appropriate sample blanks, in this case distilled water. Documented QC procedures for each instrument and analytical method are followed (Gautier et al, 1985). The appendix discusses blanks, spikes, and QC procedures used for volatile organic analyses.

B. Test Holes

1. Drilling Methodology. Seven test holes--a background hole at the western end of Mesita del Buey, 4 at Area L and 2 at Area G (Fig. 10)-- were drilled from August 13, 1985 through August 19, 1985 by Fox Engineering Company. Hollow-stem-auger, continuous coring of the tuff was accomplished using a truck-mounted CME model 55 drilling rig. A surface casing, 8 in. in diameter, was cemented 4 ft into the tuff. The hole was continuously cored through the surface casing using a 3-in. diameter, 5-ft-long, split-barrel sampler attached to the center drill stem of standard 6-5/8 in. O.D. hollow-stem augers.

Core was obtained in 5-ft intervals. Core alignment was maintained by marking core with a lengthwise crayon stripe once it was removed from the core barrel. Core sections for sample analyses were not marked. The core barrel was wiped clean between each core run. Each hole was cored to a depth of 100 ft. Core samples for laboratory analysis (detailed below) were taken at 10 ft intervals.

After each hole was cored to 100 ft depth, the continuous sampling system was removed from the center drill stem and replaced with the standard center drill bit. The hole was then extended, in most cases approximately 20 ft below the desired final hole depth. As the center drill stem and auger flights were removed from the hole some cuttings dropped downhole, filling the hole to the approximate desired depth. The depth of each hole, recorded during geophysical logging, is greater than 100 ft. The average hole diameter was 7 1/4 in., determined from the 3-arm caliper log.

Downhole equipment (e.g., auger flights, center drill stem, and continuous sampler) was decontaminated between drilling each hole using the following procedures. For drill holes in and around Area L, the equipment was steam-cleaned, then rinsed in methanol and allowed to air dry in successive tanks. For drill holes in Area G, all equipment was first monitored for radioactive contamination by Laboratory personnel (none was discovered); then downhole equipment was decontaminated using the same procedure as above.

During all drilling activities, cuttings brought to the surface by auger flights were immediately placed in 55-gallon drums to minimize potential for spreading contamination if encountered while the holes were being augered. In addition, for each 5-ft interval cored, measurements were taken in the hole and in the driller's breathing zone using an Organic Vapor Meter (OVM) and an Explosimeter, in accord with established procedures (BFEC, 1985a; BFEC, 1985b). The OVM monitoring indicated no respiratory protection was needed during the drilling phase of the study. Measurements with the explosive concentration meter in and adjacent

to each hole indicated no detectable concentration of explosive vapors present.

The hole numbering system is based on the purpose for each hole and the drilling sequence. The first letter, L, refers to Los Alamos National Laboratory. The second letter (G or L) identifies the waste disposal area in or around which the hole is located. The third letter indicates the purpose for the hole, assigned according to the following designations:

- M: Moisture Holes-To be used to determine intrinsic permeability and hydraulic conductivity of the tuff.
- C: Core and Pore-Gas Sampling Holes-To be used to collect samples for EP toxicity and volatile organic analyses, and for the installation of pore gas sampling apparatus.
- P: Psychrometer Holes-To be used for installing thermocouple psychrometers and pressure transducers to determine local moisture conditions, temperature, and pressure.
- N: Neutron Moisture Access Holes-To be used for moisture measurements.

The middle designation, 85, indicates the year (1985) that these holes were drilled. The final two digits refer to drilling sequence.

This report discusses only LLC and LGC holes: a background hole at the western end of Mesita del Buey (Test Hole Number LLC-85-13), 4 at Area L (LLC-85-12; LLC-85-14; LLC-85-15; LLC-85-16) and 2 at Area G (LGC-85-09; LGC-85-10).

2. Sampling Methodology. Sampling was conducted in accordance with EPA procedures (US EPA, 1985). From each 10 ft section of core, two representative samples were taken--one for volatile organic analyses and one

for inorganic analyses, respectively. Samples were collected in 500 mL widemouth glass bottles. The laboratory performing analyses on these samples was the Health and Environmental Chemistry Group (HSE-9) at Los Alamos National Laboratory.

a. Inorganic Samples. Each sampling container for inorganic analyses was filled with crushed soil core, given a sample label, chain of custody form and parafilm seal (intended to ensure sample integrity). The seal had to be broken to open the container. Information pertinent to sampling was recorded in a field log book. Samples were placed in boxes for transport to the laboratory. At the laboratory, sample custody was transferred to an inorganic chemist and samples were stored in a locked laboratory. A sample analysis request sheet was completed to track laboratory analysis of samples.

b. Volatile Organic Samples. Prior to sample collection, sample jars were washed with soap and rinsed with distilled water. The jars were stored at 105°C until taken to the field for sample collection.

Sampling containers for organic analyses were completely filled with crushed soil core, and the jar cap sealed with teflon. Each jar had a sample label, chain of custody form and parafilm seal (intended to insure sample integrity). The seal had to be broken to open the container. Information pertinent to sampling was recorded in a field log book. In the field, samples were stored on ice in ice chests immediately after sample collection.

For each drill hole, a field blank was submitted with the samples. It was a jar with organic-free water

open to the atmosphere at the site while the hole was being drilled.

Samples were transported to the laboratory in ice chests and sample custody transferred to an organic chemist. Until analyses were conducted, samples were stored in a locked refrigerator, in a locked laboratory. A sample analysis request sheet was completed to track laboratory analysis of samples.

3. Analytical Methods. Core samples were analyzed for inorganics (i.e., toxic metals) and volatile organics as defined in Table V. The volatile organic compounds analyzed for are listed in Table VI. These compounds are referred to as "target" volatile organic compounds. This is analytical laboratory terminology, and has no regulatory significance. Other volatile organic compounds present were identified using GC/MS. Any non-target compounds detected are detailed in Section III. Analysis used an atomic absorption spectrophotometer for metals. A purge and trap/GC/Flame Ionization Detection (FID) procedure, using GC/MS to identify non-target compounds, was used for volatile organic analyses. The methods of extraction and analysis for volatile organic compounds, detailed in the Appendix, are modifications and compilations of recommended procedures (US EPA, 1984; US EPA, 1985).

4. Quality Assurance/Quality Control. Documented quality assurance/quality control (QA/QC) procedures were followed (US EPA, 1985; Gautier et al, 1985). The QA program is managed by a Quality Assurance Coordinator who heads an independent Quality Assurance, Sample and Data Management Section within HSE-9. Daily QC is the responsibility of the analysts.

The QA involves concurrent analysis of matrix-based certified QA materials with every batch of samples. The laboratory maintains traceability to the National Bureau of Standards (NBS) standard reference materials (SRM) whenever matrix-based SRM's are available. When SRM's are not available, reference materials from national and international agencies (e.g., US EPA for chemical reference materials) are used. A QA computer database contains the following information for each sample: sample number, owner, matrix, analysis, request number, requestor, request date, project number, analyst, technique, symbol, result, uncertainty, units, completion date, status and analytical comment.

The QA evaluates accuracy and precision from results of analysis of reference materials. Accuracy is the degree of difference between average test results and true results, when the latter are known or assumed. Precision is the degree of mutual agreement among replicate measurements (frequently assessed by calculating the standard deviation of a set of data points).

The standard deviation is a measure of precision. Precision is a function of the concentration of analyte; that is, as the absolute concentration approaches the limit of detection, precision deteriorates. The laboratory addresses this by calculating a quality assurance parameter:

$$| \bar{X}_E - \bar{X}_C | < \sqrt{(S_E)^2 + (S_C)^2}$$

where $\bar{X}_E$ and $\bar{X}_C$ are experimentally determined and certified/concensus mean elemental concentrations, respectively. The S_E and S_C parameters are the standard deviations associated with $\bar{X}_E$ and $\bar{X}_C$, respectively. An

analysis is considered under control when this condition is satisfied for a certain element in a given matrix.

The minimum detectable amount is the smallest amount of an analyte in a sample that will be detected with a beta probability of non-detection (Type II error) while accepting an alpha probability of erroneously detecting that analyte in an appropriate blank sample (Type I error). The alpha and beta probabilities are commonly set at 0.05. Further details on AQ are presented elsewhere (Gautier et al, 1985).

The number of QC analyses is a minimum of 10% of all analyses. The QC samples include duplicates, spikes and appropriate sample blanks. Also, ten samples selected at random were split with an outside contract laboratory. Documented QC procedures for each instrument and analytical method are followed (Gautier et al, 1985). The Appendix details blanks, spikes and QC procedures used for volatile organic analyses.

Standard reference materials do not exist for EP toxicity analyses. They were generated by making a sample for each EP toxic constituent at 20% of the maximum concentration limit. The sample was split--analyses were run on spiked and unspiked parts.

III. DATA

Quarterly water levels for the observation wells are given in Table VII. Radiochemical and chemical quality of water from the observation wells, from samples taken June 11, 1985, is in Table VIII. All chemical and radiochemical constituents were at concentrations below primary and secondary maximum contaminant levels specified for drinking water (US EPA, 1976; US

EPA, 1979), with the exception of two manganese measurements. Radionuclides present in observation well water are naturally occurring and do not indicate radionuclide contamination. None of the "target" volatile organics in Table VI were detected in observation well water, samples September 12, 1985 (see the Appendix for further detail).

Results of analyses of cores from test holes for EP toxicity are in Tables IX to XV. All EP toxic parameters were below the EP toxic regulated concentration (Hazardous Waste Management Regulations 201.B.5). All EP toxic parameters were below the detection limit (Tables IX-XV) with the exception of one measurement for barium. Barium was detected in the 0-10 ft depth of drill hole number LGC-85-10 at 1.5 +/- 0.4 mg/L (Table X).

None of the "target" volatile organics listed in Table VI were detected in samples from any of the drill holes. Some non-target compounds, primarily common organic solvents, were detected in some samples (Table XVI). Approximate concentrations ranged from the detection limit to about 1.5 times the detection limit.

IV. ACKNOWLEDGEMENTS

The author acknowledges the many people who have contributed to this project to date. Particular thanks go to Bendix Field Engineering Corporation staff for their technical assistance in directing the drilling and sampling operations at Areas G and L; Suzanne Ehart and Daryl Knab of the Health and Environmental Chemistry Group for their direction of volatile organic and inorganic analyses respectively; and to Dave McInroy for his assistance in field operations.

Other members of the Environmental Surveillance Group, HSE-8, provided significant direction and assistance in field operations and report review: Thomas Gunderson, Alan Stoker, Anthony Drypolcher, William Purtymun and Naomi Becker. Additional review was provided by Wayne Hansen and Jim Mitchell.

Kathy Derouin and Mary Lou Keigher did the word processing and assembly of this report in a very professional manner.

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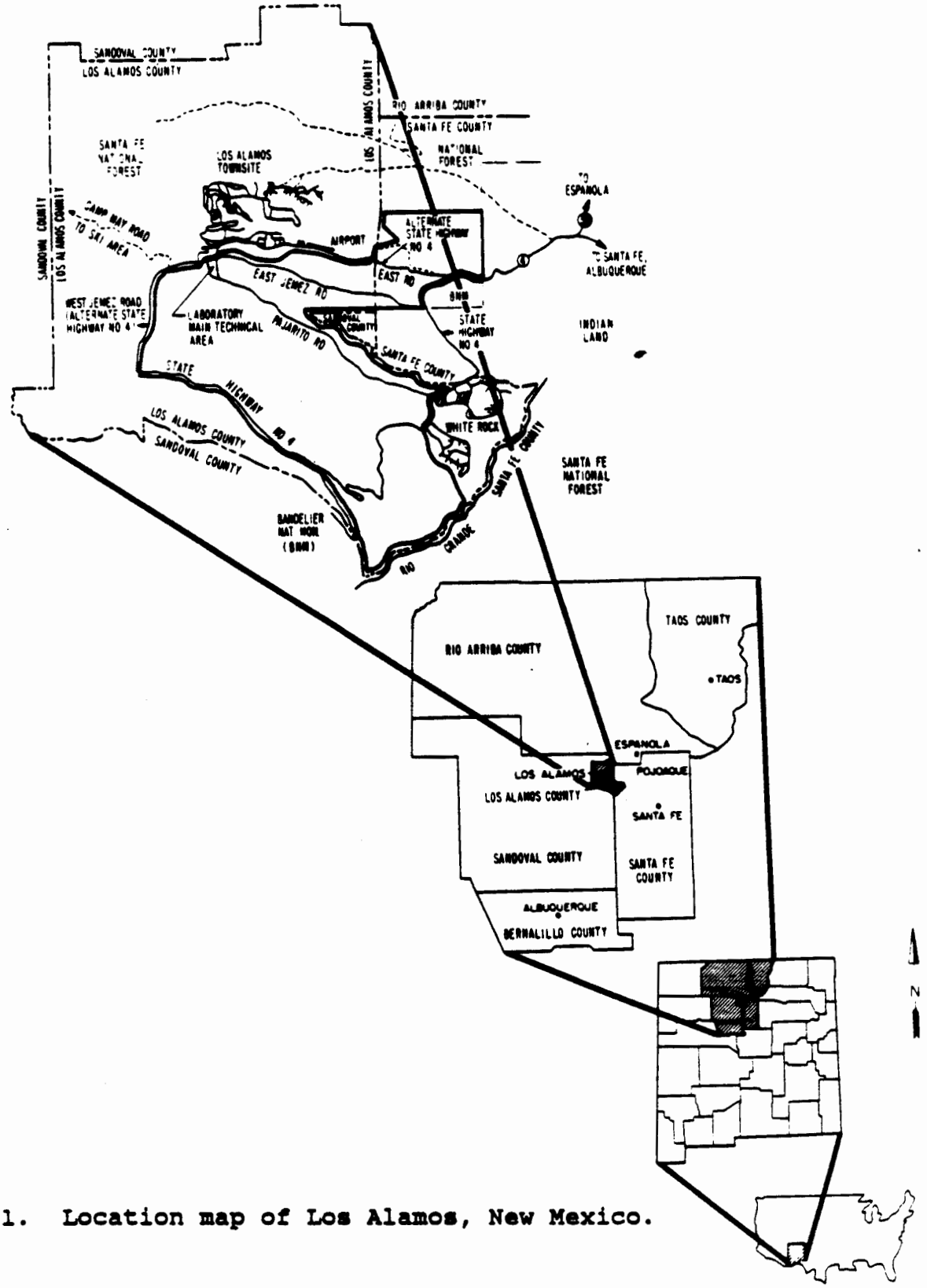


Fig. 1. Location map of Los Alamos, New Mexico.

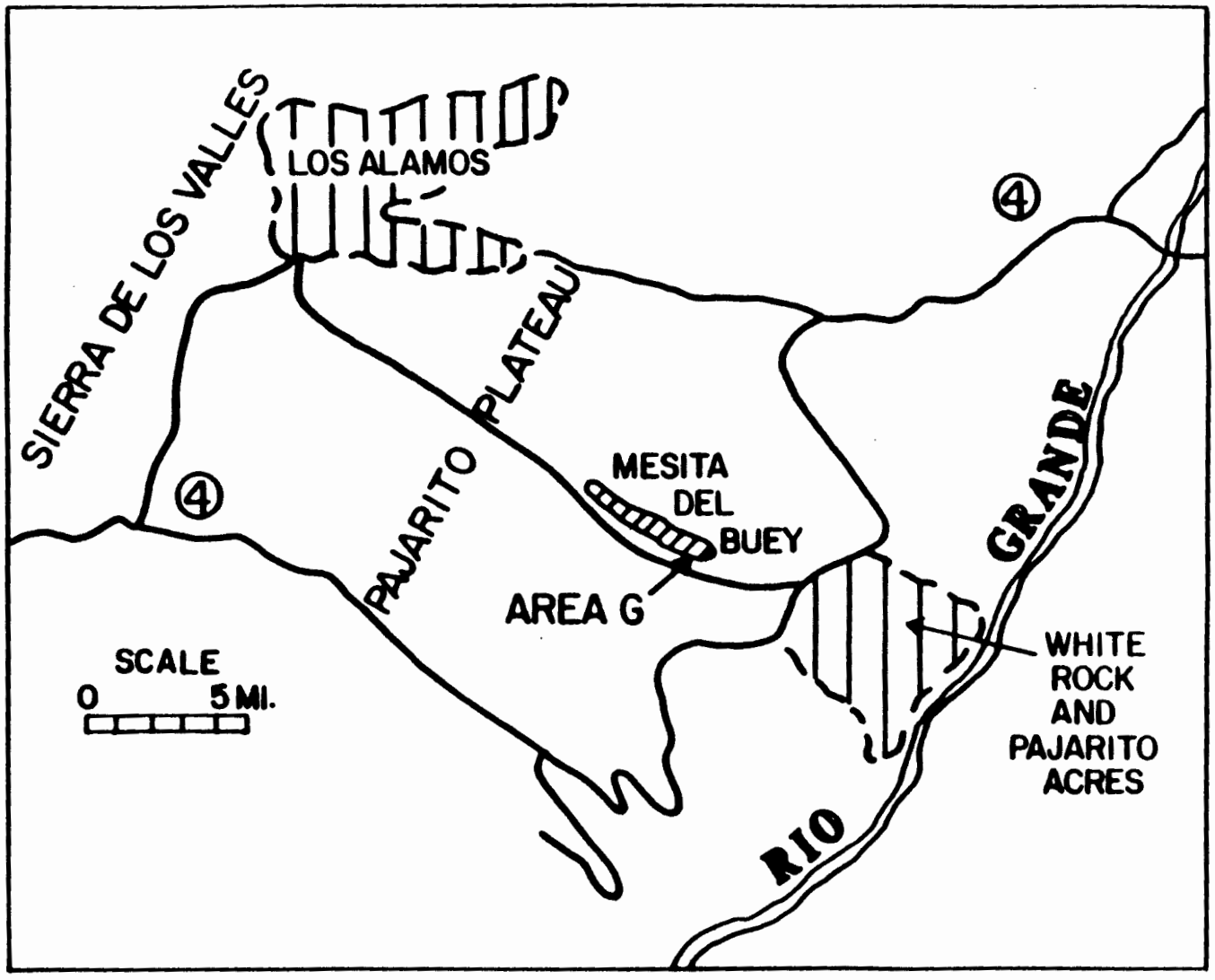


Fig. 2. Location of Mesita del Buey on the Pajarito Plateau.

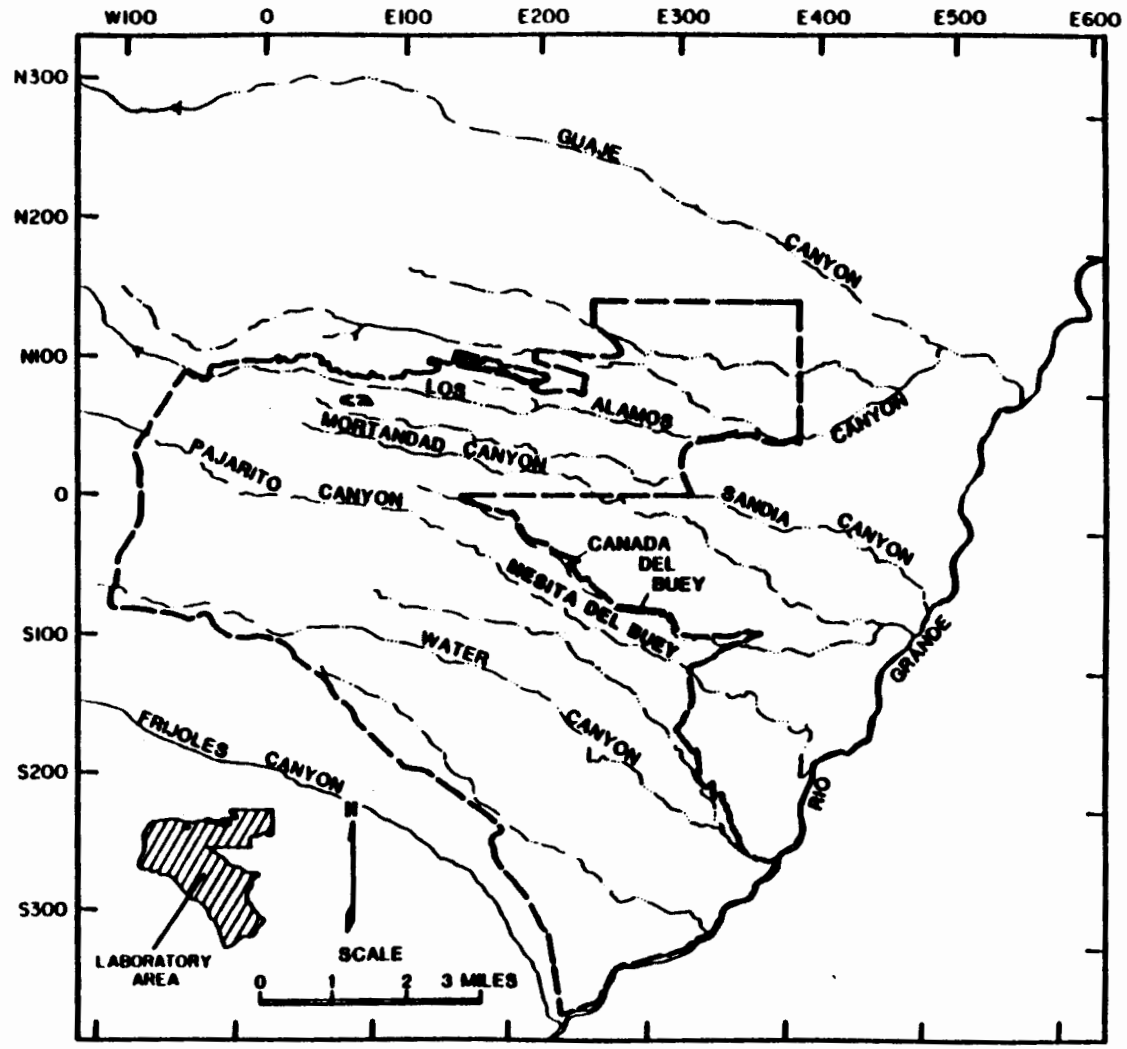


Fig. 3. Map of Los Alamos Area showing location of Mesita. del Buey, Cañada del Buey and Pajarito Canyon.

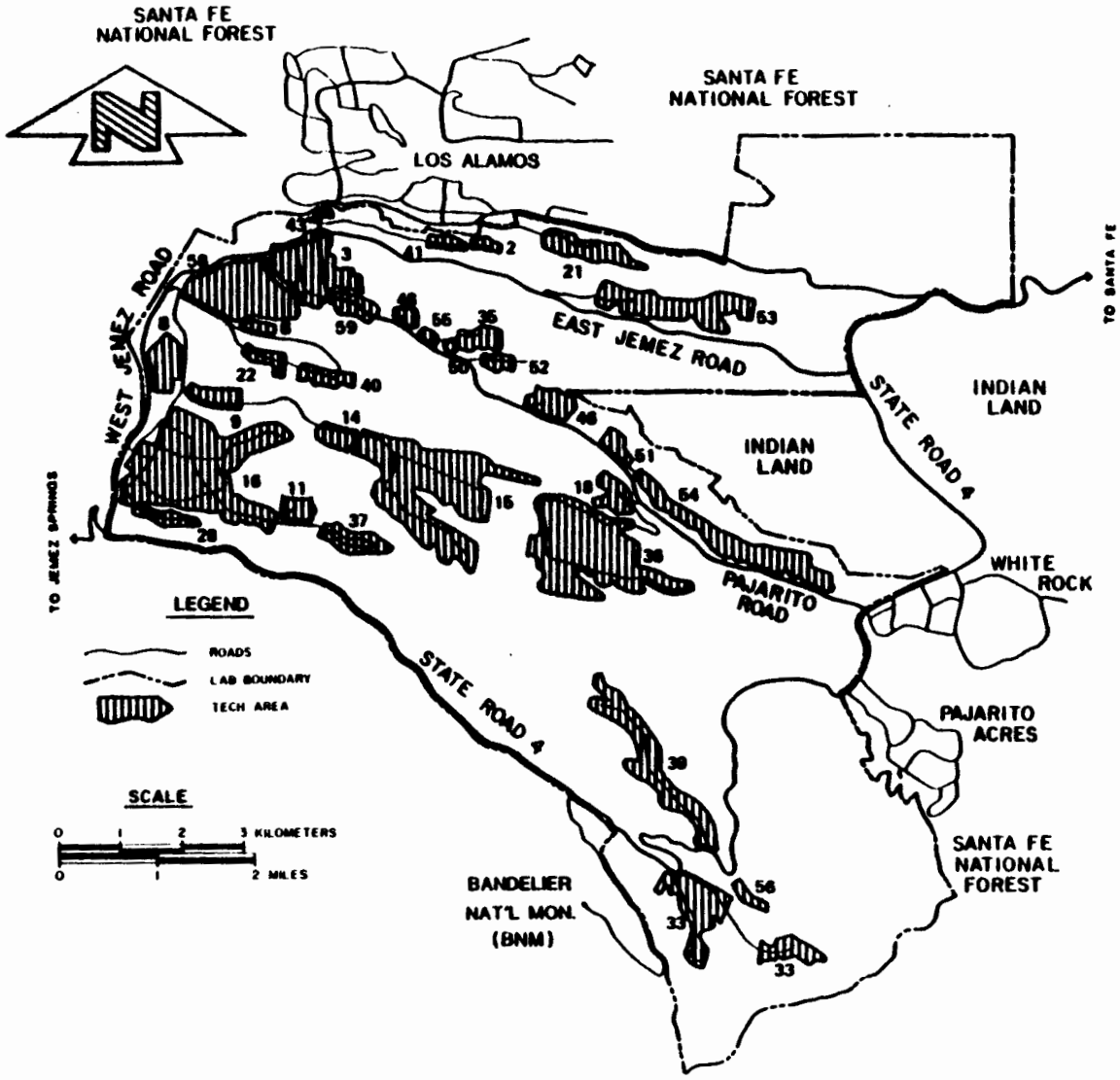


Fig. 4. Los Alamos National Laboratory--technical areas and adjacent communities.

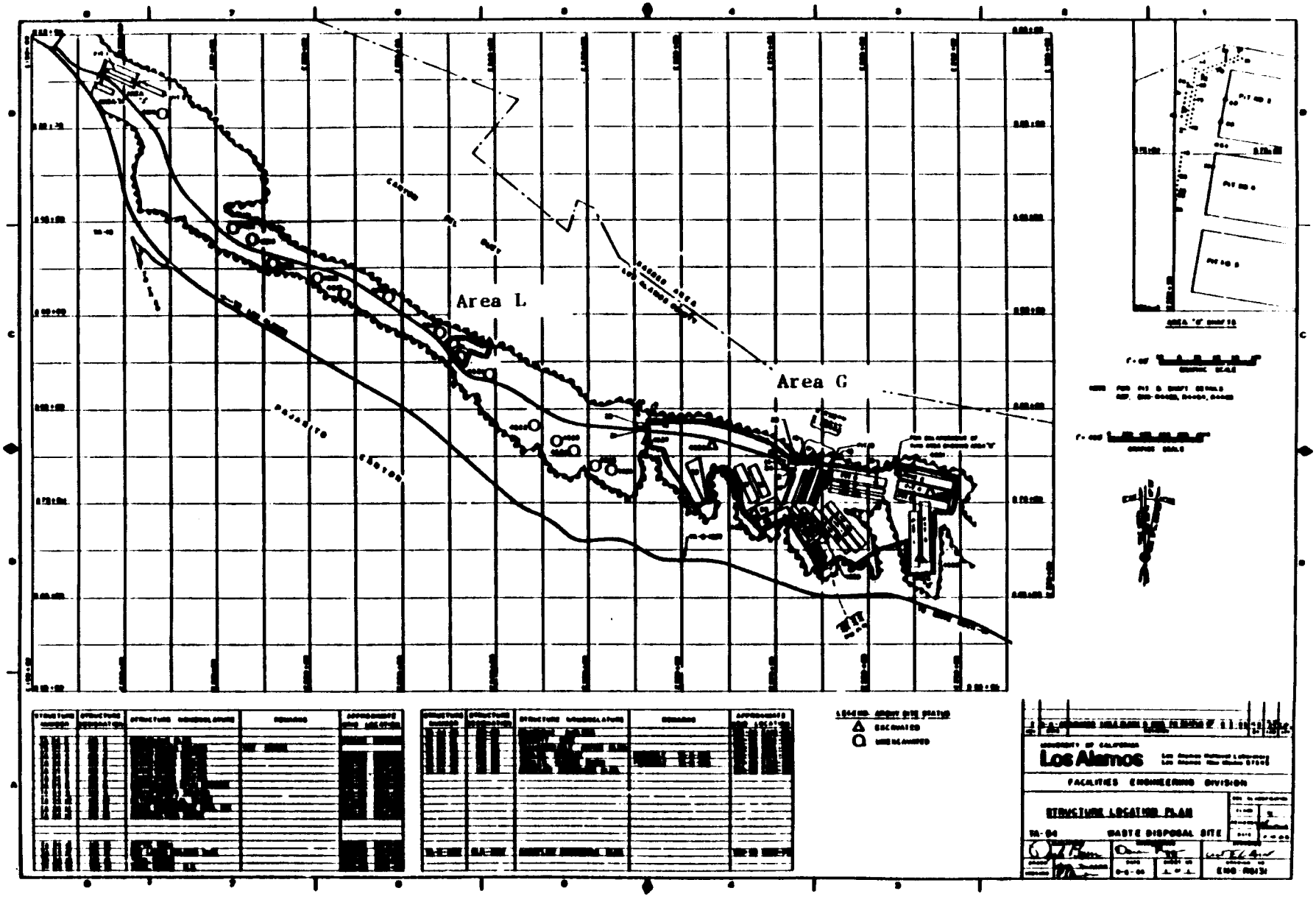


Fig. 5. Map of TA-54 showing Areas L and G.

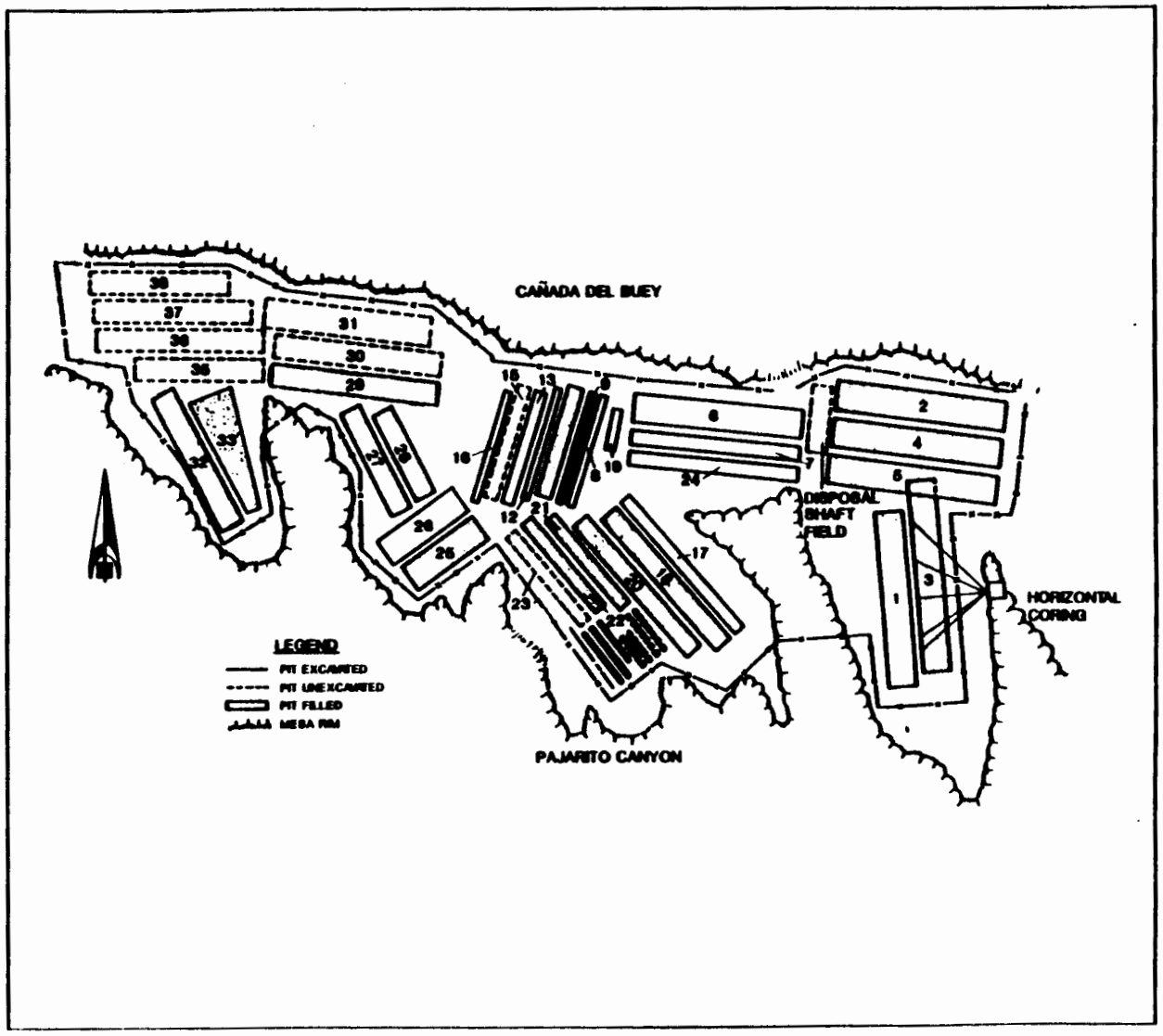
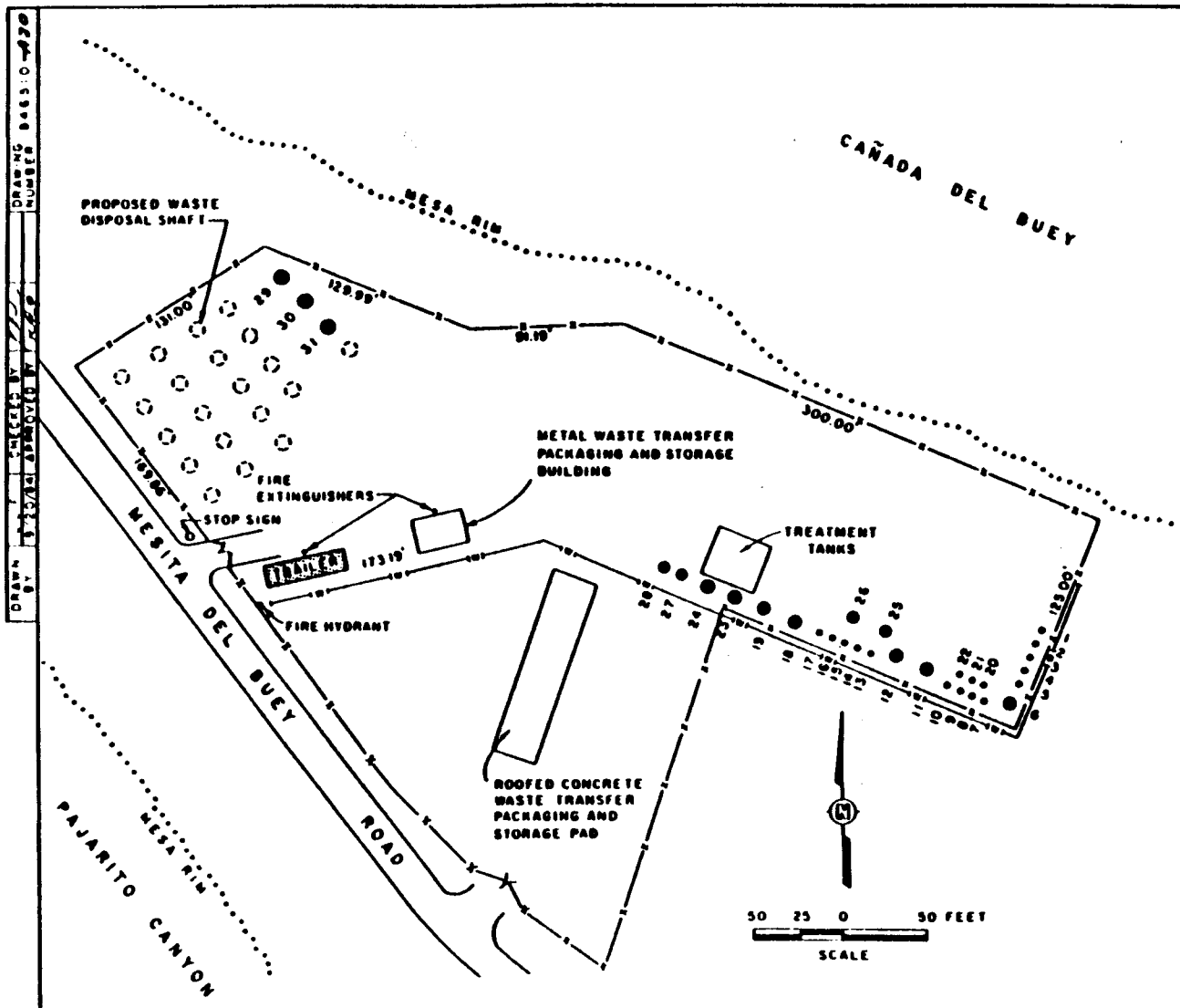


Fig. 6. Planimetric map of Area G.



AREA L SHAFTS[1]
(INFORMATION CURRENT MARCH 1985)

SHAFT NO.	SHAFT DIAMETER (FEET)	DATE DRILLED	DATE CAPPED	CONTENTS
1	3	4/80	5/81	ORGANICS[2]
2	3	2/75	7/79	ACIDS & BASES
3	3	2/75	10/79	INORGANIC
4	3	2/75	5/80	ORGANIC
5	3	2/75	6/77	WASTE OIL
6	4	6/75	6/79	REACTIVE
7	3	6/75	6/79	REACTIVE
8	3	6/75	6/79	REACTIVE
9	3	6/75	6/79	GAS CYLINDERS
10	3	6/77	6/79	WASTE OIL
11	3	5/78	7/79	WASTE OIL/SOLVENT
12	4	5/78	7/79	WASTE OIL/SOLVENT
13	3	6/79	5/82	INORGANIC
14	3	6/79	5/82	REACTIVE
15	3	6/79	5/82	REACTIVE
16	3	6/79	5/82	GAS CYLINDERS
17	3	6/79	5/82	ORGANIC
18	3	6/79	6/80	WASTE OIL
19	3	4/80	5/82	WASTE OIL
20	3	4/80	5/83	INORGANIC
21	3	4/80	OPEN	GAS CYLINDERS
22	3	4/80	5/83	ORGANIC
23[3]	3	4/82	2/84	WASTE OIL
24[4]	3	4/82	4/84	ORGANIC & WASTE OIL
25	6	5/82	OPEN	INORGANIC
26	6	5/82	3/84	ORGANIC
27	4	5/83	2/85	SPECIAL[5]
28	4	1/82	OPEN	SPECIAL
29	6	12/83	8/84	ORGANIC
30	6	12/83	8/84	ORGANIC
31	6	12/83	5/84	ORGANIC
32	4	5/84	5/84	ORGANIC
33	6	5/84	2/85	ORGANIC
34	6	2/85	OPEN	ORGANIC

NOTES:
(1) ALL SHAFTS ARE APPROXIMATELY 60 FEET DEEP.
(2) SHAFT ONE CONTAINS WASTES NOT IN DRUMS.
(3) PRIOR TO SHAFT 23, LIQUIDS WERE DISPOSED OF IN DRUMS WITHOUT ADDING ABSORBENTS
(4) MIDDLE SECTION OF THIS SHAFT NOT USED.
(5) USED FOR MISCELLANEOUS WASTE REQUIRING GREATER ISOLATION.

Fig. 7. Planimetric map of Area L.

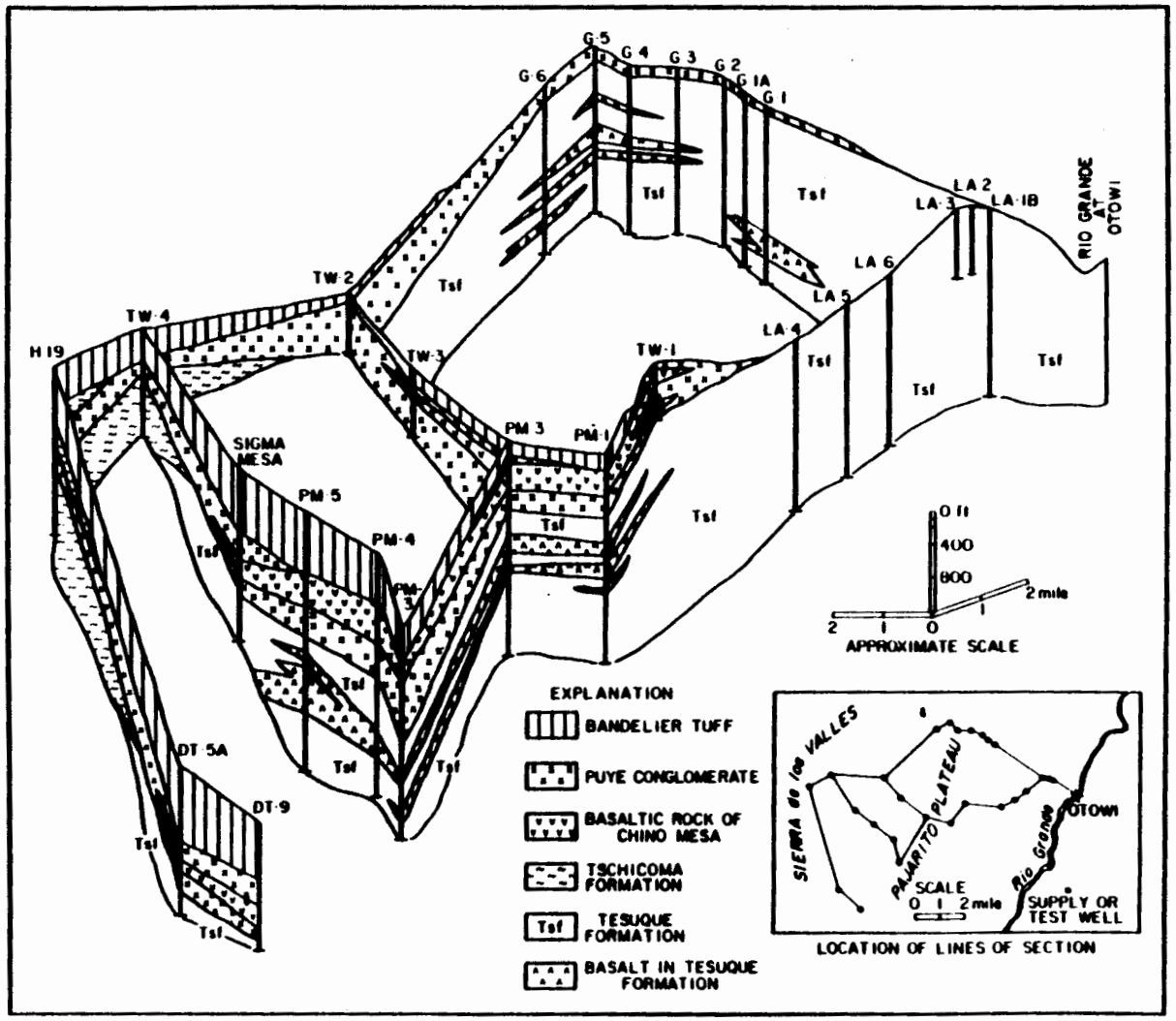


Fig. 8. Detailed geologic section based on test holes and supply wells completed into the main aquifer.

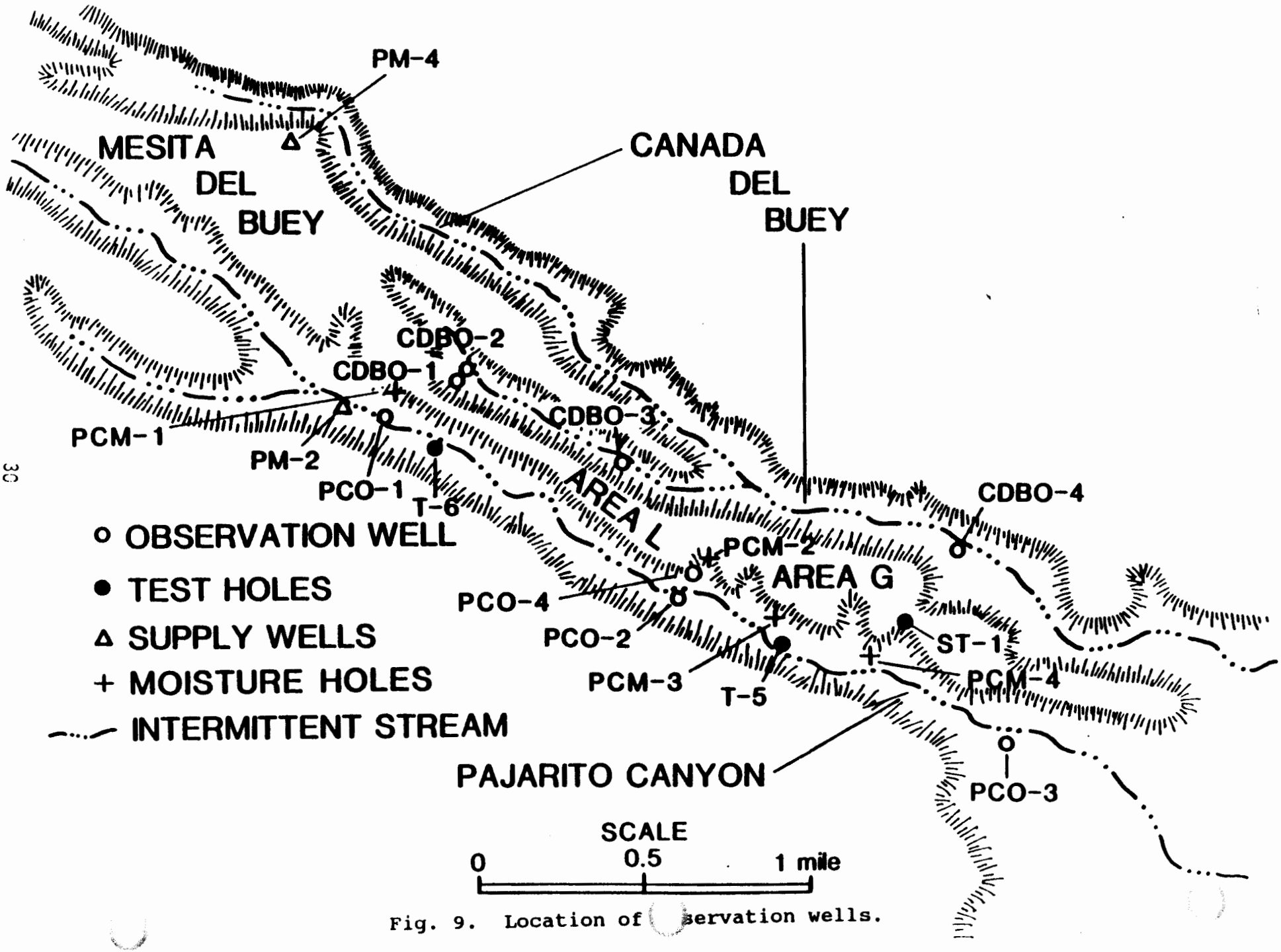


Fig. 9. Location of observation wells.

(Figure is at the back of the report in the pocket.)

Fig. 10. Location of test holes (see text for explanation of hole numbering scheme).

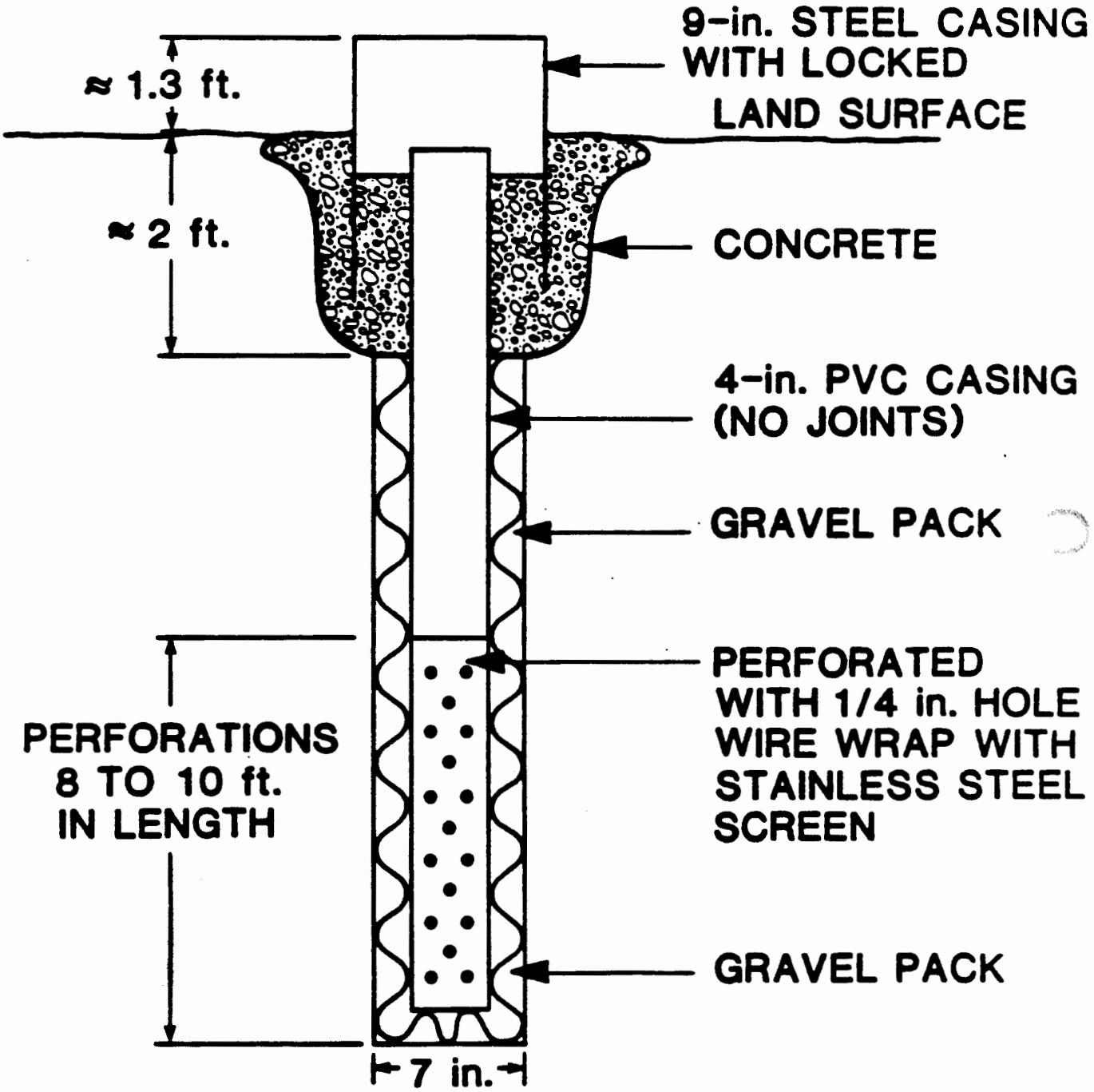


Fig. 11. Schematic of observation well construction.

DATE	TIME	SAMPLE NO.	ORIGIN

SAMPLE TAG HSE-8 HSE-9

LOS ALAMOS NATIONAL LABORATORY

LOCATION SAMPLED
DESCRIPTION
REMARKS
REQUESTED ANALYSIS

SAMPLED BY: (PRINT AND SIGN)	TAG NO.____ OF ____	LOG REFERENCE

CHAIN OF CUSTODY

RELEASED BY: (PRINT AND SIGN)	DATE AND TIME	PURPOSE	RECEIVED BY: (PRINT AND SIGN)

FINAL DEPOSITION	BY: (PRINT AND SIGN)

Fig. 12. Chain of custody form.

TABLE I - Stratigraphy at Mesita del Buey

BANDELIER TUFF		Approximate Thickness Feet	Description
Tshirege Member	Unit 2b	60	Rhyolite tuff, light gray to brown moderately welded, forms upper surface of Mesita del Buey.
	Unit 2a	30-85	Rhyolite tuff, light gray pumiceous moderately welded, outcrops on walls of Mesita del Buey, thin from west to east.
	Unit 1b	25	Rhyolite tuff, grayish brown, moderately welded, outcrop on wall of Mesita del Buey.
	Unit 1a	10-30	Rhyolite tuff, light orange to light brown pumiceous tuff, non-welded to moderately welded, outcrops in lower slopes of Mesita del Buey, thin west to east.
Otowi Member		120	Rhyolite Tuff, light gray, non-welded, pumiceous, does not outcrop at Mesita del Buey is found in subsurface.
Guaje Member		10-30	Rhyolite pumice, light gray, nonwelded, an ashfall pumice.
SANTA FE GROUP			
Chino Mesa Basalt		250-300	Composed of basalt flow rocks and interbedded sediments.
Puye Conglomerate		700-750	Upper 600-650 feet is volcanic debris, lower 70 feet is poorly consolidated channel-fill.
Tesuque Formation		+1200	Silty sandstones, sandstones with lenses of clay and pebbly conglomerate, many contain interbedded basalts.

TABLE II - Observation Well Construction[1]

Well[2]	Height of Steel Casing (ft)	Total Depth (ft)	Casing Depth[3] Interval (ft)	Perforated Depth[3] Interval (ft)
PCO-1	1.2	12.3	0-4.3	4.3-12.3
PCO-2	1.0	9.5	0-1.5	1.5-9.5
PCO-3	1.2	17.7	0-5.7	5.7-17.7
CDBO-1	1.37	13.1	0-5.1	5.1-13.1
CDBO-2	1.30	17.9	0-5.9	5.9-17.9
CDBO-3	1.20	12.4	0-4.4	4.4-12.4
CDBO-4	1.30	12.1	0-4.1	4.1-12.1

[1]All numbers in this table are measured from the land surface datum.
[2]Well abbreviations are: PCO = Pajarito Canyon Observation Well and CDBO = Canada del Buey Observation Well.
[3]All holes were cased with 4-inch diameter Polyvinyl Chloride (PCV) pipe. See Fig. 11 for schematic of well construction.

TABLE III - Geologic Logs of Observation Wells in Canada del Buey

	Depth (ft) From	To
CDBO-1		
Alluvium, light brown, silty, sand with some clay	0	9
Tuff, brown, weathered, quartz and sanidine crystal and crystal fragments Few rock fragments, (tuff weathered contains est. 20 to 30% silt and clay). (Drilled 4/17/85, Dry)	9	15
CDBO-2		
Alluvium, light brown as in Obs. Well CDBO-1	0	12
Tuff, brown, as in Obs. Well CDBO-1 (Drilled 4/18/85, Dry)	12	18
CDBO-3		
Alluvium, light brown, silty, sand, with some clay	0	8
Tuff, light gray, quartz, and sanidine crystal and crystal fragments. Some small rock fragments, slight amount of clay as result of weathering. (Drilled 4/18/85, Dry)	8	12
CDBO-4		
Alluvium, light brown as in Obs. Well CDBO-3	0	9
Tuff, light gray as in Obs. Well CDBO-3 (Drilled 4/18/85, Dry)	9	12

TABLE IV - Geologic Logs of Observation Wells in Pajarito Canyon

	Depth (ft) From	To
PCO-1		
Alluvium, light brown, gravels, cobbles, and boulders intermixed with clays, silts, and sands	0	11
Tuff, light reddish brown, non- to moderately-welded quartz and sanidine crystals and crystal fragments, few small rock fragments (Drilled 4/16/85)	11	22
Water level 5/23/85 1.12 ft (from land surface datum)		
PCO-2		
Alluvium, same as PCO-1	0	9
Tuff, same as PCO-1 (Drilled 4/17/85)	9	22
Casing driven in hole to a depth of about 10 ft. Unable to clean out to total depth of hole.		
Water level 5/28/85 3.25 ft (from land surface datum)		
PCO-3		
Alluvium, light brown, gravels, a few cobbles in a matrix of silty sand	0	12
Tuff, light gray to light brown, weathered, some quartz and sanidine crystals and fragments, a few small rock fragments in a matrix of weathered tuff, mostly silts and clay (Drilled 4/17/85)	12	20
Water level 5/23/85 1.71 ft (from land surface datum)		

TABLE V - Analysis Parameters and Analytical Methods

Parameters	Analytical Method	Reference[1]
EP Toxicity	EP Toxicity Extraction and Graphite Furnace Atomic Absorption Spectrophotometry	SW 1310
Arsenic		SW 7060
Selenium		SW 7740
	EP Toxicity Extraction and Direct Aspiration Atomic Absorpiton Spectrophotometry	SW 1310
Barium		SW 7080
Cadmium		SW 7130
Chromium		SW 7190
Lead		SW 7420
Silver		SW 7760
	EP Toxicity Extraction and Manual Cold Vapor Teschnique	SW 1310
Mercury		SW 7470
Volatile Organics		
Purge and Trap/GC/FID[2]		624;SW; US EPA; Appendix

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1 "SW" refers to Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 2nd Edition, EPA, July 1982. Method numbers are given. "624" refers to Federal Register, Vol. 44, No. 233, Monday, December 3, 1979. "US EPA" refers to A Characterization of Hazardous Waste Sites. A Methods Manual. Volume III Available Laboratory Analytical Methods, EPA-600/4-84-038, April 1984. "Appendix" refers to Appendix of this report.

2 "GC/FID" refers to Gas Chromatograph/Flame Ionization Detection.

TABLE VI - Characteristics of Target Volatile Organic Compounds

Compound	Retention Time (min)	Detection Limit[1] Water (mg/L)	Soil (µg/kg)	Internal Standard[2]
11 Dichloroethylene[3]	4.26			
Methylene chloride	4.36	5	521	BCM
T 1,2 Dichloroethylene	4.63	5	521	BCM
11 Dichloroethane	4.76	10	1042	BMC
Chloroform	5.27	10	1042	1C2BP
111 Trichloroethane	5.68	15	1563	BCM
12 Dichloroethane	5.72	8	833	BCM
Benzene	5.96	521	BCM	BCM
Carbon Tetrachloride	5.98	20	2083	BCM
Trichloroethylene	6.65	5	521	1C2BP
12 Dichloropropane	6.69	5	521	BCM
Bromodichloromethane	6.86	10	1042	14 DCB
Toluene	8.36	5	521	1C2BP
112 Trichloroethane	8.37	15	1527	1C2BP
Chlorodibromomethane	9.15	10	1042	14 DCB
Tetrachloroethylene	9.52	20	2083	1C2BP
Chlorobenzene	10.56	12	1250	1C2PB
Ethylbenzene	10.83	8	833	14 DCB
Bromoform	11.71	10	1042	14 DCB
1122 Tetrachloroethane	12.35	20	2083	14 DCB
Bromobenzene	12.95	22	2292	1C2BP
13 Dichlorobenzene	14.75	5	521	14 DCB
14 Dichlorobenzene	14.91			
12 Dichlorobenzene	15.48	5	521	14 DCB

[1]The detection limit is based on the intercept of the external standard calibration curve and assumes 100% recovery.
[2]The internal standards are abbreviated, and their retention times given as follows:
BCM = bromochloromethane, retention time = 5.23;
1C28P = 1-chloro-2-bromopropane, retention time = 8.52; and
14DCB = 1,4 dichlorobutane, retention time = 12.15.
[3]Blank lines indicate no quantitation standard available.

TABLE VII - Quarterly Water Levels for Observation Wells

Date	Water Level Measured from Land Surface Datum (ft)						
	PCO-1	PCO-2	PCO-3	CDBO-1	CDBO-2	CDBO-3	CDBO-4
5-28	-	-	-	Dry	Dry	Dry	Dry
6-11	1.25	3.63	2.98	-	-	-	-
9-4	-	-	-	Dry	Dry	Dry	Dry
9-12	1.29	5.05	3.30	-	-	-	-

Table VIII

Radiochemical and Chemical Quality of Water from Observation Wells

Well No.	^{137}Cs (10^{-9} µCi/mL)	^{238}Pu (10^{-9} µCi/mL)	$^{239,240}Pu$ (10^{-9} µCi/mL)	Gross Alpha (10^{-9} µCi/mL)	Gross Beta (10^{-9} µCi/mL)	^{3}H (10^{-9} µCi/mL)	Total U (µg/L)	Gross Gamma (counts/min/L)
PCO-1	74 ± 98	0.000 ± 0.020	0.005 ± 0.016	2.0 ± 4.0	8.0 ± 1.8	-0.4 ± 0.8	1.4 ± 1.0	-50 ± 120
PCO-2	70 ± 82	0.000 ± 0.001	0.000 ± 0.024	9.0 ± 26.0	16.0 ± 4.0	0.6 ± 0.8	3.8 ± 1.6	+60 ± 120
PCO-3	-10 ± 84	0.026 ± 0.030	0.016 ± 0.022	3.0 ± 4.0	4.0 ± 1.2	1.3 ± 0.8	1.5 ± 1.0	+40 ± 120
Maximum Contaminant Level[a]	200	15	15	15[b]	---	20	1800[c]	---

Table VIII (cont)

	Primary Chemical Quality (concentrations in mg/L)							
	Cl	Cu	Fe	Mn	SO_4	Zn	TDS	pH
PCO-1	68	0.014	0.095	0.018	18.5	0.029	298	6.7
PCO-2	14	<0.005	0.072	0.371	10.0	<0.01	143	6.89
PCO-3	22	0.038	0.005	0.388	7.6	0.052	251	7.5
Secondary Contaminant Level[d]	250	1.0	0.3	0.05	250	5.0	500	6.5-8.5

Table VIII (cont)

	Primary Chemical Quality (concentrations in mg/L)									
	Ag	As	Ba	Cd	Cr	F	Hg	N	Pb	Se
PCO-1	<0.001	0.004	0.196	<0.001	0.006	0.5	<0.002	1.7	<0.003	<0.003
PCO-2	<0.001	0.001	0.069	<0.001	0.006	0.3	<0.002	0.3	0.006	<0.003
PCO-3	<0.001	0.001	0.104	<0.001	0.005	0.7	<0.002	0.5	<0.003	<0.003
Primary Contaminant Level[a]	0.05	0.05	1.0	0.01	0.05	2.0	0.002	-	0.05	0.01

Table VIII (cont)

	Miscellaneous Chemical Analyses (concentrations in mg/L)									
	SiO_2	Ca	Mg	K	Na	CO_3	HCO_3	P	Total Hard	Cond (mS/m)
PCO-1	31	33	9.9	5.7	47	0	97	<0.2	122	48
PCO-2	26	18	5.1	3.9	18	0	66	<0.2	62	19
PCO-3	35	40	9.8	3.6	24	0	150	<0.2	141	38

[a]Reference (US EPA, 1976).
[b]The Environmental Protection Agency's MCL for gross alpha is 15×10^{-9} μCi/mL. However, gross alpha results from the distribution system that exceed EPA's screening limit of 5×10^{-9} μCi/mL require isotopic analysis to determine radium content.
[c]Level recommended by International Commission on Radiological Protection.
[d]Reference (US EPA 1979).

Note: The ± value represents twice the uncertainty term for the analysis.

TABLE IX - EP Toxicity Analytical Results for Core from Drill-Hole Number LGC-85-09

Parameter	EP Toxic Regulated Concentration[1] (mg/L)	Detection Limit[2] (mg/L)	Depth Intervals in Feet									
			0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Arsenic	5.0	0.1 ± 0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	100.0	1.0 ± 1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	1.0	0.1 ± 0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	5.0	0.2 ± 0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	5.0	0.5 ± 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.2	0.01 ± 0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	1.0	0.05 ± 0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	5.0	0.5 ± 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[1]Hazardous Waste Management Regulations (HWMR) 201.B.5.
[2]ND = Not detected.
The ± value represents the uncertainty term for the analysis.

TABLE X - EP Toxicity Analytical Results for Core from Drill-Hole Number LGC-85-10

Parameter	EP Toxic Regulated Concentration[1] (mg/L)	Detection Limit[2] (mg/L)	Depth Intervals in Feet									
			0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Arsenic	5.0	0.1 ± 0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	100.0	1.0 ± 1.0	1.50 ±0.40	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	1.0	0.1 ± 0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	5.0	0.2 ± 0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	5.0	0.5 ± 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.2	0.01 ± 0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	1.0	0.05 ± 0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	5.0	0.5 ± 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[1]Hazardous Waste Management Regulations (HWMR) 201.B.5.
[2]ND = Not detected.
The ± value represents the uncertainty term for the analysis.

TABLE XI - EP Toxicity Analytical Results for Core from Drill-Hole Number LGC-85-12

Parameter	EP Toxic Regulated Concentration[1] (mg/L)	Detection Limit[2] (mg/L)	Depth Intervals in Feet									
			0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Arsenic	5.0	0.1 ± 0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	100.0	1.0 ± 1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	1.0	0.1 ± 0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	5.0	0.2 ± 0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	5.0	0.5 ± 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.2	0.01 ± 0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	1.0	0.05 ± 0.020	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	5.0	0.5 ± 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[1]Hazardous Waste Management Regulations (HWMR) 201.B.5.
[2]ND = Not detected.
The ± value represents the uncertainty term for the analysis.

TABLE XII - EP Toxicity Analytical Results for Core from Drill-Hole Number LGC-85-13

Parameter	EP Toxic Regulated Concentration[1] (mg/L)	Detection Limit[2] (mg/L)	Depth Intervals in Feet									
			0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Arsenic	5.0	0.05 ± 0.025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	100.0	1.0 ± 1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	1.0	0.1 ± 0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	5.0	0.2 ± 0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	5.0	0.5 ± 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.2	0.01 ± 0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	1.0	0.05 ± 0.025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	5.0	0.5 ± 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[1]Hazardous Waste Management Regulations (HWMR) 201.B.5.
[2]ND = Not detected.
The ± value represents the uncertainty term for the analysis.

TABLE XIII - EP Toxicity Analytical Results for Core from Drill-Hole Number LGC-85-14

Parameter	EP Toxic Regulated Concentration[1] (mg/L)	Detection Limit[2] (mg/L)	Depth Intervals in Feet									
			0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Arsenic	5.0	0.05 ± 0.025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	100.0	1.0 ± 1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	1.0	0.1 ± 0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	5.0	0.2 ± 0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	5.0	0.5 ± 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.2	0.01 ± 0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	1.0	0.05 ± 0.025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	5.0	0.5 ± 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[1]Hazardous Waste Management Regulations (HWMR) 201.B.5.
[2]ND = Not detected.
The ± value represents the uncertainty term for the analysis.

TABLE XIV - EP Toxicity Analytical Results for Core from Drill-Hole Number LGC-85-15

Parameter	EP Toxic Regulated Concentration[1] (mg/L)	Detection Limit[2] (mg/L)	Depth Intervals in Feet									
			0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Arsenic	5.0	0.05 ± 0.025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	100.0	1.0 ± 1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	1.0	0.1 ± 0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	5.0	0.2 ± 0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	5.0	0.5 ± 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.2	0.01 ± 0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	1.0	0.05 ± 0.025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	5.0	0.5 ± 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[1]Hazardous Waste Management Regulations (HWMR) 201.B.5.
[2]ND = Not detected.
The ± value represents the uncertainty term for the analysis.

TABLE XV - EP Toxicity Analytical Results for Core from Drill-Hole Number LGC-85-16

Parameter	EP Toxic Regulated Concentration[1] (mg/L)	Detection Limit[2] (mg/L)	Depth Intervals in Feet									
			0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Arsenic	5.0	0.05 ± 0.025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	100.0	1.0 ± 1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	1.0	0.1 ± 0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	5.0	0.2 ± 0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	5.0	0.5 ± 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.2	0.01 ± 0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	1.0	0.05 ± 0.025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	5.0	0.5 ± 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[1]Hazardous Waste Management Regulations (HWMR) 201.B.5.
[2]ND = Not detected.
The ± value represents the uncertainty term for the analysis.

TABLE XVI - Identified Volatile Nontarget Pollutants

Drill Hole Number	Depth Interval (ft)	Volatile Organic Compound	Estimated Limit of Detection (μg/kg)	Estimated Concentration[1] (μg/kg)
LLC-85-12	38-39	2-Hexanone	3300	3710-4130[2]
LLC-85-13[3]	48-49	2-Pentanone	3300	3300
LLC-85-14	38-39	2-Pentanone	3300	3640
	48-49	1-Butanol	62,500	83,330
LLC-85-15[4]	18-19	Tetrahydrofuran	3000	4500
	28-29	1,4 Dioxane	1500	1500
	38-39	1,4 Dioxane	1500	1500
		1 butanol	62,500	100,000
	68-69	1 butanol	62,500	93,750
	88-89	2-Pentanone	3300	3300

[1]Concentration estimated using total ionization peak area relative to estimated limit of detection.
[2]Range given because two samples were prepared since portions of one sample were spilled.
[3]This background hole is a considerable distance from any waste disposal area. However, in volatile organic analyses it is difficult to determine whether ketones are artifacts or are actually present above the detection limit.
[4]Several other volatile compounds were present in this drill hole, but they could not be definitively identified. The mass spectrometer scans of these compounds were consistent with small chain alcohols. They were most concentrated at depth intervals of 18-19, 28-29, and 38-39 ft.

APPENDIX: VOLATILE ORGANIC ANALYSES

The contents of this appendix were prepared by the Health and Environmental Chemistry Group (HSE-9).

I. SAMPLE PREPARATION

The samples received consisted of large (approximately 500 mL) jars of soil. Sample jars had minimal headspace and were sealed with a teflon liner between the jar and the lid. The jars were sealed with parafilm and initialed by the collector. Upon receipt, the samples were placed into a locked refrigerator and stored until extraction.

The soil was extracted within 24 hours of receipt. Extraction was carried out by first agitating the soil in order to achieve some degree of homogeneity. The sample containers were opened and any odors noted. The color and consistency of the soil was also transferred to a tared 10 mL reaction vial and the weight recorded to the nearest 0.0001 gm. The vial was immediately sealed using a teflon septa and tear-away seal. Four to five soils were weighted out in this manner and then the methanol extraction was carried out. There were 2.5 mL of absolute methanol injected into the sample and the mixture was vigorously shaken for approximately 2 minutes by hand. The vial was then opened and the liquid drawn off by pipette and transferred to a 1 mL reaction vial and again sealed with a teflon septum and seal. The 10 mL reaction vial was discarded. Immediately after the 4 gm aliquot of soil was removed, the jar was sealed with tape to indicate completion of extraction. Once extracted, the

soils were replaced in the refrigerator until returned to the submitters. The 1 mL reaction vials containing the methanolic extracts were placed in the refrigerator until analysis. All samples were run for the first time within 10 days.

The samples were prepared for purge and trap analysis immediately prior to purging. Ten samples (including blanks, spikes, and quality control samples) could be prepared and run at one time. Daily, an aqueous solution of the internal standard mixture was prepared using a secondary dilution of a supelco mixture containing 20 mg/mL of bromochloromethane, 1-bromo-2-chloropropane, and 1.4 dichlorobutane in methanol. Five milliliters of the aqueous solution were pipetted into a 5 mL purging vessel using a glass pipette. Approximately 30 μL of the methanolic extract was injected into this mixture, and the vessel assembled and placed on the purge and trap apparatus. All 10 samples were prepared in the same manner. The exact amount of the methanolic extract used was recorded to the nearest μL. The injection it self was carried out by rinsing the syringe with methanol several times, then drawing in several aliquots of the sample and discarding. The syringe was then filled with sample extract to approximately 30 mL and all air bubbles removed. The exact volume of the syringe was then noted, including needle volume, and then the injection was made by fully depressing the plunger one time. The syringe was removed from the aqueous solution and the residual volume noted. The actual injected volume was calculated and recorded. Refer to the instrumental section for information on how the actual analysis was carried out. After an aliquot of methanolic extract was removed from a 1 mL sample vial, the vial was resealed with a new teflon seal.

These methods of extraction and analysis are modifications and compilations of several recommended procedures. Please refer to the following references for more information:

Characterization of Hazardous Waste Sites, A Methods Manual
Volume 3. Available Laboratory Analytical Methods

Lockheed Engineering Management Services Company
Las Vegas, Nevada, May 1984.
National Technical Information Service #PB84-191048
EPA-600/4-84-038

by Russell Plumb, Jr.

Check Chapter 3, Sections J.1.1, J.2.1, J.3.1.

Test Methods for Evaluating Solid Waste

Physical/Chemical Methods SW-846
United States Environmental Protection Agency

Check Section 8, Methods 8010, 8015, 8020, and 8030.

II. INSTRUMENTAL PARAMETERS

The instrumental system was a five component system operating in tandem and controlled by either the operator or by a basic language program for automated operations. Each of these components is described in detail below.

A. Gas Chromatographic System

Hewlett-Packard Model 5880A GC
Flame Ionization Detector
Hewlett-Packard "Ultra" Capillary Column
5% Crosslinked Phenyl Methyl Silicone
60 m Length, 0.32 mm ID, 0.25 μm Film Thickness

Gases

Carrier: Helium @ 2.0 ml/min (±0.2 mL/min)
Compressed Air @ 46 psi
Hydrogen @ 35 psi

Note: No makeup gas was used.

B. Purge and Trap System

Tekmar Model 4000 Dynamic Headspace Analyzer (DHS)

The DHS embodied the trap, main temperature controls, and purge and trap controls.

Trap: Tenax
Temperature Settings: (degrees C)
- Valves: 100-120
- Lines: 100-120
- Desorb: 180
- Desorb Preheat: 100
- Bake: 220

Time Settings: (minutes)
- Purge: 11
- Dry Purge: 6 (to remove water from the trap)
- Desorb: 4
- Bake: 10-20

Purge Pressure: 20 psi
Purge Flow: 40 mL/min

C. Tekmar Automatic Liquid Sampler (ALS)

The ALS housed 10 samples and controlled the valving to switch between these samples as directed by the DHS. The heater was left at factory setting of approximately 120°C.

D. Tekmar Model 1000 Cryogenic Capillary Interface

The Model 1000 consisted of a small "cross" unit that was supplied with liquid nitrogen for cooling and equipped with a flash heating unit for introduction of the cooled, concentrated sample into the GC. Initially, the column was directly connected to the cross by pulling it out of the GC oven and connecting it directly to the sample transfer line. In the course of the analysis, it was discovered that the portion of the column exposed to flash heating broke down quickly. The bad portions of the column were then broken off and the column replaced in the oven and connected to the Model 1000 by means of a zero dead volume union and hollow fused silica capillary column. Material desorbed off of the Tenax trap entered the cross that had been previously signaled by the DHS and GC to cool to -50°C. The sample slugs were cold trapped on the portion of the column or tubing in the cross unit until the GC and DHS signaled the cross to flash heat and thus introduce the sample into the GC and begin data acquisition.

Cooling temperature: -50°C
Flash heating time: 4-10 seconds
Heating rate: approximately 50°C per second

Note: Parameters were adjusted throughout the course of sample analysis as necessary.

E. GC/Mass Spectrometer System

Hewlett-Packard 5993A GC/MS and Computer System Column:

SPB-5

0.24 mm ID

30 m

1.0 μm Film Thickness

The samples displaying suspicious or nonbackground peaks were analyzed on GC/MS. A methanol blank, QC sample, and all samples from Drill Hole Number LL-85-15, were also submitted for GC/MS analysis. Most samples were analyzed by injection of 5 μL into the GC/MS, but more concentrated samples required smaller injections. Estimated limits of detection were used to estimate concentrations of the compounds found.

F. Data Acquisition System

Hewlett-Packard 5880 Series Terminal Level Four.

The terminal was the main controlling module of the system and maintained 2-way communication with the other modules. A basic language program entered into the terminal controlled unattended operations. The terminal was responsible for sensing the readiness state of the gas chromatograph (GC) and of the purge and trap (PT) modules, and coordinating instrumental operations.

The terminal also served as a recorder and integrator, and processed all data generated by the GC. The temperature program, GC conditions, and run table parameters were all controlled by the terminal.

G. Summary of Operation

Ten individual samples were loaded into the ALS. Once the DHS reached the ready state, purging of the first sample was initiated. A basic program on the Level 4 terminal controlled the timing of the cryogenic cooling that began once purging was complete. When the cryogenic cross reached -50°C, desorption of the sample off the Tenax Trap began. Flash heating of the cold interface followed desorption. The initiation of flash heating coincided with the beginning of the GC oven program and data acquisition. While the GC was running, the DHS cycled to bake to remove residual material from the Tenax Trap. When both the GC and the DHS had completed their cycles and returned to ready, the ALS valved to the next sample and repeated the process. This cycle was repeated for the 10 loaded samples. When the last sample run was complete, the Tekmar system remained at ready, and the GC was programmed to shut the oven off after reaching ambient temperature.

III. RETENTION TIMES AND ESTIMATED DETECTION LIMITS

Standard compounds were analyzed to determine retention times and reproducibility. The results of these runs determined which compounds could be successfully identified and quantitated using the purge and trap apparatus described above. These compounds, listed below with their retention times and detection limits, are referred to as "target" volatile organic compounds. "Target" is analytical laboratory terminology. It has no regulatory significance.

Compound	Retention Time (minutes)	H^2O (ppb)	Soil (ug/kg)	Interval Standard
	Detection Limits			
1,1-Dichloroethylene	4.26	--	--	--
Methylene Chloride	4.36	5	521	BCM
T 1,2-Dichloroethylene	4.63	5	521	BCM
1,1-Dichloroethane	4.76	10	1042	BCM
Chloroform	5.27	10	1042	1C2
1,1,1-Trichloroethane	5.68	15	1563	BCM
1,2-Dichloroethane	5.72	8	833	BCM
Benzene	5.96	5	521	BCM
Carbon Tetrachloride	5.98	20	2083	BCM
Trichloroethylene	6.65	5	521	1C2BP
1,2-Dichloropropane	6.69	5	521	BCM
Bromodichloromethane	6.86	10	1042	14 DCB
Toluene	8.36	5	521	1C2BP
1,1,2-Trichloroethane	8.37	15	1527	1C2BP
Chlorodibromomethane	9.15	10	1042	14 DCB
Tetrachloroethylene	9.52	20	2083	1C2BP
Chlorobenzene	10.56	12	1250	1C2BP
Ethylbenzene	10.83	8	833	14 DCB
Bromoform	11.71	10	1042	14 DCB
1,1,2,2-Tetrachloro-ethane	12.35	20	2083	14 DCB
Bromobenzene	12.95	22	2292	1C2BP
1,3-Dichlorobenzene	14.75	5	521	14 DCB
1,4-Dichlorobenzene	14.91	--	--	---
1,2-Dichlorobenzene	15.48	5	521	14DCB

Internal Standards =

Bromochloromethane(BCM)	5.23
1-Chloro-2-Bromo-propane (1C2BP)	8.52
1,4-Dichlorobutane (14DCB)	12.15

The retention time of these compounds changed during the course of the analyses as the system was modified (part of the column was broken off, gas flows altered, etc.) but remained stable and reproducible between runs made with similar parameters.

The limit of detection is based on the intercept of the external standard calibration curve and assumes 100% recovery. The

observed percent recovery of samples spiked with a known amount of a methanolic solution containing 1,2-Dichloroethane, benzene, and ethyl benzene is as follows (see Section IV for discussion of spikes):

Compound	Average Recovery (%) Initial Runs	Repeat Runs
1,2-Dichloroethane	81.5	80.3
Benzene	85.6	86.5
Ethyl Benzene	23.0	99.3

Ethyl benzene recovery was low on initial runs due to machine problems described in Section II. Acceptable recovery was greater than 75%.

IV. BLANKS, SPIKES, AND QUALITY CONTROL

A. Field Blanks

Samples were delivered in batches of approximately 10 samples per hole drilled. For each batch, field blanks were requested and received. Generally, one jar reportedly prepared exactly as a sample vessel was taken to the field filled with organic free water. This jar was left open to the atmosphere on site and then sealed as the other samples upon completion of drilling. A second blank empty jar was usually submitted, although it was decided that the water blank was of more value and most of the empty jar blanks were not processed. Five mL of the water was added to a purge vessel and run as the other samples. The resulting chromatographs were used to define background peaks along with other background runs described below.

B. Methanol Blanks

For each batch of samples extracted, a methanol blank was prepared using the same extraction technique as the soils. These blanks were run alongside the soil samples of the corresponding batch and the resulting chromatographs used to help define background peaks.

C. System Blanks

Five mL aliquots of organic free water were purged between most of the samples. This practice was reduced as the 7-day deadline for completion of the initial runs approached. If a water blank showed excessive carryover from prior samples, the system was baked and if necessary, samples were rerun. Later runs of organic free water included approximately 10 µL of methanol. The characteristic products of interface tubing and column breakdown were found to be water insoluble but methanol soluble and thus problems with the interface were difficult to detect as the water blanks showed essentially no peaks. This problem arose twice during the course of sample analyses. Once the problem was detected (usually during the running of a methanol blank) it was corrected by breaking off the top of the column and later by replacing the column with the zero dead volume/hollow capillary tubing arrangement. By the time the problem was finally solved, the deadline for running the samples had passed so rerunning them was not feasible. However, all the samples had been run at least once. The elusion of the breakdown products did not mask the elusion of any of the target volatile organics or internal standards and the rate of recovery of the internal standards remained good. As an additional precaution, most of the samples run during times when breakdown was suspected were subjected to GC/MS analysis.

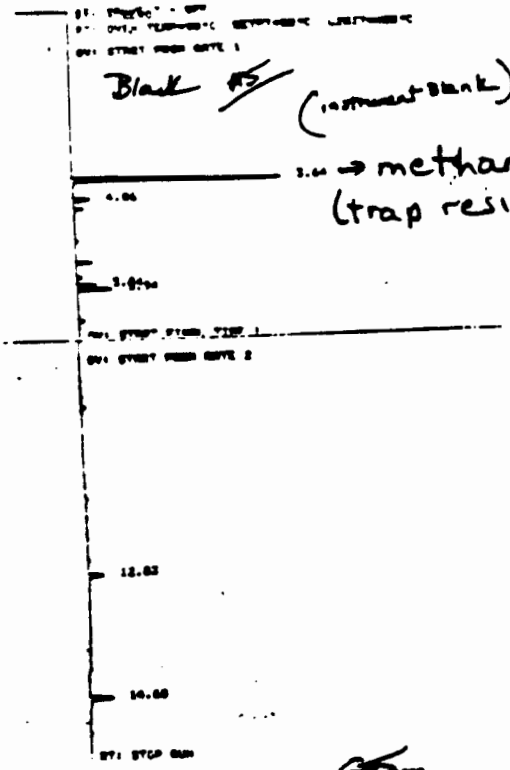
The results of the field blanks, methanol blanks, and system blanks were combined in order to define background peaks for each batch of samples. Examples of blanks are given on the following pages.

D. Spikes

One soil sample per batch was spiked with a known amount of a methanolic solution containing 1,2 dichloroethane, benzene, and ethyl benzene. The spike soil was prepared by selecting a soil sample at random and weighing out approximately 4 gms as described in the sample preparation section. Prior to extraction, a aliquot of the stock spike solution was injected into the sealed vial and the vial agitated. Extraction then proceeded as with all samples. The spike was then run along with the corresponding soil samples. In all cases in the initial runs, the recovery of the benzene and 1,2-dichloroethane was very good and that of the ethyl benzene was low (see Section III for average percentage recovery). Subsequent runs made approximately 1 week later showed excellent recoveries on all of the spikes. The recovery of the internal standards was in all cases acceptable, i.e., greater than 75%. The mean recovery of spikes was 81.5%.

E. Quality Control Samples

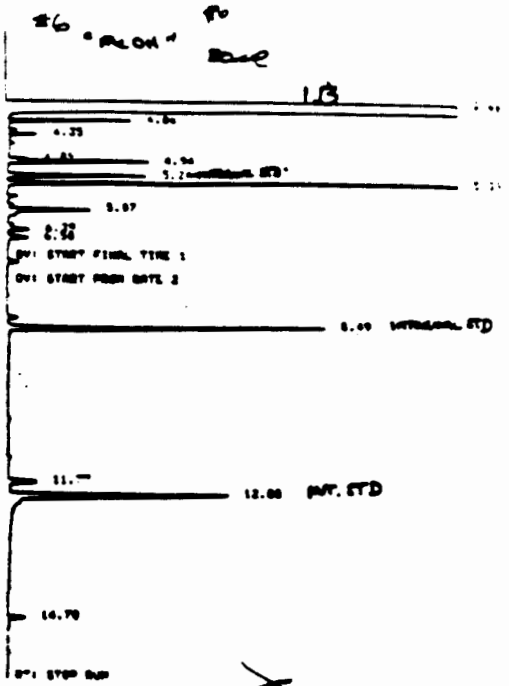
QC samples consisted of 10 soil samples selected at random that were split with an outside contract lab and 10 spiked soil samples from the QC section of HSE-9. Spiked soil samples were extracted and run as the samples were. The spikes each contained six compounds that were all successfully identified each time they were run. Quantitation of the QC samples was performed both with and without adjusting for recovery (based on the recovery



RT	AREA	TYPE	AREA %
3.64	271.00	BB	64.982
4.06	21.00	BB	5.073
5.04	26.94	BV	6.363
5.94	23.75	VV	5.686
12.03	26.04	BB	6.230
14.00	26.04	BB	6.651

TOTAL AREA = 417.43
MULTIPLIER = 1

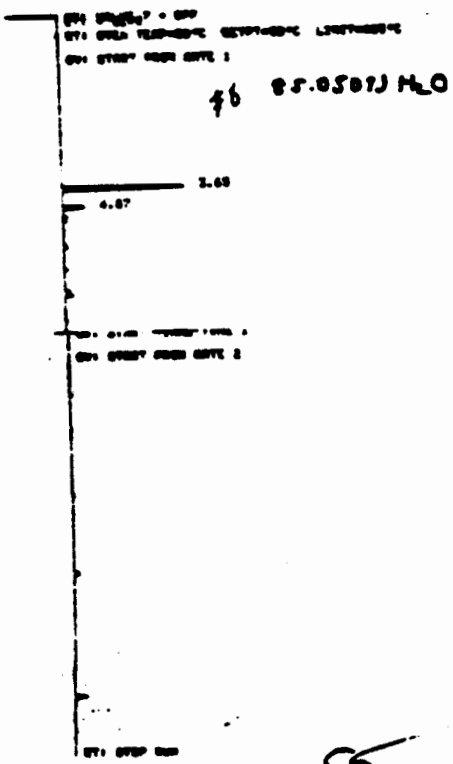
INSTRUMENT BLANK



RT	AREA	TYPE	AREA %
3.66	1712.90	BV	13.609
3.75	9580.40	VB	57.574
4.08	183.09	BV	1.075
4.39	27.64	VV	0.247
4.89	16.16	BV	0.169
4.94	160.28	VB	1.073
5.24	189.83	BB	1.700
5.39	[illegible]	BB	10.167
5.97	128.40	BV	1.046
6.39	36.98	BB	0.296
6.88	82.14	BV	0.668
8.93	487.32	VB	3.894
11.77	66.32	BB	0.631
12.00	518.06	BB	3.402
14.70	26.16	BV	0.273

TOTAL AREA = [illegible]
MULTIPLIER = 1

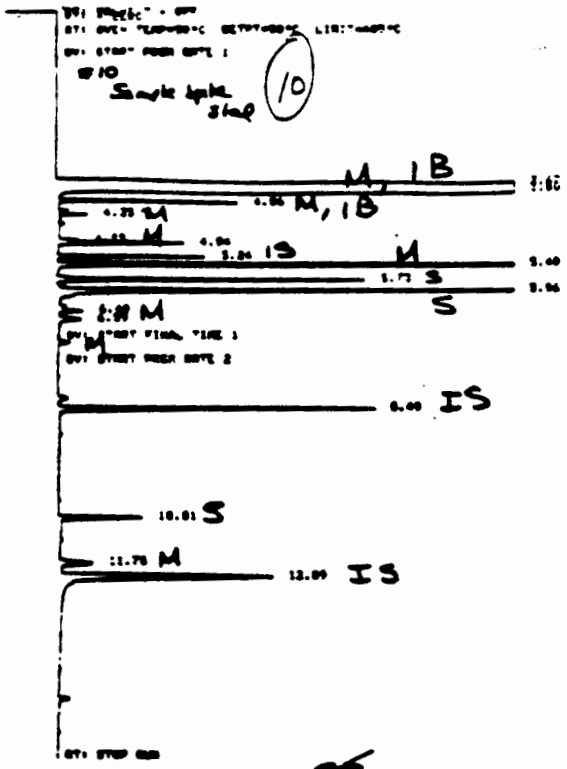
TYPICAL METHANOL BLANK



RT	AREA	TYPE	AREA %
3.65	164.60	BB	86.481
4.07	25.75	BB	13.519

TOTAL AREA = 190.35
MULTIPLIER = 1

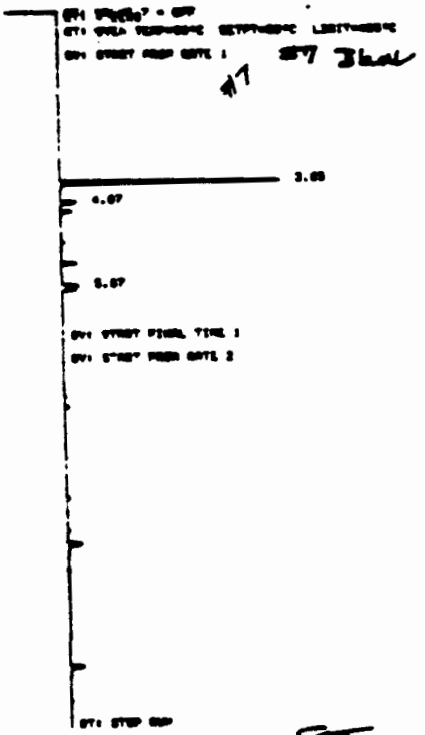
Typical field water blank



RT	AREA	TYPE	AREA %
3.07	[illegible]	[illegible]	[illegible]
3.68	[illegible]	[illegible]	[illegible]
4.06	[illegible]	[illegible]	[illegible]
4.38	[illegible]	[illegible]	[illegible]
4.95	[illegible]	[illegible]	[illegible]
5.04	[illegible]	[illegible]	[illegible]
5.66	[illegible]	[illegible]	[illegible]
5.68	[illegible]	[illegible]	[illegible]
5.73	[illegible]	[illegible]	[illegible]
5.96	[illegible]	[illegible]	[illegible]
6.40	[illegible]	[illegible]	[illegible]
6.95	[illegible]	[illegible]	[illegible]
9.49	[illegible]	[illegible]	[illegible]
10.01	[illegible]	[illegible]	[illegible]
11.75	[illegible]	[illegible]	[illegible]
13.09	[illegible]	[illegible]	[illegible]

TOTAL AREA = [illegible]
MULTIPLIER = 1

INSTRUMENT BLANK



RT	AREA	TYPE	AREA %
3.68	[illegible]	[illegible]	[illegible]
4.07	[illegible]	[illegible]	[illegible]
5.07	[illegible]	[illegible]	[illegible]

TOTAL AREA = [illegible]
MULTIPLIER = 1

Soil sample spike

IS = internal standard
S = spiked material
M = methanol blank peak
IB = instrument blank peak

rates of the spikes). The first batch of 5 QC samples was extracted within 8 hours of receipt, and the second batch sat at 20°C for 24 hours prior to extraction. The calculated quantities of four of the compounds in the first batch (benzene, 1,2-dichloroethane, 1,1,1-trichloroethane, and bromochloromethane) agreed well with the reported value (considering uncertainties). The recoveries of trichloroethylene and 1,3-dichlorobenzene were low. This trend repeated itself with the second batch of 5 samples except, where all recoveries were low. This was not unexpected considering the headspace in storage vials and the time delay between sampling and extraction. All soil samples were extracted within 30 minutes of being weighed, so the problem of volatile loss to headspace while awaiting extraction should be minor. An example of QC results is given on the following page. To the right, values are adjusted for mean recovery of 81.5%.

The expected area counts of the internal standards were also used also to interpret results and to flag any sample displaying unusually low recoveries for reanalysis.

Mean recovery of spikes = 81.5%

ADJUSTED RECOVERY
QC RESULTS

(81.5%)

UG/KG
(Soil Concentrations)

Run 9-18-86

NUMBER	COMPOUND	BCW/15	BCBP/85	BKT STD	ACTUAL	UNCERTAINTY	LO VALUE	HI VALUE	15 MEAN	% DIFF(MEAN)	% DIFF LO	% DIFF HI	ADJ. 15 MEAN	%DIFF MEAN	%DIFF LO	HI
QC700																
	111 TRICHLOROETHANE	7949.40	8130.00	7500.22	8525.00	853.00	7762.00	8400.00	8044.50	-5.73	3.64	-16.21	8070.79	14.44	27.17	[illegible]
	12 DICHLOROETHANE	8000.22	8073.51	7822.40	9075.00	804.00	8267.00	8903.00	8081.92	-10.94	-2.24	-10.22	8015.46	9.27	19.95	[illegible]
	BENZENE	8552.00	8560.00	8267.33	8525.00	853.00	8572.00	10470.00	8561.04	0.20	11.43	-0.04	11720.17	23.06	36.73	[illegible]
	BROMODICHLOROETHANE	8352.60	7851.20	8100.79	8775.00	878.00	7007.00	8868.00	8105.04	-7.61	2.66	-16.02	8047.17	13.36	25.36	[illegible]
QC701																
	111 TRICHLOROETHANE	2300.51	2322.35	1823.05	2071.70	207.00	2584.70	3150.70	2311.44	-10.61	-10.57	-26.02	2036.12	-1.24	9.73	[illegible]
	12 DICHLOROETHANE	2400.03	2410.30	2476.57	2021.60	302.00	2718.60	3323.60	2410.16	-10.67	-10.64	-26.00	2001.79	-1.31	9.64	[illegible]
	BENZENE	2060.24	2021.10	2712.05	3171.40	317.00	2064.40	3400.40	2640.21	-16.76	-7.60	-24.31	2239.52	2.16	13.49	[illegible]
	BROMODICHLOROETHANE	2454.37	2271.70	2420.20	2021.60	202.00	2620.60	3213.00	2363.00	-10.12	-10.14	-26.47	2000.40	-0.76	10.26	[illegible]
QC702																
	111 TRICHLOROETHANE	7110.05	6943.19	6604.05	7460.10	747.00	6721.10	8215.10	7031.02	-6.06	4.61	-14.41	6527.02	15.62	26.36	[illegible]
	12 DICHLOROETHANE	7310.19	6057.20	6864.00	7066.60	707.00	7070.60	8662.60	7130.24	-0.25	0.04	-17.50	6760.57	11.36	23.73	[illegible]
	BENZENE	6636.01	6224.23	6230.42	6247.40	625.00	7422.40	8872.40	6430.12	2.22	13.50	-7.00	10343.71	25.42	39.36	[illegible]
	BROMODICHLOROETHANE	7440.60	6060.38	7163.71	7607.00	760.00	6837.00	8857.00	7063.03	-7.17	3.16	-16.61	6664.02	13.00	26.56	[illegible]
QC703																
	111 TRICHLOROETHANE	9466.61	9640.28	8320.61	11400.60	1160.00	10340.60	12640.60	9562.04	-16.02	-7.60	-24.47	10721.35	1.04	13.27	[illegible]
	12 DICHLOROETHANE	9046.40	8773.46	8705.54	12000.50	1210.00	10000.50	13300.50	8000.07	-10.02	-8.91	-26.29	12036.77	-0.51	10.65	[illegible]
	BENZENE	11245.00	11102.34	1107.60	12600.00	1270.00	11020.00	13850.00	11213.07	-11.60	-1.00	-19.72	13759.10	0.36	20.39	[illegible]
	BROMODICHLOROETHANE	10070.30	8403.05	8004.05	11600.00	1170.00	10520.00	13000.00	8737.12	-16.77	-7.62	-24.33	11047.30	2.13	13.40	[illegible]
QC704																
	111 TRICHLOROETHANE	2266.20	2277.64	1707.01	2073.00	207.00	2606.00	3160.00	2271.47	-20.06	-12.10	-20.14	2707.07	-3.02	7.74	[illegible]
	12 DICHLOROETHANE	2401.43	2441.30	2517.05	3023.00	302.00	2641.00	3406.00	2666.41	-10.44	-6.64	-27.60	3026.27	0.00	14.55	[illegible]
	BENZENE	2017.10	2765.66	2060.07	3173.00	317.00	2066.00	3400.00	2704.30	-12.06	-2.20	-20.04	3425.00	7.91	19.00	[illegible]
	BROMODICHLOROETHANE	2400.04	2294.62	2462.74	2023.00	203.00	2630.00	3216.00	2304.72	-10.30	-0.00	-26.06	2034.62	0.37	11.64	[illegible]

21 HOUR DELAY 2 IN EXTRACTION

NUMBER	COMPOUND	BCW/15	BCBP/85	BKT STD	ACTUAL	UNCERTAINTY	LO VALUE	HI VALUE	15 MEAN	% DIFF(MEAN)	% DIFF LO	% DIFF HI	ADJ. 15 MEAN	%DIFF MEAN	%DIFF LO	HI
QC705																
	111 TRICHLOROETHANE	805.00	800.70	573.17	1437.30	144.00	1203.30	1601.30	800.30	-37.40	-30.54	-43.10	1102.32	-23.31	-14.77	[illegible]
	12 DICHLOROETHANE	1050.20	1035.72	1050.07	1612.30	161.00	1361.30	1663.30	1047.60	-30.73	-23.05	-37.02	1205.20	-15.01	-5.50	[illegible]
	BENZENE	1010.74	900.05	1040.20	1507.30	150.00	1420.30	1746.30	1000.30	-35.41	-20.34	-42.20	1230.40	-21.00	-13.30	[illegible]
	BROMODICHLOROETHANE	842.63	735.60	800.07	1482.30	146.00	1316.30	1600.30	800.61	-44.53	-30.40	-40.05	883.30	-32.07	-24.53	[illegible]
QC706																
	111 TRICHLOROETHANE	1437.40	1466.12	1127.40	2290.20	230.00	2060.20	2520.20	1461.01	-36.03	-20.00	-42.50	1701.36	-22.49	-13.[illegible]	[illegible]
	12 DICHLOROETHANE	1400.40	1470.50	1470.02	2410.10	242.00	2176.10	2660.10	1404.04	-30.03	-31.00	-44.21	1820.90	-24.70	-16.3[illegible]	[illegible]
	BENZENE	1401.03	1475.40	1400.02	2530.00	254.00	2284.00	2792.00	1470.47	-41.76	-36.27	-47.05	1814.07	-28.52	-20.5[illegible]	[illegible]
	BROMODICHLOROETHANE	1103.50	1105.02	1142.56	2330.10	234.00	2104.10	2572.10	1145.10	-61.02	-46.57	-66.40	1406.14	-39.00	-33.22	[illegible]
QC707																
	111 TRICHLOROETHANE	849.05	852.02	520.37	1433.40	143.00	1290.40	1576.40	856.54	-40.31	-33.70	-46.73	1049.74	-26.77	-18.65	[illegible]
	12 DICHLOROETHANE	851.52	851.40	858.70	1600.00	161.00	1357.00	1660.00	856.46	-36.61	-29.56	-42.30	1173.57	-22.22	-13.5[illegible]	[illegible]
	BENZENE	807.33	870.46	1013.53	1603.70	164.00	1426.70	1741.70	803.04	-37.03	-31.06	-43.66	1206.10	-23.04	-15.46	[illegible]
	BROMODICHLOROETHANE	743.00	882.20	706.10	1460.00	146.00	1313.00	1606.00	717.00	-60.70	-46.32	-66.27	800.07	-30.62	-32.50	[illegible]
QC708																
	111 TRICHLOROETHANE	677.23	692.36	366.43	862.00	86.00	776.00	948.00	684.00	-20.66	-11.75	-27.76	840.24	-2.52	8.20	[illegible]
	12 DICHLOROETHANE	706.36	702.01	716.94	906.00	91.00	815.00	997.00	704.09	-22.36	-13.70	-29.44	863.91	-4.74	5.00	[illegible]
	BENZENE	859.00	850.46	862.42	861.00	86.00	866.00	1046.00	859.23	-0.60	1.46	-16.07	1066.53	12.04	24.46	[illegible]
	BROMODICHLOROETHANE	586.10	850.13	664.26	877.00	80.00	700.00	886.00	677.66	-34.13	-26.70	-40.14	700.70	-18.10	10.17	[illegible]
QC709																
	111 TRICHLOROETHANE	631.26	668.09	300.37	862.50	86.00	776.50	948.50	660.12	-24.62	-16.20	-31.46	797.69	-7.51	[illegible]	[illegible]
	12 DICHLOROETHANE	636.41	649.47	661.40	907.50	91.00	816.50	998.50	642.04	-29.16	-21.26	-36.61	780.00	-13.07	3.36	[illegible]
	BENZENE	862.40	873.04	800.76	862.50	86.00	867.50	1047.50	863.17	1.12	12.32	-0.06	1101.00	24.07	37.[illegible]	[illegible]
	BROMODICHLOROETHANE	621.06	687.13	590.04	877.50	87.00	790.50	964.50	600.54	-30.54	-22.00	-36.00	747.00	-14.77	5.35	[illegible]

ADJUSTED

V. OBSERVATION WELL WATER SAMPLE RESULTS

Observation well water samples, taken September 9, 1985, were analyzed using the same instrumental procedures previously described. No sample preparation (i.e., methanol extraction) was required; 5 mL of the water was added to the purging vessel and analyzed. System blanks were utilized as described previously. One EPA quality control (QC) sample, received from the quality control section of HSE-9, was analyzed with the well water samples. Results are given on the following page.The QC sample contained nine volatile organic compounds; all nine were detected and four quantitated (only those compounds for which a valid calibration curve was available were quantitated). The values calculated agreed closely with the "true" and average reported values.

None of the target volatile organics were detected in the well water samples. Only background peaks were noted on the chromatographs.

WATER ANALYSIS QUALITY CONTROL SAMPLE

QC SAMPLE NUMBER: 00.010305 (EPA)
VOA CONC 2 WP483

CONCENTRATIONS LISTED IN ug/ul (PPB)

COMP	TRUE	X	SD	95% CL	CL X	SD	95% CL	%T	%X
12DCE	22.2	22.0	4.24	13.5-30.5	17.1	0.22	16.7-17.5	77.0	77.7
111TC	14.3	12.7	2.91	6.9-18.5	11.9	0.17	11.6-12.2	83.0	93.7
BDCM	7.9	7.8	1.45	4.9-10.7	6.6	0.25	6.1-7.1	83.5	84.6
CDBM	10.7	10.2	2.11	6.0-14.4	10.0	1.57	13.1-6.9	94.5	98.0

COMP = COMPOUND
TRUE = EPA REPORTED TRUE CONCENTRATION
X = EPA REPORTED MEAN CALCULATED VALUE
SD = STANDARD DEVIATION
95% CL = 95% CONFIDENCE LIMITS
CL X = CALCULATED MEAN VALUE OF ANALYSES
%T = PERCENTAGE OF EPA TRUE VALUE
%X = PERCENTAGE OF EPA MEAN

12DCE = 12 DICHLOROETHANE
111TC = 111 TRICHLOROETHANE
BDCM = BROMODICHLOROMETHANE
CDBM = CHLORODIBROMOMETHANE

COMPOUNDS DETECTED BUT NOT QUANTITATED:

CHCL3 (CHLOROFORM)
112 TRICHLOROETHYLENE
CCL4 (CARBON TETRACHLORIDE)
1122 TETRACHLOROETHANE
BROMOFORM