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7. Abstract

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ACRONYMS

AID	argon ionization detector
cis-1,2-DCE	cis-1,2-dichloroethylene
DOE	U.S. Department of Energy
EII	Environmental Investigations Instruction
FID	flame ionization detector
GC	gas chromatograph
HEIS	Hanford Environmental Information System
JAJ	J.A. Jones
NA	not analyzed
ND	not detected
NRDWL	Nonradioactive Dangerous Waste Landfill
OD	outside diameter
1,1,1-TCA	1,1,1-trichloroethane
PCE	perchloroethylene
PID	photoionization detector
PNL	Pacific Northwest Laboratory
QA	quality assurance
QC	quality control
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
SWL	Solid Waste Landfill
TCE	trichloroethylene
TSD	treatment, storage, or disposal
VOC	volatile organic compound
WHC	Westinghouse Hanford Company

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1.0 SUMMARY

A soil-gas survey was conducted for the Nonradioactive Dangerous Waste Landfill (NRDWL), which is part of the 200-IU-3 Operable Unit of the Hanford Site. The soil-gas survey was performed in accordance with Section 7.1.1 of the *Nonradioactive Dangerous Waste Landfill Closure/Postclosure Plan* (DOE-RL 1990). The objective was to assess the extent of detectable gaseous or volatile organic compounds (VOC) within the vadose zone of the NRDWL resulting from hazardous wastes disposed from 1975 to 1985.

Beginning in March 1993, soil-gas probes were installed in the vadose zone within the fenced boundary of the NRDWL and the area immediately outside the NRDWL fence. Gas samples from the soil-gas probes were analyzed using portable field-screening instruments during the initial portion of the soil-gas survey to determine potentially contaminated regions within the study area. Each soil-gas probe was monitored for combustible gas, methane, carbon dioxide, oxygen, and total VOCs. The screening data indicated elevated carbon dioxide and deficient oxygen levels in the southern and western portion of the NRDWL near the boundary with the adjacent Solid Waste Landfill (SWL). These anomalies may represent increased subsurface microbial activity, which may result from biodegradation of landfill contents. In addition, organic vapors were detected in the northeast portion of the NRDWL (the hazardous waste portion of the landfill) using a photoionization detector and a flame ionization detector. Concentration levels of the other screening parameters were at or below the detection limit of the screening instruments. Installation of the soil-gas network and the initial field-screening results were summarized in an earlier report (Jacques 1993a).

The final portion of the NRDWL soil-gas survey involved collecting soil-gas samples for onsite analysis using portable gas chromatographs (GC). These analyses were used to further delineate the regions of potential contamination detected by the field screening instruments. In addition, deep soil-gas probes were installed at four locations of the soil-gas network as prescribed in DOE-RL (1990). The probes were installed at depths of 9 and 15 ft. Soil gas collected from the probes was also analyzed using the portable GCs. This report documents the methods implemented and activities performed to collect and analyze soil-gas samples from the NRDWL soil-gas network. It also discusses results from the soil-gas analyses and proposes strategies for future investigation.

Several organic compounds listed on the NRDWL waste inventories were identified in samples collected from the soil-gas network. Three organic chemicals--acetone, trichloroethylene (TCE), and perchloroethylene (PCE)--were identified at varying concentrations throughout the entire landfill site. The highest concentrations of these chemicals appeared to be associated with specific waste disposal trenches. Three other organic chemicals--chloroform, carbon tetrachloride, and 1,1,1-trichloroethane--were detected in association with specific chemical trenches at the NRDWL. Trace amounts of cis-1,2-dichloroethylene and 1,1,2-trichloroethane were also detected in the study area.

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2.0 FACILITY DESCRIPTION

The NRDWL is an inactive disposal facility regulated by the *Resource Conservation and Recovery Act* (RCRA) as a Treatment, Storage, or Disposal (TSD) facility. It is located adjacent to and northeast of the Solid Waste Landfill (SWL) in the 600 Area of the Hanford Site (Figure 2-1). The NRDWL was operated from 1975 through 1985 and received nonradioactive dangerous waste from process operations, research and development laboratories, and maintenance functions on the Hanford Site.

Nineteen trenches are defined within the NRDWL (Figure 2-2). Dangerous waste was disposed in six chemical trenches (19N, 26, 28, 31, 33, and 34). Chemical trench 34 was the first to be used and was opened in January 1975 (DOE/RL 1990). Waste disposal at the NRDWL was discontinued in May 1985. Unused portions of trenches 19N and 26 have remained open since that time.

According to *Nonradioactive Dangerous Waste Landfill Closure/Postclosure Plan* (DOE/RL 1990), nine trenches (2N, 20, 21, 22, 23, 25, 27, 29, and 30) were used for disposal of asbestos waste from 1975 through 1988. Trench 1N was used exclusively for disposal of sanitary wastes. Trenches 24, 32, and 18N were never used. The geophysical survey data, however, revealed some discrepancies from this reported information. It appears that it is trench 23 instead of trench 24 (as reported in DOE/RL [1990]) that is unused. The geophysical data also indicated that trench 31 extends into the area designated for trench 32 (Mitchell et al. 1993). According to the geophysical data, the other trenches were positioned as reported in DOE/RL (1990).

The general waste disposal method used at the NRDWL was the trench method. Wastes were placed in an excavated trench and covered with native soil. The trenches were excavated on 46-ft centers to a depth of about 15 ft. The trenches were about 16 ft wide at the base and about 400 ft in length. Excavated soil was deposited in spoils piles on both sides of the trench and used later to cover the waste materials (DOE/RL 1990).

The chemical trenches were constructed with a gravel access ramp to the bottom of each trench. Chemicals were normally overpacked in 55-gal drums before disposal in the trenches. The wastes were placed standing on end in rows in the unlined trenches. Occasionally when the shipment of drums was large, the drums were stacked two-high. At the end of the day, a portion of the spoils pile was pushed over the drums. The final cover over the trenches was about 6 to 10 ft of native soil (DOE/RL 1990).

Waste acceptance criteria at the time of disposal required a detailed list of each waste constituent and its volume. Chemical wastes consisted of small quantities of laboratory chemicals, waste oils, waste solvents, and empty chemical containers. The chemical wastes were both regulated and unregulated. Chemicals disposed in the NRDWL are listed by trench in DOE/RL (1990). The first trenches used, trenches 34 and 33, contain the largest amounts of regulated chemicals. Trenches used later contained smaller amounts of both regulated and unregulated chemicals.

Waste liquids were either absorbed with porous materials or lab-packed before disposal. Lab-packed wastes contained liquids in no greater than 1-gal glass or 5-gal plastic or metal containers packed in at least twice their volume of absorbent. The final lab-pack disposal container was generally a

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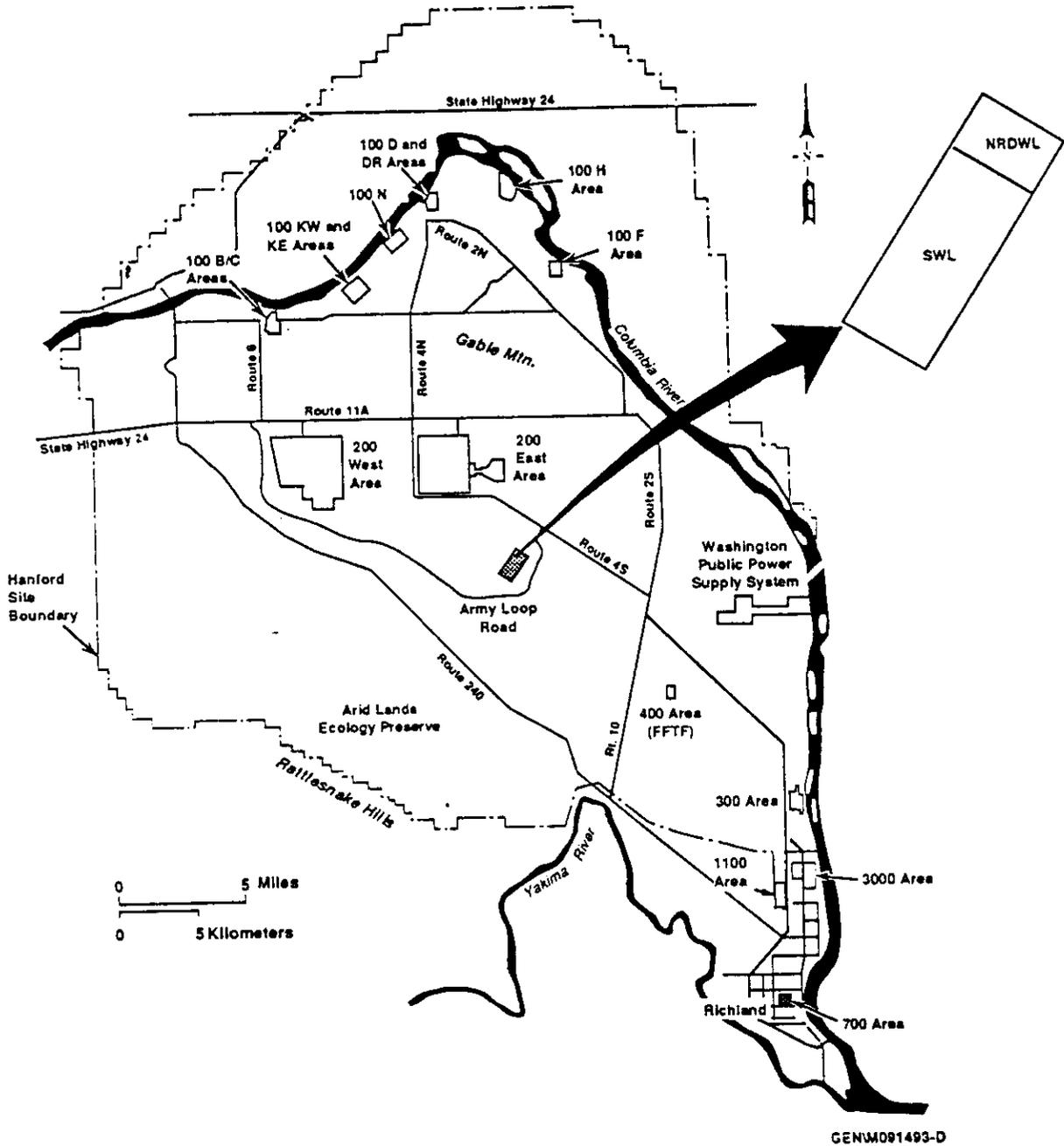
55-gal drum. No containers holding free liquids were known to have been disposed at the NRDWL site (DOE/RL 1990).

For the asbestos and sanitary trenches, waste was unloaded at the base of the open trench or at the top of the working face. As the waste was unloaded, a tractor was used to push the wastes to the desired height. Asbestos waste and sanitary solid wastes were generally put into containers for disposal. Sanitary wastes included unregulated solid materials such as office, construction, and some gardening wastes. At the end of the day, a portion of the spoils pile was pushed over the wastes. The final cover was about 4 to 6 ft thick (DOE/RL 1990).

The NRDWL is currently managed by Westinghouse Hanford Company (WHC) and will be closed in conformance with standards required under WAC 173-303-610 as described in DOE-RL (1990). One of the requirements specified in DOE-RL (1990) is a soil-gas survey to assess detectable gaseous vapors in the vadose zone. The results of this survey will complement data generated from other characterization activities (e.g., groundwater monitoring or soil sampling).

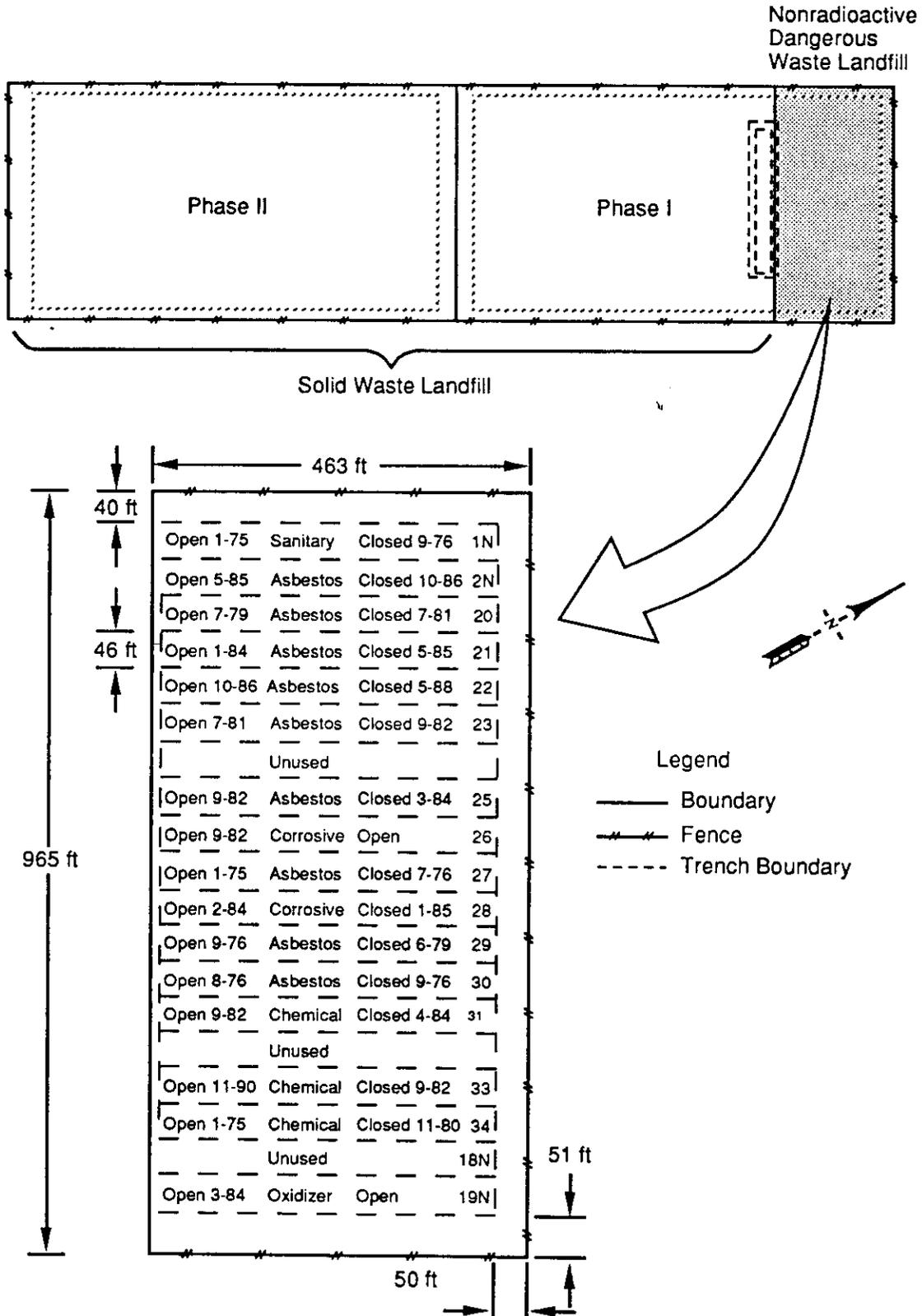
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Figure 2-1. Location of the SWL and the NRDWL on the Hanford Site.



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Figure 2-2. Trench Locations and Waste Designations for the NRDWL.



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3.0 SITE DESCRIPTION

Surface geological conditions at the NRDWL and the adjacent SWL consist of surficial dune sand overlying the flood-deposited silts, sands, and gravels of the Hanford formation. These deposits overlie silts, sands, and gravels of the fluvial/lacustrine Ringold Formation (Evans et al. 1989). Some gravel exists at the surface around the NRDWL, primarily as the result of trenching and road-making activities.

The unconfined aquifer occurs in the sediments of both the Hanford formation and Ringold Formation at a depth of about 125 ft below ground surface. The general groundwater flow direction is from west to east. The hydraulic gradient under the SWL and NRDWL is flat, approximately 0.1 ft/1,300 ft (0.00001). Estimates of groundwater flow rates range from 2 to 5 ft per day (Evans et al. 1989).

The surficial dune sand layer is about 3 to 4 ft thick. Beneath the surface sand is a narrow horizontal silt layer about 3 to 4 in. thick that marks the top of the sand subunit of the Hanford formation (Evans et al. 1989). This silt layer is evident in the open trenches of the NRDWL and was encountered in the undisturbed areas of the site both during the surface geophysical survey and when the soil-gas probes were installed (Mitchell et al. 1993). In contrast to the undisturbed areas, the closed disposal trenches represent large disturbed areas containing reworked soil and wastes. The disturbed portions of the site contain medium- to coarse-grained sands.

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4.0 METHODS

4.1 SHALLOW SOIL-GAS PROBES

During March 1993, 170 shallow soil-gas probes were installed over a 30-acre area extending 200 ft beyond the north, east, and west NRDWL perimeter fence and 200 ft into the north end of the SWL (Figure 4-1). Figure 4-1 also shows the designation for each trench and the type of waste disposed. The J.A. Jones (JAJ) trench is a sanitary waste trench used by the general engineering contractor.

Probes were installed along each trench centerline in the chemical disposal area and along alternating trench centerlines in the asbestos disposal area. The trench centerlines are oriented to magnetic north. Soil-gas probes located on the waste trenches were positioned using the geophysical data (Mitchell et al. 1993). Positions were chosen that were judged most likely to encounter vapors while minimizing the potential to penetrate buried waste. Open trenches and berms prevented installation of probes in some areas. Probe locations outside the NRDWL fence followed a 100-ft grid, which is also oriented to magnetic north (Jacques 1993a). Figure 4-2 shows an aerial view of the NRDWL.

Each soil-gas probe was installed in accordance with Environmental Investigations Instruction (EII) 5.9, "Soil-Gas Sampling" (WHC 1988). The soil-gas probes consisted of a dedicated, perforated stainless-steel point connected to an 8-ft section of $\frac{1}{4}$ -in. outside diameter (OD) Teflon (a trademark of E. I. du Pont de Nemours & Company) tubing. The soil-gas probes were driven to a depth of approximately 4 to 6 ft below ground surface using a PD-36 (a trademark of Rhino Tool Company) pneumatic post driver (Figure 4-3). This depth was chosen to ensure that the probe inlet was placed beneath the confining silt layer when it was present. The end of the tubing protruding from the ground was capped with a plastic cap. Finally, the soil around the tubing was firmly packed to ensure minimal annular space between the tubing and the emplacement hole. Probe depths and locations were recorded in the field logbook, and a marker flag with the probe coordinates was placed next to each probe (Jacques 1993b).

Approximately one week after the soil-gas probes were installed, each probe was sampled using a series of portable vapor monitoring instruments. These data identified two main areas of potential vapor contamination. The southern and western portions of the site appeared to contain organic vapors characteristic of a sanitary landfill. The northeastern portion of the site appeared to contain organic vapors associated with chemical waste disposal. A more detailed discussion of the probe installation and field-screening procedures as well as the analytical results can be found in Jacques (1993b).

4.2 FIELD-SCREENING SAMPLES

On June 3 and 4, 1993, the shallow soil-gas probes were screened a second time for total-VOC levels using two portable vapor screening instruments (Figure 4-4). The instruments used were a MicroTip HL-2000 (a trademark of Photovac International, Inc.) Photoionization Detector (PID) equipped with a 10.6-eV lamp and an OVA 128 Organic Vapor Analyzer (a trademark of Foxboro

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Company) Flame Ionization Detector (FID). The instruments were calibrated twice daily (morning and noon) as follows.

- The PID was zeroed using ambient air filtered through a charcoal filter. The instrument span was set using 101 ppm isobutylene in air. Finally, the calibration was verified using 9.51 ppm isobutylene in air.
- The FID factory calibration was checked using 9 and 95 ppm methane in air. The instrument was zeroed to ambient air.

The instruments were connected directly to each soil-gas probe using a 1-in. section of Tygon (a trademark of the Norton Company) tubing. A consistent methodology was used for collecting the field-screening measurements as follows.

- (1) The PID was connected to the probe and allowed to pump for about 30 seconds. This purge time was sufficient to pump about 3 tube-volumes (about 250 mL). The instrument response was then recorded.
- (2) The FID was attached to the probe and the instrument response was recorded. The soil gas in several probes did not contain sufficient oxygen to support the FID hydrogen flame. In these cases, the instrument was disconnected from the probe before the flame was extinguished, and the response was recorded as less than detectable.

Field-screening measurements were recorded in the field using a GRiD 2260 Convertible (a trademark of GRiD Systems Corporation) pen-based notebook computer. The computer application stored the data in a table format, which was then directly imported into a spreadsheet format where the data were sorted according to probe location. These field-screening data are listed in Appendix A.

4.3 SOIL-GAS SAMPLES

Beginning on June 17, 1993, soil-gas samples were collected for analysis using a portable gas chromatograph (GC). A plastic 60-cc syringe fitted to a 3-way valve was attached to the soil-gas probe using a 1-in. piece of Tygon tubing. The probe was purged using the 60-cc syringe to extract a total purge volume of 360 mL and expel it out the exhaust end of the 3-way valve (Figure 4-5). The purge volume (about 4 tube volumes) was determined by testing VOC recovery from several sample probes using various purge volumes. A purge volume of 360 mL proved to produce the most representative and reproducible results.

After the probe was purged, a 1-mL vapor sample was collected using a 5-mL, gas-tight syringe. The syringe needle was inserted into the sample tube through the 1-in. Tygon connector. Before the sample was collected, the syringe was flushed two to three times with soil gas to equilibrate the sample with the syringe. After the sample was collected, the needle was sealed by inserting it into a rubber septum. The sample was then transported to a trailer located near the NRDWL entrance for analysis. The entire sampling operation took about 5 to 10 minutes. Each sample was tracked using a unique Hanford Environmental Information System (HEIS) number. Quality control

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samples collected included equipment blanks, ambient air samples, field duplicate samples, split samples, and calibration standards (Jacques 1993b).

Table 4-1 contains a list of the principal analytes for the NRDWL soil-gas survey. The analytes were selected based on volatility, previous soil-gas studies, and burial inventories for the NRDWL. The vapor samples were analyzed for detectable VOCs using a Photovac 10S Plus (a trademark of Photovac International, Inc.) portable GC (10S Plus). The 10S Plus is a self-contained, battery-powered portable gas chromatograph that incorporates a 10-m non-polar, wide-bore, capillary column and a photoionization detector (PID) with a 10.6 eV lamp. The PID is a broad-spectrum detector that is particularly sensitive to aromatic compounds and can adequately detect the chlorinated compounds listed in Table 4-1. The 1-mL soil-gas samples were injected directly to the column. The 10S Plus was operated isothermally at 40 °C using ultra high-purity air carrier gas at a flow rate of 8 mL/min.

The 10S Plus was equipped with a library to detect a variety of compounds based on retention time. Quantification is based on peak area, with appropriate response factors for each compound of interest. Three-point calibration curves for benzene, carbon tetrachloride, cis-1,2-dichloroethylene (cis-1,2-DCE), TCE, and tetrachloroethylene were developed using calibration gas standards. The calibration gas standards have a concentration tolerance of $\pm 2\%$. Three-point calibration curves for chloroform, 1,1-dichloroethane, dichloromethane, 1,4-dioxane, tetrahydrofuran, 1,1,1-trichloroethane, and 1,1,2-trichloroethane were prepared by adding headspace vapor above laboratory-grade pure chemical standards into a Tedlar (a trademark of E.I. du Pont de Nemours & Company) bag containing 1.5 L high-purity air. This method is described in Photovac 1990 and has a concentration tolerance of about $\pm 5\%$. One-mL samples of the gas standards were analyzed to create the method library.

At the beginning of each sampling day, the 10S Plus was calibrated using a gas calibration standard containing 1 ppm each of cis-1,2-DCE, TCE, and tetrachloroethylene. The acceptable calibration tolerance was $\pm 10\%$ (ASTM 1993).

All the probes located within the NRDWL fence were sampled and analyzed using the 10S Plus. In addition, all the probes in the NRDWL monitoring network with positive field-screening results from either the PID or the FID located outside the NRDWL fence were sampled. Finally, about 50% of the probes located outside the NRDWL fence showing non-detectable concentrations of total-VOC were sampled and analyzed using the 10S Plus. This consisted of sampling and analyzing alternate probes in the grid outside the NRDWL fence. If significant levels of VOC were detected, samples were collected from the adjacent probes until background levels were detected.

On June 23, 24, and 28, 1993, 15 duplicate samples were collected and analyzed by the Pacific Northwest Laboratory (PNL) Environmental Sciences Department. Ambient air, calibration standards, and samples from selected NRDWL soil-gas probes were collected in 0.5-L glass gas sampling bulbs. The gas samples were drawn through the glass sampling bulbs with a battery-powered pump drawing at a rate of 2 L per minute. A minimum of 3 minutes purge time was used for all samples.

The samples were analyzed using a Hewlett Packard 5971A GC/MS at the PNL Sigma 5 Building in Richland. The system is equipped with a 15-m DB-624

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megabore column. One-mL air samples were injected into the split injector with a gas-tight syringe. A 1-mL aliquot was collected from two of the samples by WHC for onsite split analysis.

Beginning on July 29, 1993, the soil-gas probes located over the NRDWL chemical trenches were resampled and analyzed using a second portable GC. Vapor samples of about 500 mL volume were collected in 1-L Tedlar bags. The samples were collected using a battery powered pump drawing at a rate of about 500 mL per minute. Each soil-gas probe was purged for a minimum of two minutes. Each sample was tracked using a unique HEIS number. Quality control samples collected included equipment blanks, ambient air samples, field duplicate samples, and calibration standards (Jacques 1993b).

The samples were transported to a trailer located outside the NRDWL fence for analysis using a Sentex Scentograph (a trademark of Sentex Systems Incorporated) portable GC. The Scentograph is a self-contained, battery-powered portable gas chromatograph that incorporates a 30-m non-polar, wide-bore, capillary column and an argon ionization detector (AID). The AID is a broad-spectrum detector with an effective ionization potential of 11.7 eV. The sample was drawn into the Scentograph from the sample bag by an on-board pump and routed to a preconcentrator. The sample was then desorbed at high temperature into the column for separation. The Scentograph column was operated isothermally at 40 °C using high-purity argon carrier gas at a flow rate of 6.5 mL/min.

Quantification of the compounds of interest is based on a comparison of an observed peak area and a peak of known concentration in the method library. A calibration gas standard containing carbon tetrachloride, chloroform, TCE, 1,1,1-trichloroethane, 1,1,2-trichloroethane, and tetrachloroethylene was prepared each sampling day by adding headspace vapor above laboratory-grade pure chemical standards to a Tedlar bag containing 1.5 L high-purity air (Photovac 1990). The calibration standard was analyzed to create the method library.

4.4 DEEP SOIL-GAS PROBES

Beginning on September 21, 1993, eight deep soil-gas probes were installed in the NRDWL study area. The probes were installed in pairs with one probe driven to a depth of about 9 ft and the second driven to a depth of about 15 ft. Three pairs of probes were installed along the interface between the SWL and the NRDWL. One pair of probes was installed as an up-gradient sampling point in the northwest corner of the study area. Figure 4-6 shows the location of the four sets of deep probes.

The deep probes were driven using a Geoprobe 8A soil probe unit (a trademark of Geoprobe Systems). Each probe consisted of a 6-in. stainless steel wire-mesh gas inlet section attached to a steel probe point. A length of 1/4-in. OD teflon tubing is attached to the gas inlet section and extends to the soil surface. The teflon tubing was capped to prevent contamination of the sample tube. As the probes were installed, the annulus around each gas inlet section was backfilled with about 8 in. of 20/40 silica sand. A 4-in. cap of bentonite was installed above the silica sand to seal the annulus. Native soil served as the backfill around the teflon tubing to the soil surface.

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Beginning on October 12, 1993, each deep soil-gas probe and the adjacent shallow probe installed earlier was sampled and analyzed using the two portable GCs used earlier in the survey. Vapor samples of about 500 mL volume were collected in 1-L Tedlar bags. The samples were collected using a battery powered pump drawing at a rate of about 500 mL per minute. Each soil-gas probe was purged for a minimum of one minute. Each sample was tracked using a unique HEIS number. Quality control samples collected included equipment blanks, ambient air samples, field duplicate samples, and calibration standards (Jacques 1993a).

The samples were transported to a trailer located outside the NRDWL fence for analysis using a Photovac 10S Plus portable GC and a Sentex Scentograph portable GC. The two GCs were calibrated and operated in the same manner as discussed in the earlier sections of this report.

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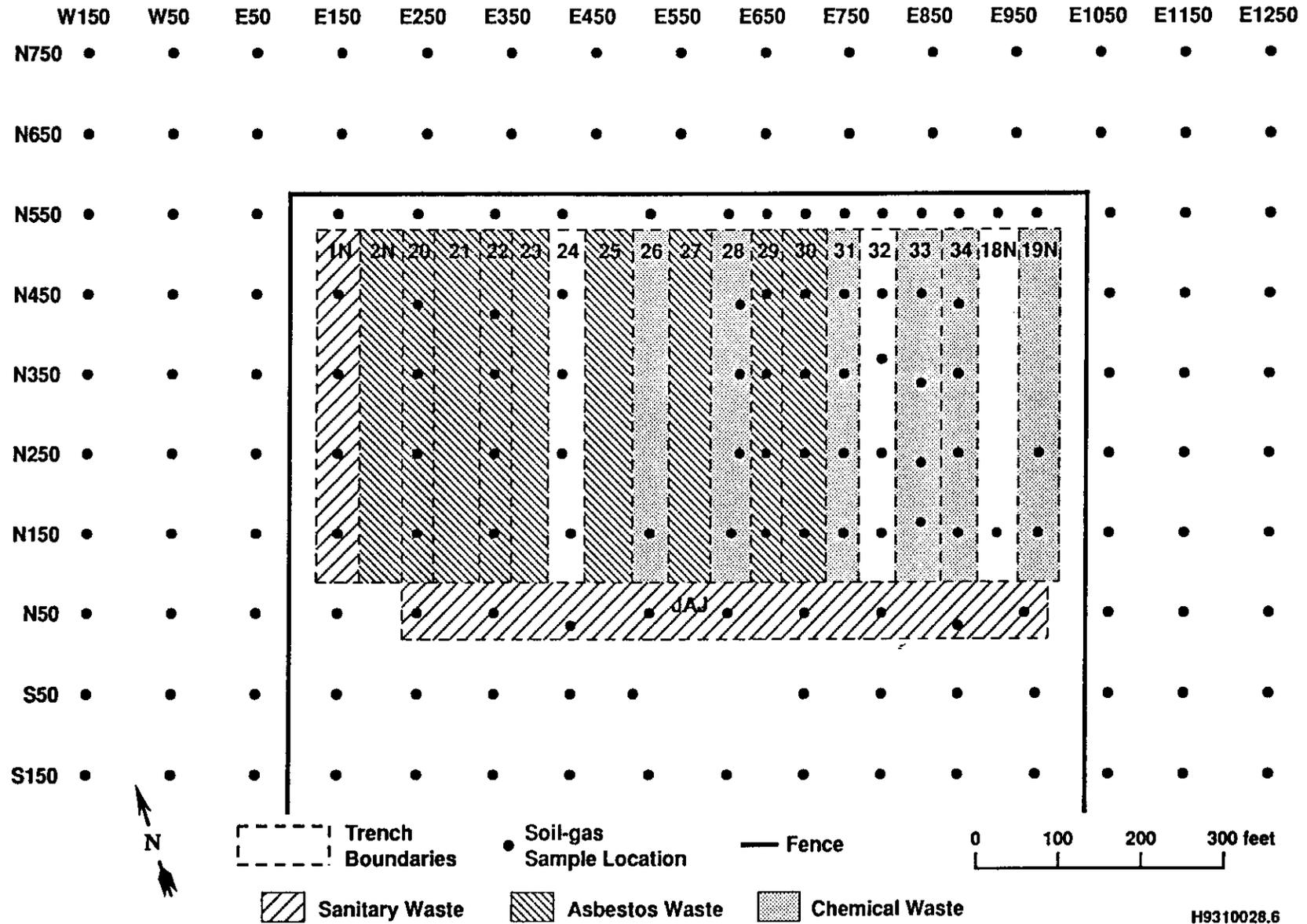
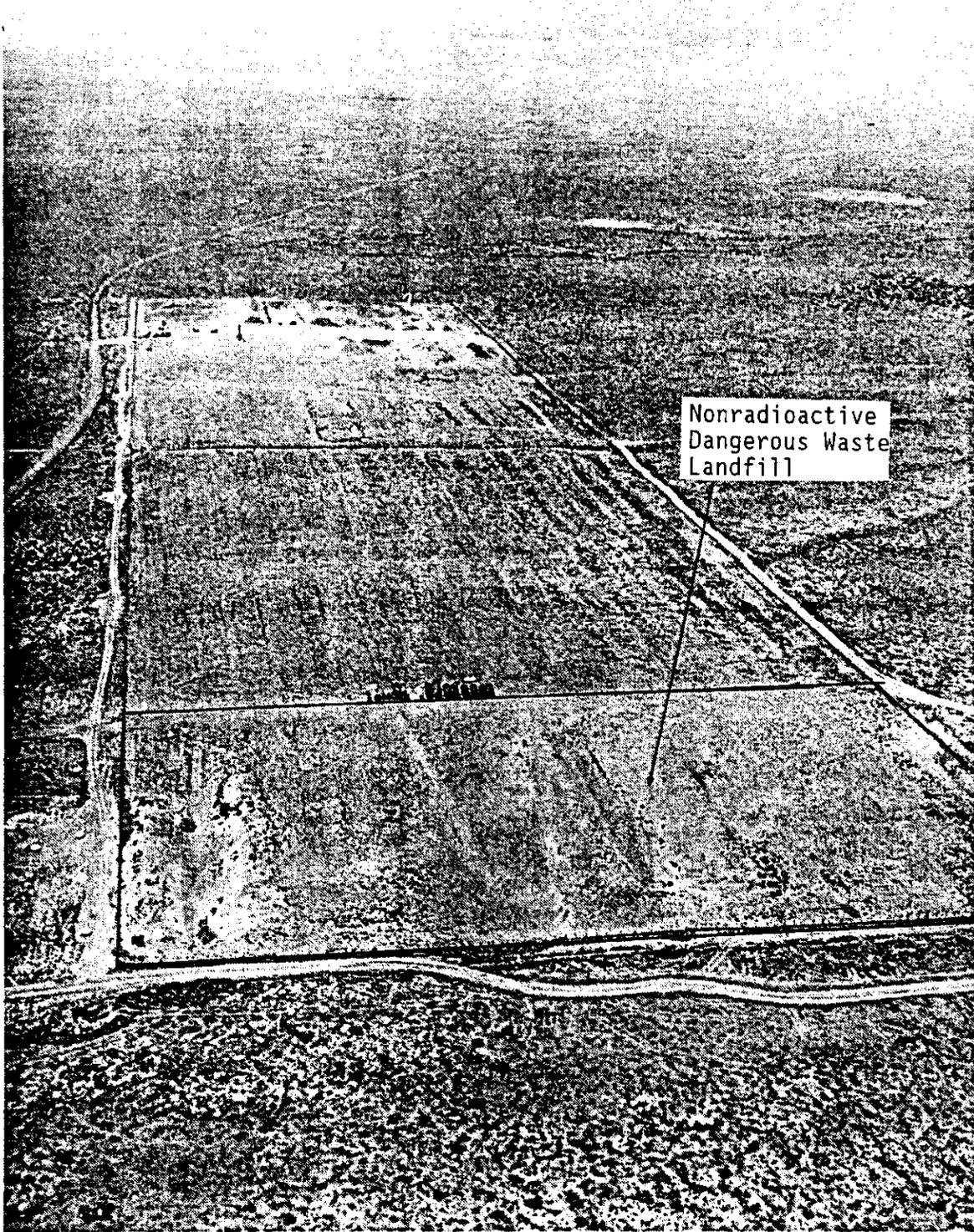


Figure 4-1. NRDWL Soil-Gas Probe Locations.

Figure 4-2. Aerial View of the NRDWL Looking Southwest.



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Figure 4-3. Installing Soil-Gas Probes.

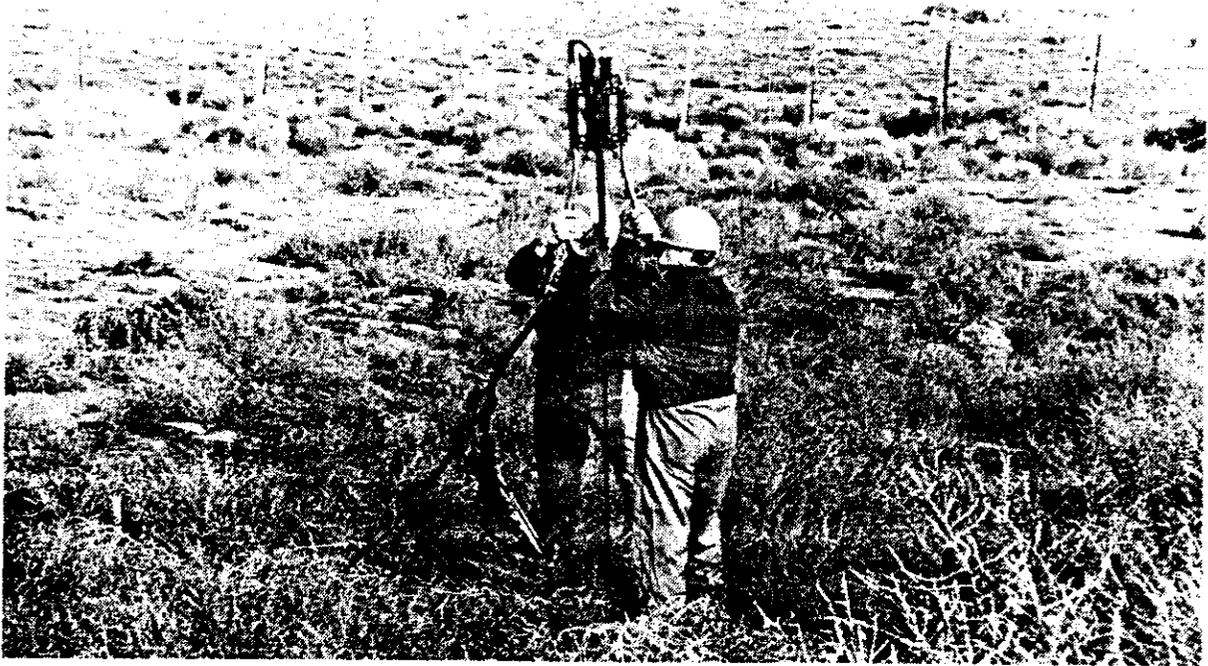
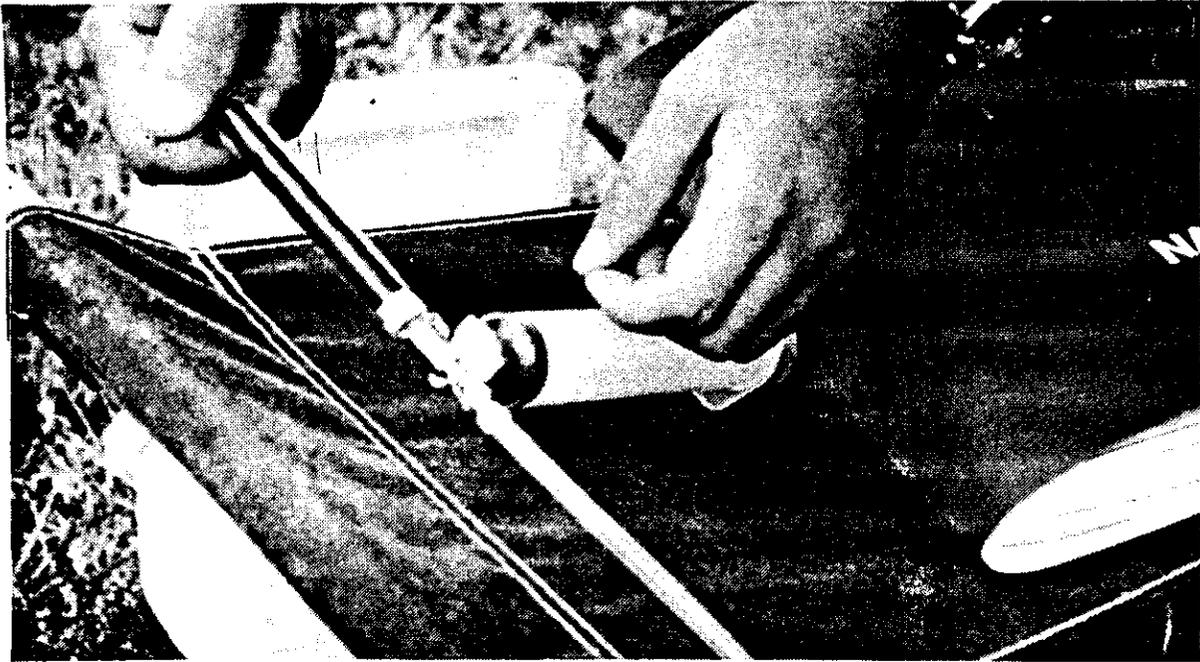


Figure 4-4. Collecting Field-Screening Data.



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Figure 4-5. Collecting Soil-Gas Samples.



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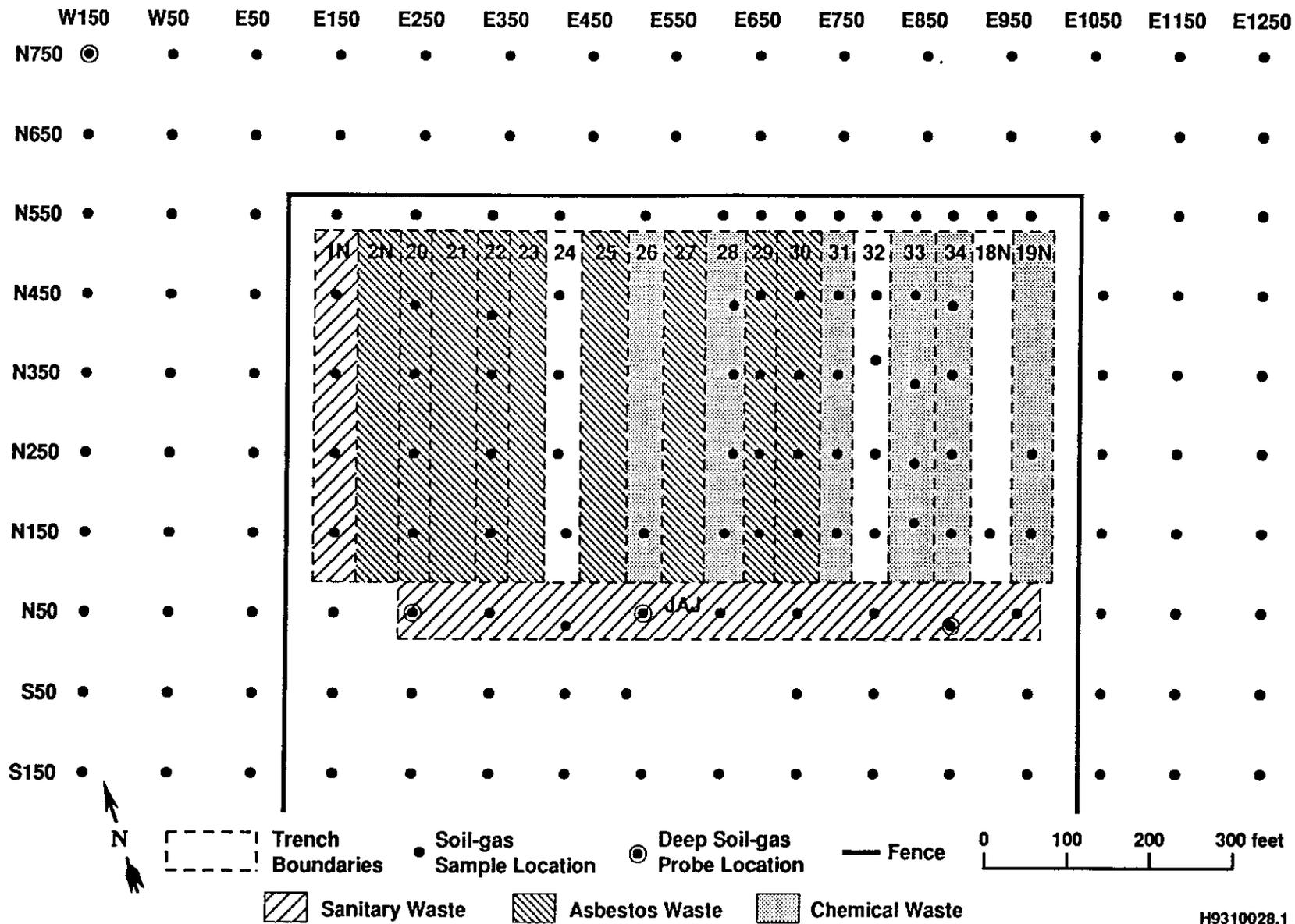


Figure 4-6. NRDWL Deep Soil-Gas Probe Locations.

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Table 4-1. Principal Soil-Gas Analytes at the NRDWL.

Analyte	CAS Number	Formula	Molecular Weight	Ionization Potential (eV)
Acetone	67-64-1	CH ₃ COCH ₃	58.08 ¹	9.69 ²
Benzene	71-43-2	C ₆ H ₆	78.11 ²	9.56 ²
Carbon tetrachloride	56-23-5	CCl ₄	153.82 ²	11.47 ²
Chloroform	67-66-3	CHCl ₃	119.38 ²	11.42 ²
1,1-dichloroethane (DCA)	74-34-3	CHCl ₂ CH ₃	98.96 ²	11.06 ²
dichloromethane (methylene chloride)	75-09-2	CH ₂ Cl ₂	84.93 ²	11.35 ²
1,4-dioxane	123-91-1	OCH ₂ CH ₂ OCH ₂ CH ₂	88.20 ²	9.19 ³
Tetrachloroethylene (PCE)	127-18-4	Cl ₂ C=CCl ₂	165.83 ²	9.71 ²
Tetrahydrofuran	109-99-9	C ₄ H ₈ O	72.16 ³	9.45 ³
1,1,2-Trichloroethane (1,1,2-TCA)	79-00-5	CHCl ₂ CH ₂ Cl	133.40 ²	N/A
Trichloroethylene (TCE)	79-01-6	ClCH=CCl ₂	131.39 ²	9.94 ²

1. Montgomery, J.H., and L.M. Welkom, 1989, *Groundwater Chemicals Desk Reference*, Lewis Publishers, Inc., Chelsea, Michigan.
2. Verschuieren, K., 1983, *Handbook of Environmental Data on Organic Chemicals*, Second Edition, Van Nostrand Reinhold, New York.
3. NIOSH, 1990, *Pocket Guide to Chemical Hazards*, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, Washington, D.C.

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5.0 RESULTS AND OBSERVATIONS

5.1 SHALLOW SOIL-GAS RESULTS

Table A-1 of Appendix A contains results for soil-gas probes sampled in the NRDWL soil-gas network and analyzed using the Photovac 10S Plus portable GC. Each probe is listed by its grid coordinates. Several of the target analytes, including benzene, 1,1-dichloroethane, dichloromethane, 1,4-dioxane, and tetrahydrofuran, were not detected during the survey. For simplicity, only the principal analytes detected are included in the table. The values shown are expressed as parts per million volume/volume (ppm-v). Where a compound was not detected in the sample, it is designated as Not Detected (ND). Compounds detected but in concentrations less than 0.010 ppm-v are shown as <0.010.

The table also shows the depth of each sample probe and the total-vapor values detected during the PID and FID screening survey in June 1993. The PID and FID field-screening values are also shown as ppm-v. Several of the probes could not be monitored with the FID because the vapors did not contain sufficient oxygen to support the flame. These values are listed as Not Analyzed (NA). These field-screening data were used to direct and focus sampling the probes for GC analysis.

The GC data indicate three principal analytes were detected in a relatively widespread distribution throughout the NRDWL site. These compounds were acetone, TCE, and PCE. Figures 5-1, 5-2, and 5-3 are contour maps of the acetone, TCE, and PCE distributions throughout the NRDWL soil-gas network. The maps were produced using SURFER, version 4, (a registered trademark of Golden Software, Inc.).

Figure 5-1 shows the distribution of acetone over the NRDWL site. The contour data indicate low concentrations of acetone were detected primarily in the western portion of the NRDWL site. This portion of the NRDWL corresponds to the location of the sanitary trench (1N). Low concentrations of acetone were also detected in the southeastern margin of the study area near the Phase I portion of the SWL. It is reported that liquid sewage waste and sludge was disposed along the facility fence line in both of these areas. This disposal practice may explain the presence of acetone in these regions. Acetone can be a byproduct of oxidative decomposition of humus or sewage sludge by soil bacteria and is often detected in landfill gases (Verchueren 1983).

The acetone concentrations measured in soil-gas samples collected from the chemical trench portions of the NRDWL were near the detection levels of the GC. Acetone does not appear to be a principal contaminant in the NRDWL chemical trenches.

Figure 5-2 shows the distribution of TCE throughout the NRDWL site. The distribution of TCE appears to be associated with two main disposal areas, with small amounts of the material detected throughout the study area. One region of high concentrations is found in probes on the E835 profile along the centerline of chemical trench 33. Trichloroethylene is listed several times in the waste inventory of this trench.

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Another region containing relatively high concentrations of TCE is the southeast corner of the study area over the closed SWL sanitary trenches. Trichloroethylene was identified in an earlier soil-gas study of the SWL (Evans 1989).

Finally, TCE was detected in low levels in many of the soil-gas samples. These low levels of TCE appear to be associated with higher levels of the solvent PCE. Trichloroethylene can be produced as a breakdown product of PCE, which may explain the wide distribution of trace levels of this material.

Figure 5-3 shows the distribution of PCE throughout the NRDWL site. Perchloroethylene appears to have the highest concentration and widest distribution of the contaminants detected at the NRDWL. The relatively low vapor pressure and high boiling point of this material may contribute to its persistence in the vadose zone environment. The data indicate two main regions of PCE contamination with small amounts of the compound distributed throughout the site.

The highest concentration of PCE was detected in soil-gas associated with chemical trenches 33 and 34. Perchloroethylene is listed as a constituent in the waste inventory of both trenches. A second region of elevated PCE concentration is on the western side of the NRDWL and appears to be associated with the sanitary trench 1N. Operating records state this trench received only sanitary wastes. However, the soil-gas values indicate PCE may have been disposed in this area.

A third region of relatively high PCE concentration is in the southern portion of the study area. This region is associated with closed sanitary trenches that are part of the Phase I section of the SWL. As was discussed earlier concerning TCE contamination, these values may be associated with SWL disposal activities. Perchloroethylene was also detected by the earlier soil-gas study at the SWL (Evans 1989).

Three other compounds of interest--carbon tetrachloride, chloroform, and 1,1,1-TCA--were detected almost exclusively in soil-gas samples collected from the chemical trench area. However, the concentrations do not appear to follow a clear pattern. After evaluating the data, it was decided to resample the probes in the chemical trench region and analyze the vapors with an instrument capable of detecting these chlorinated chemicals at lower concentrations than the Photovac 10S Plus GC. These data are contained in Table A-4.

5.2 QA/QC RESULTS

Table A-2 of Appendix A contains the results of all QA/QC samples tested to support analysis of the soil-gas network using the Photovac 10S Plus GC. These values are also listed as ppm-v and show compounds detected in each sample. The majority of the samples were GC blank analyses or equipment blanks and show nondetects for all compounds. The compounds acetone and PCE were the most widespread VOC detected in the soil gas and were occasionally detected in low concentrations in the ambient air samples.

Analyses of a 1.1 ppm-v cis-1,2-DCE, 1.3 ppm-v TCE, and 1.2 ppm-v PCE standard calibration gas are shown in Table A-2. The measured values are within $\pm 10\%$ of the actual values (ASTM 1993). Duplicate analyses are also

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shown on the table. The duplicate samples show high correlation concerning the compounds detected. However, the actual measured values may vary considerably. This is not uncommon for soil-gas analyses because of the highly variable nature of volatile compounds in the soil gas (ASTM 1993).

Table A-3 of Appendix A contains the analytical results of duplicate samples analyzed by the PNL Environmental Sciences Group. The main purpose of these analyses was to verify the identification of the compounds detected in the soil-gas samples. Each PNL gas sample consisted of a much larger volume than the WHC samples, and larger purge volumes were used to collect the sample. These factors make direct comparison of the PNL and WHC values inappropriate (ASTM 1993). However, correlation of the compounds identified between the two analytical techniques is high.

Aliquots of two PNL samples were collected by WHC and analyzed using the Photovac 10S Plus GC. These two samples were obtained from probes N159, E835 and N249, E881. The bottom portion of Table A-3 shows a comparison of the PNL and WHC results. The principal analyte detected in the N159, E835 sample was 1,1,1-TCA, and the two measured values were within 63% of each other. Carbon tetrachloride detected in the PNL samples appears to be below the detection level of the Photovac 10S Plus GC. The principal analytes detected in the N249, E881 were chloroform, carbon tetrachloride, and PCE. These three measured values were within 93%, 87%, and 100% respectively.

Two standard calibration gases were also analyzed by PNL. The 1.1 ppm-v cis-1,2-DCE, 1.3 ppm-v TCE, and 1.2 ppm-v PCE standard calibration gas was analyzed as sample B08KJ8. The analyses show good correlation for TCE and PCE. The measured cis-1,2-DCE value was about $\pm 20\%$ of the actual value. Samples of the 1.1 ppm-v carbon tetrachloride standard gas were analyzed by PNL on two occasions. The measured values were consistently three to four times higher than the stated value. Additional analyses of this gas indicate the stated value for this standard is incorrect and should be in the range detected by the PNL analyses.

5.3 CHEMICAL TRENCH SOIL-GAS RESULTS

Table A-4 of Appendix A contains analytical results for samples collected from the soil-gas probes located over the chemical trenches. These samples were collected in late July and early August 1993. The samples were analyzed using a Scentograph portable GC to better define the distribution of chlorinated compounds detected by the Photovac 10S Plus GC. The compounds detected are similar to those observed by the Photovac GC but in somewhat higher concentrations. This may be related to greater volatilization of the target compounds due to the higher ambient temperatures during this time of year.

As determined in the earlier analyses, the compounds and concentrations detected in this region of the NRDWL appear to be randomly distributed. There are no discernable plumes, but instead clusters of chemicals. This corresponds to the disposal method of placing the drums in the trenches in groups as they were received. To better understand the data, the concentrations of chemicals detected in each trench were charted along the length of the trench from south to north.

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Figure 5-4 shows the identity and concentration of contaminants detected in soil gas analyzed from five consecutive soil-gas probes located along the E605 profile. This profile corresponds to the centerline of chemical trench 28. The probes were located at about 100-ft intervals from N159 to N549. The VOC concentrations are shown on a log scale in ppm-v. The profile shows two regions, N349 and N429, where carbon tetrachloride, 1,1,1-TCA, and TCE were detected. The disposal record for trench 28 indicates 825 gal of 1,1,1-TCA was disposed on 6-22-84 and may explain the presence of this material in this region. The concentrations of PCE probably do not correspond directly to disposal of the chemical in this trench. The source of PCE appears to relate to dispersion of the chemical as a vapor in the soil pore space, as shown on earlier contour maps. This may also be true of the TCE vapors.

Figure 5-5 shows the concentration of contaminants detected in the soil-gas probes along the E651 profile. This profile corresponds to trench 29, which is designated as an asbestos trench. This trench does not appear to contain disposed chemicals. The low concentration of carbon tetrachloride may be due to dispersion of contaminants from trench 28. As stated earlier, the PCE concentrations also appear to result from dispersion of this material from other regions of the site.

Figure 5-6 shows the concentration of contaminants detected in soil-gas probes along the E697 profile, which corresponds to trench 30. This trench is also designated an asbestos disposal trench. Other than PCE, no target analytes were detected in vapors collected from this trench.

Figure 5-7 shows soil-gas contaminants detected along the E743 profile, which corresponds to trench 31. According to DOE/RL (1990), trench 31 is a chemical trench operated from September 1982 to April 1984. The geophysical survey of the site revealed a large disturbed area in this region that extended north into the area designated for trench 32. According to DOE/RL (1990) trench 32 was unused. The geophysical and soil-gas data indicate this information is not entirely correct.

Figure 5-8 shows soil-gas contaminants detected along the E789 profile corresponding to trench 32. Several target analytes, including chloroform, TCE, and 1,1,1-TCA were detected in the south end of this trench area. The 1,1,1-TCA was also detected in the south region of trench 31. The data indicate that hazardous chemicals were disposed in this enlarged trench, which extends through the area designated for trenches 31 and 32. The materials detected in these regions are listed in the waste inventory of trench 31 (DOE/RL 1990). The high PCE value detected at probe N449 E789 may indicate waste PCE material was disposed in this region. Perchloroethylene is also listed as a waste constituent for trench 31.

Figure 5-9 shows soil-gas contaminants detected along the E835 profile, which corresponds to chemical trench 33. Figure 5-10 shows contaminants detected along the E881 profile corresponding to chemical trench 34. As can be seen from these figures, relatively high concentrations of the principal analytes were detected in both trenches, especially the southern portions of the trenches. Trenches 33 and 34 are the oldest chemical trenches in NRDWL and contain the largest inventory of hazardous chemicals. The soil-gas data appear to confirm this information. All of the constituents detected in the soil gas are listed as wastes disposed in the two trenches.

5.4 DEEP SOIL-GAS RESULTS

Table A-5 of Appendix A contains analytical results for soil-gas samples collected from the four sets of deep probes installed in September 1993. Also included are analytical results for samples collected from the shallow probe located adjacent to each set of deep probes. The samples were analyzed for VOC concentrations using a Photovac 10S Plus portable GC and are expressed as ppm-v. The methane, carbon dioxide, and oxygen values were obtained using a GA90 Infrared Gas Analyzer (a trademark of Geotechnical Instruments). These values are expressed as percent (%).

Three sets of deep probes were placed south of the JAJ sanitary trench along the interface between the SWL and the NRDWL. Figure 5-11 shows the levels of carbon dioxide, oxygen, and PCE detected in the three probes located at grid location N20 E881. This grid point is located on the eastern side of the SWL/NRDWL interface. The depth of each probe increases downward on the Y axis. The X axis of the graph is a logarithmic scale and shows the concentration of each analyte in parts per million.

The concentration of PCE increased slightly in the deeper probes at this sampling location. The concentrations of carbon dioxide and oxygen were detected in levels typical of soil gas collected near a landfill. The concentration of carbon dioxide is elevated and increased with depth. The increased carbon dioxide levels are probably the result of microbial decomposition of organic materials in the landfill. As the carbon dioxide levels increase, the oxygen levels show a decrease with depth. The reduced oxygen levels would also indicate microbial activity.

Figure 5-12 shows the levels of carbon dioxide, oxygen, and PCE detected in the three probes located at the middle of the SWL/NRDWL interface. This grid location is N39 E513. As observed at grid point N20 E881, the PCE concentrations increase with depth. This may result from migration of the dense PCE vapors downward through the porous layers of the soil profile. Also, the levels of carbon dioxide increase with depth while the oxygen levels decrease. This trend is similar to what was observed at grid point N20 E881 and is probably related to microbial activity associated with the SWL.

Figure 5-13 shows the carbon dioxide, oxygen, and PCE levels detected in the three deep probes located on the western side of the SWL/NRDWL interface. This grid location is N39 E237. As observed with the other probes along the SWL/NRDWL interface, the PCE levels show a slight increase in concentration at depth. The levels of carbon dioxide also increase while the oxygen levels decrease.

Finally, one set of deep probes was placed upgradient and outside the NRDWL at grid location N750 W149. This sampling location was selected to represent ambient soil-gas conditions for the study area. Figure 5-14 shows the carbon dioxide and oxygen levels detected at grid location N750 W149. The concentration of PCE measured at this grid location was less than the detection limit of the GC. The carbon dioxide levels are somewhat elevated at this location and increase slightly with depth. The oxygen levels are near ambient levels in the shallow probe and show a slight decrease with depth.

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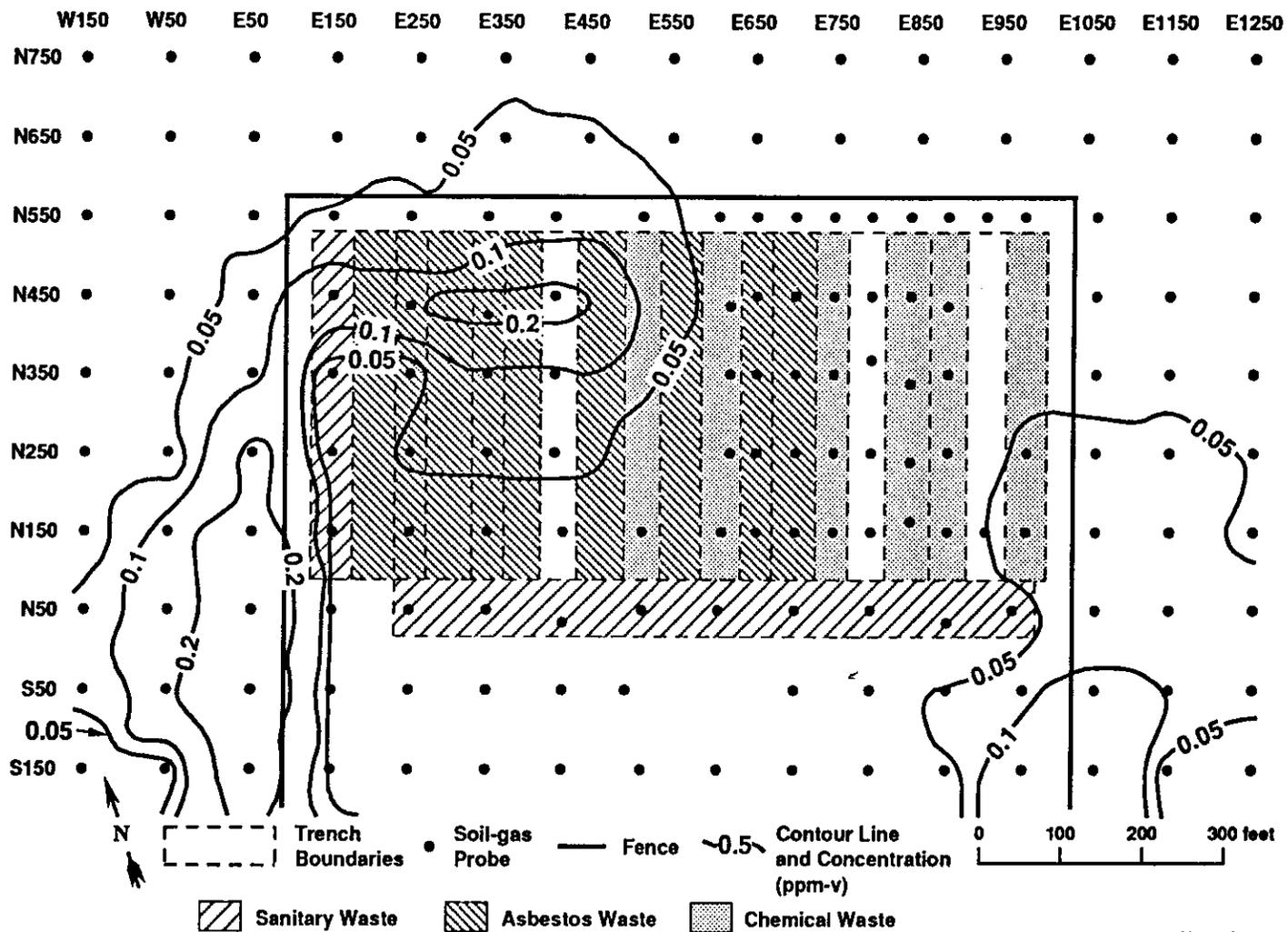
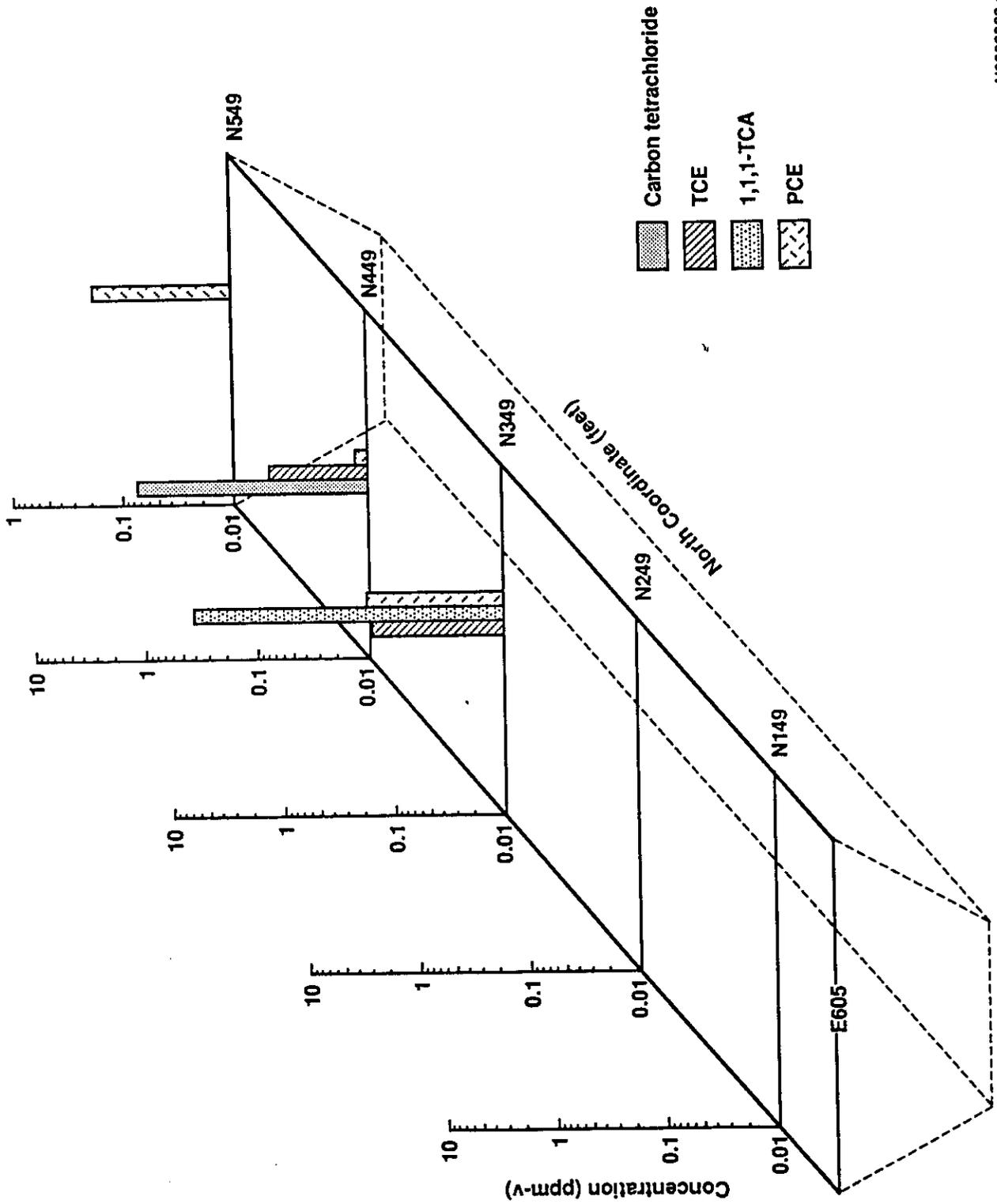


Figure 5-1. Contour Map Showing Acetone Levels at the NRDWL.

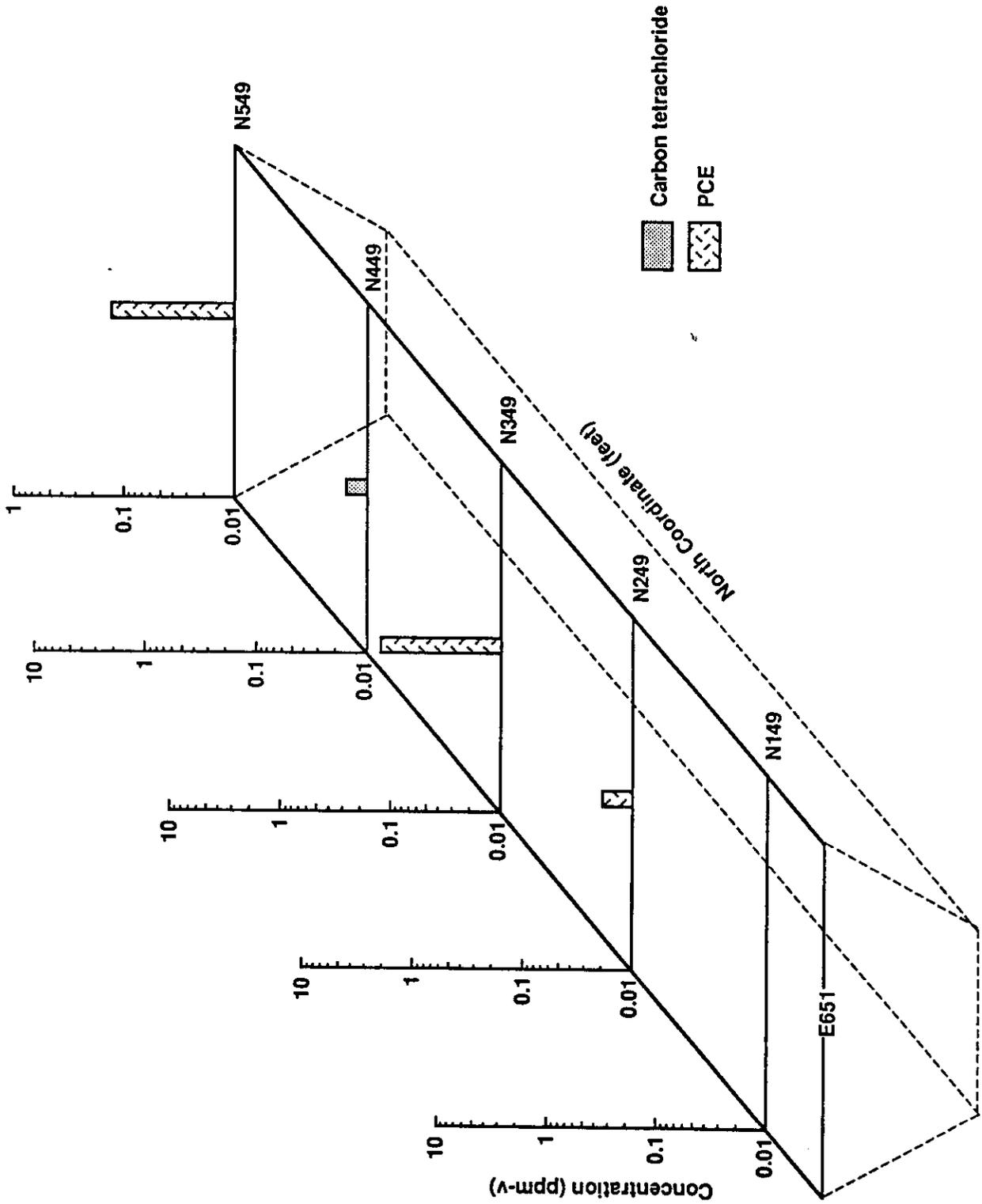
Figure 5-4. Concentration of Contaminants Detected in the E605 (Trench 28) Profile.



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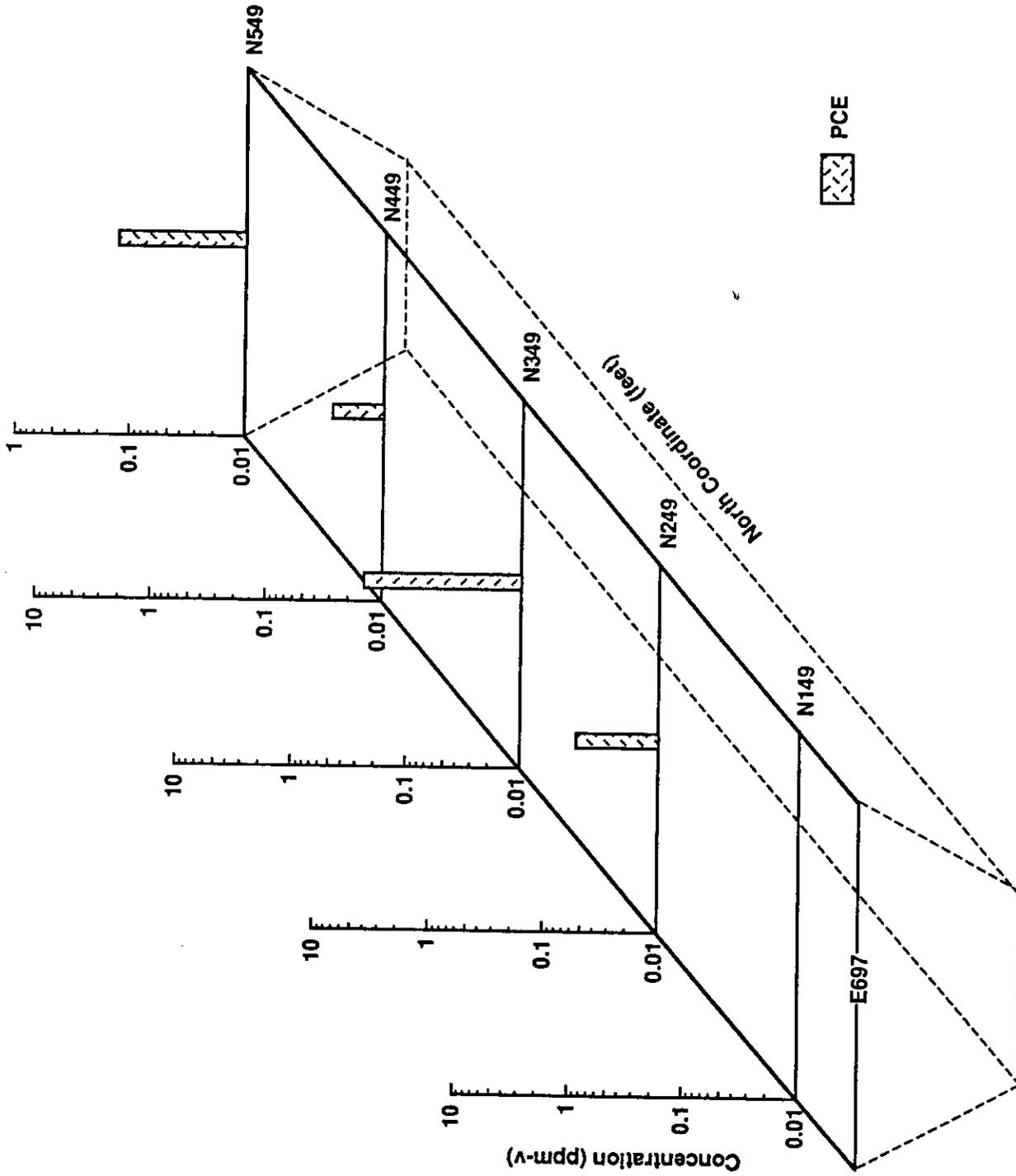
Figure 5-5. Concentration of Contaminants Detected in the E651 (Trench 29) Profile.



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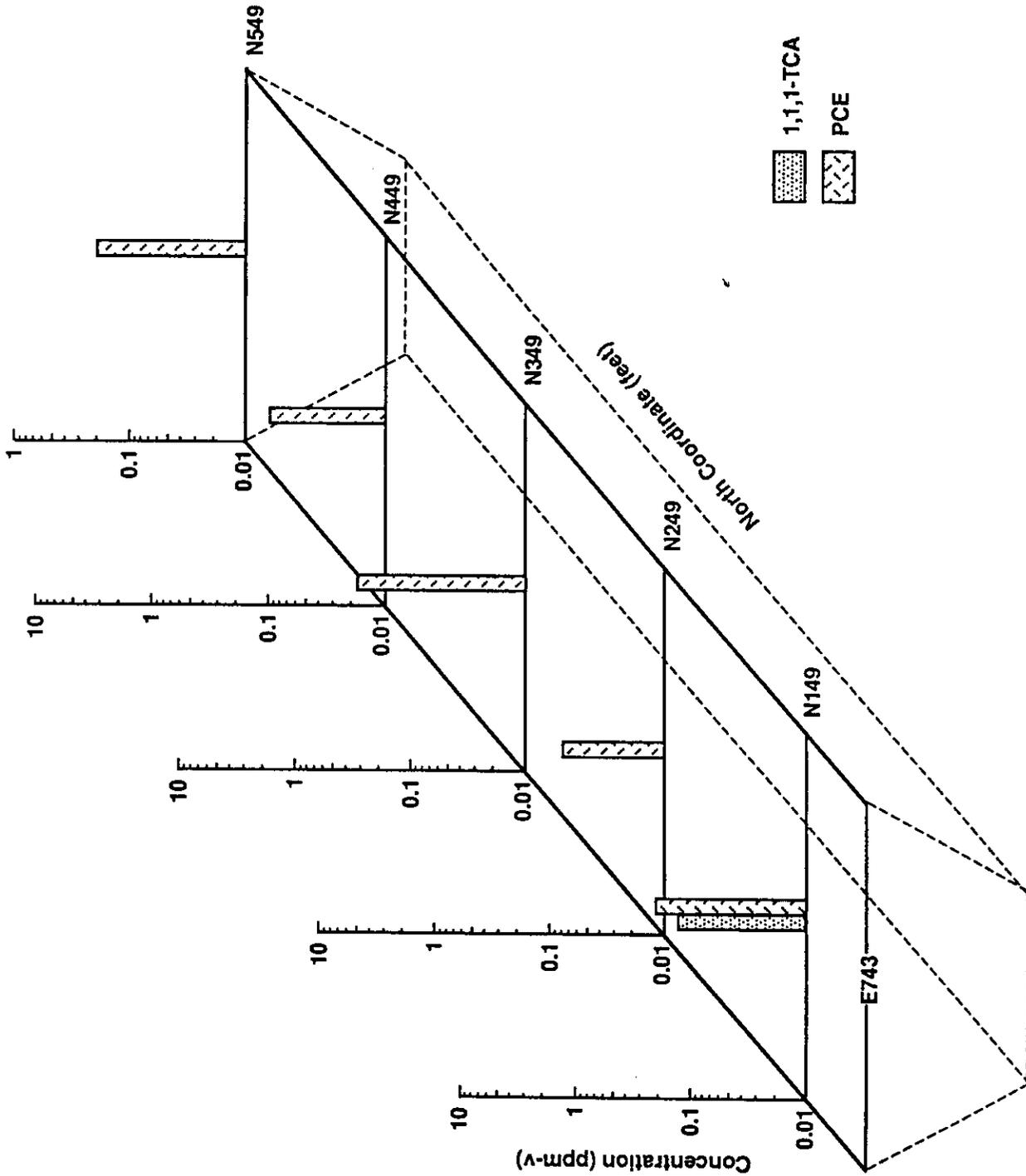
Figure 5-6. Concentration of Contaminants Detected in the E697 (Trench 30) Profile.



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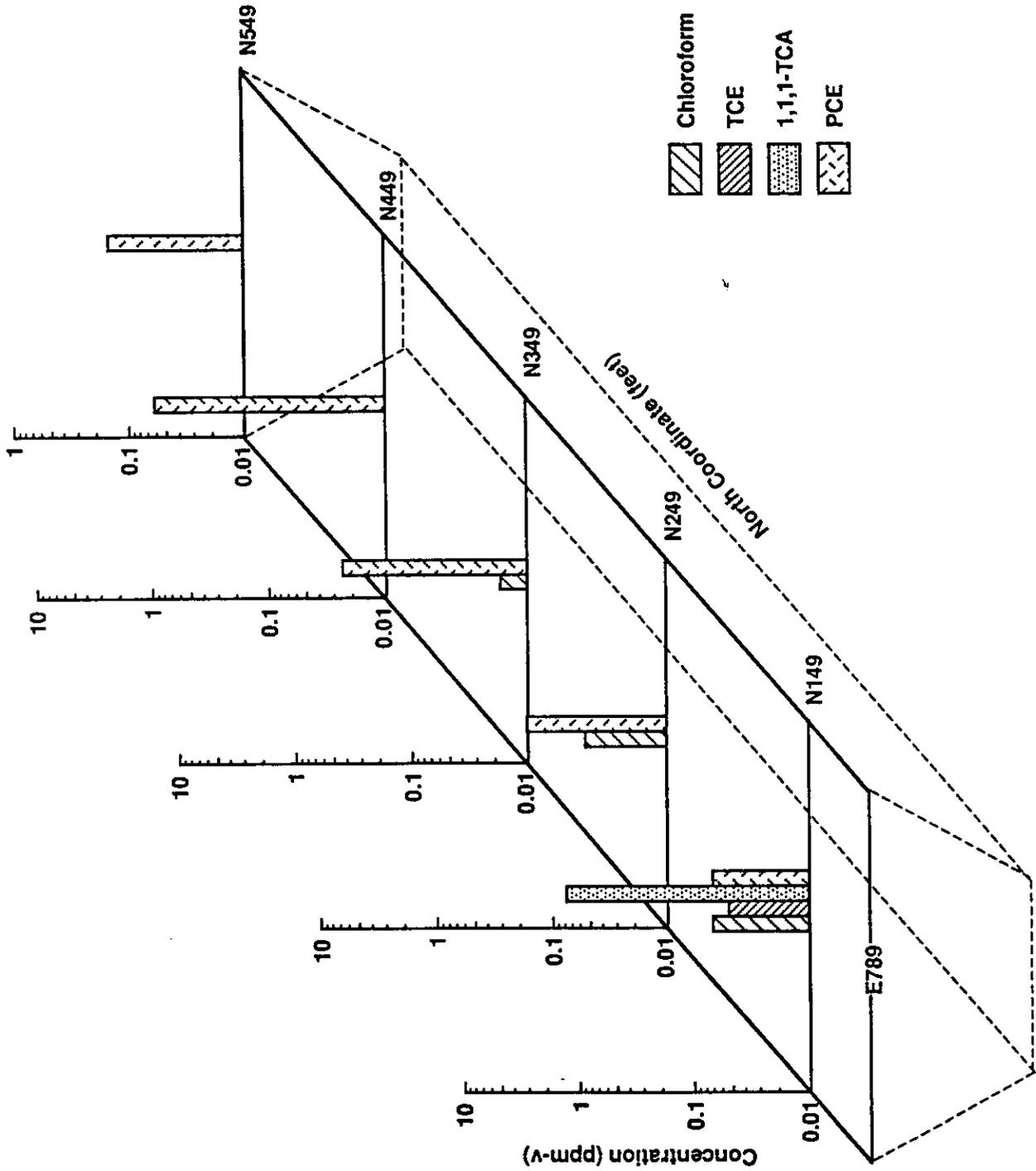
Figure 5-7. Concentration of Contaminants Detected in the E743 (Trench 31) Profile.



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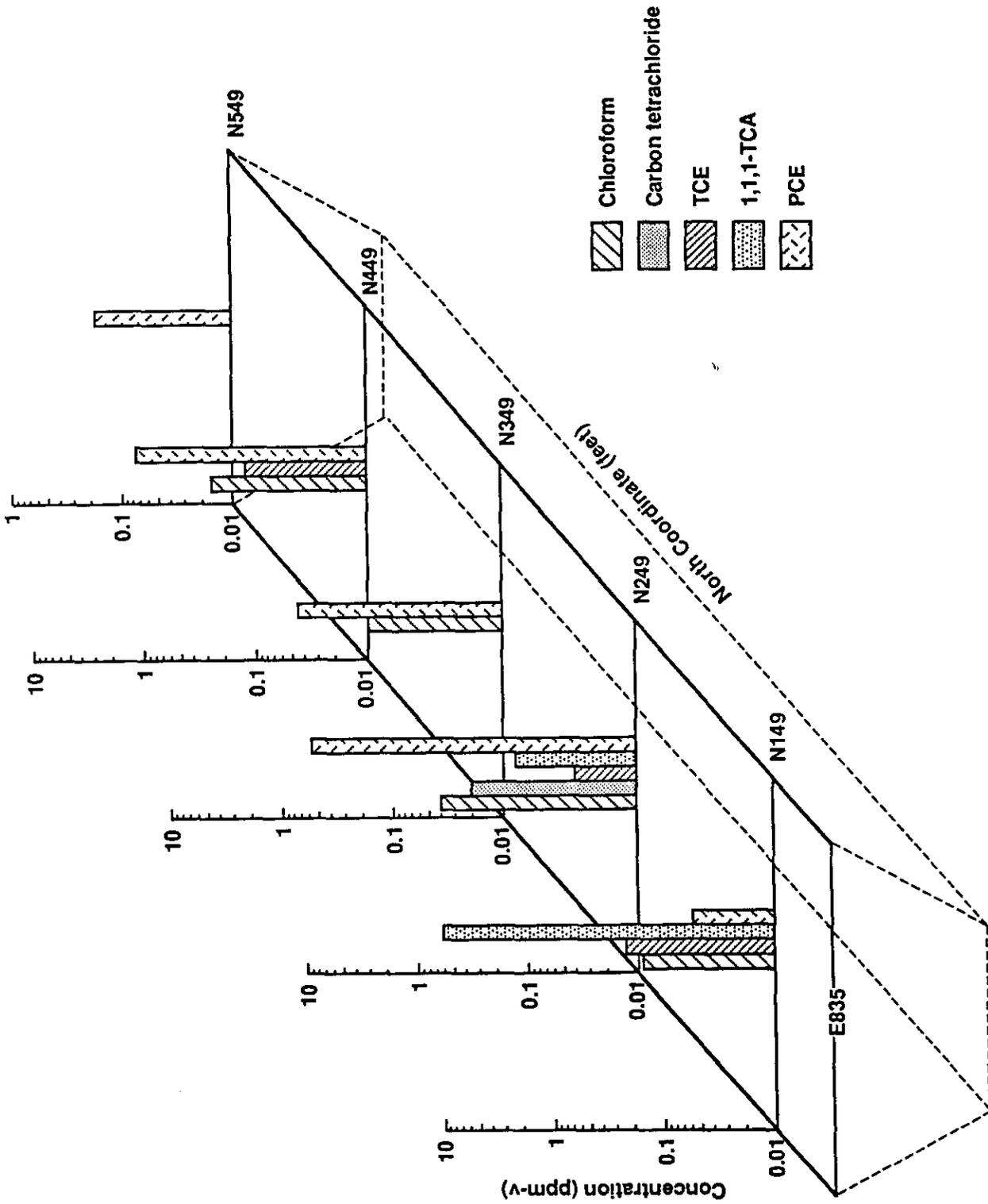
Figure 5-8. Concentration of Contaminants Detected in the E789 (Trench 32) Profile.



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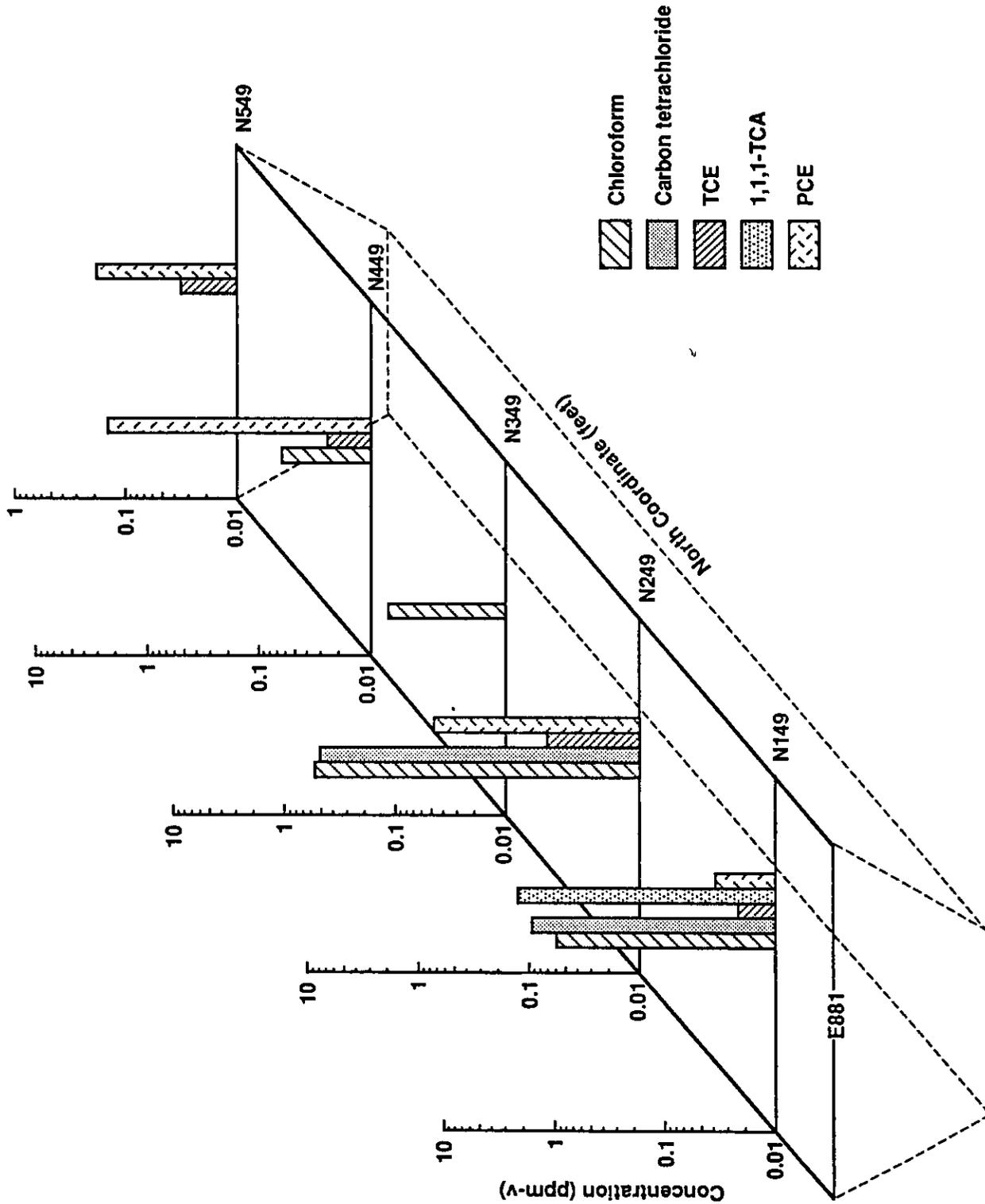
Figure 5-9. Concentration of Contaminants Detected in the E835 (Trench 33) Profile.



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Figure 5-10. Concentration of Contaminants Detected in the E881 (Trench 34) Profile.



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Figure 5-11. Deep Probe Results for Grid Location N20 E881.

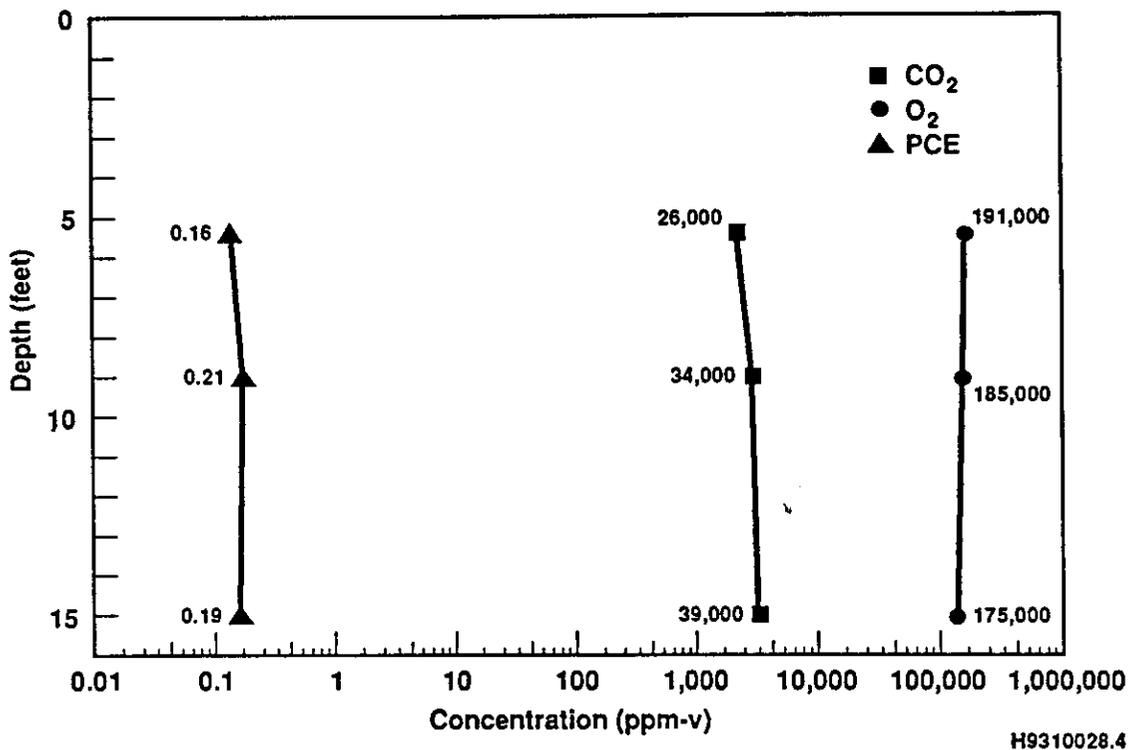
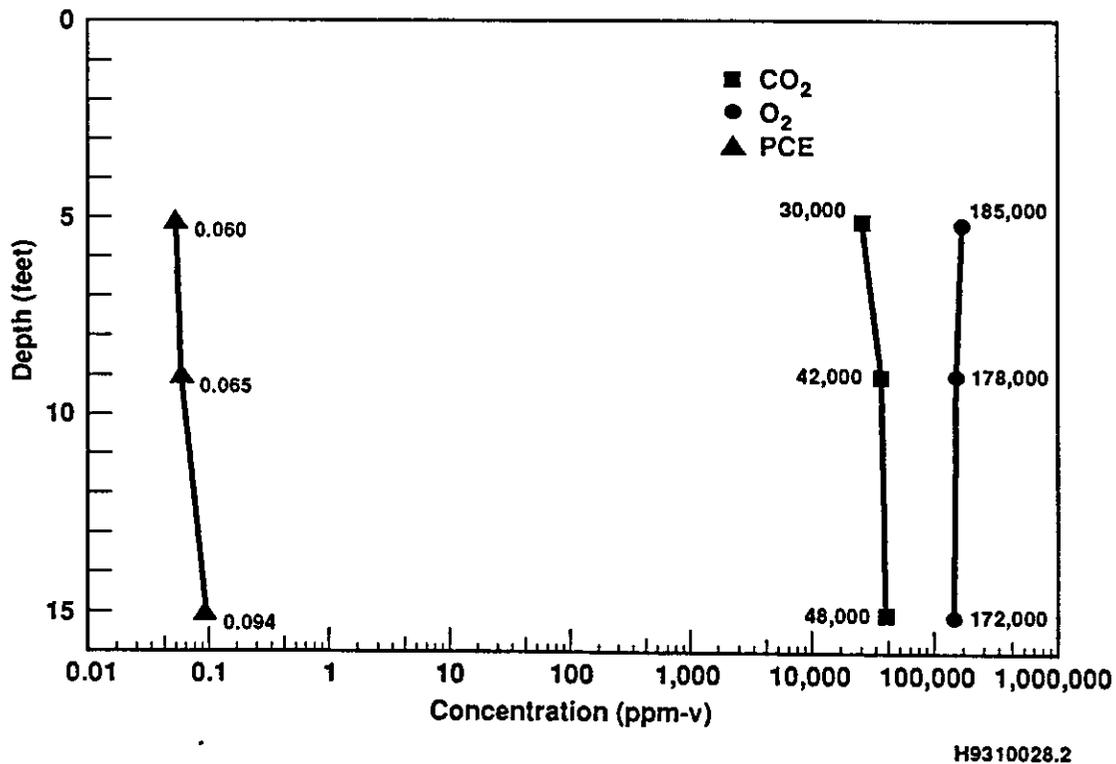


Figure 5-12. Deep Probe Results for Grid Location N39 E513.



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Figure 5-13. Deep Probe Results for Grid Location N39 E237.

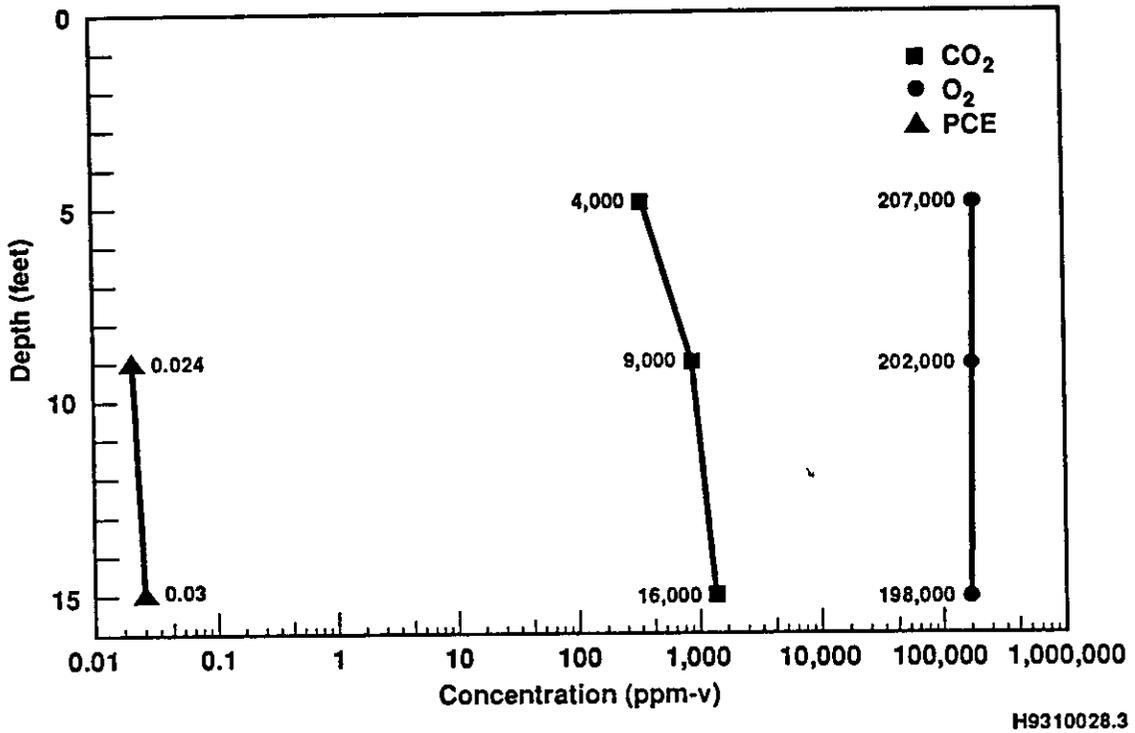
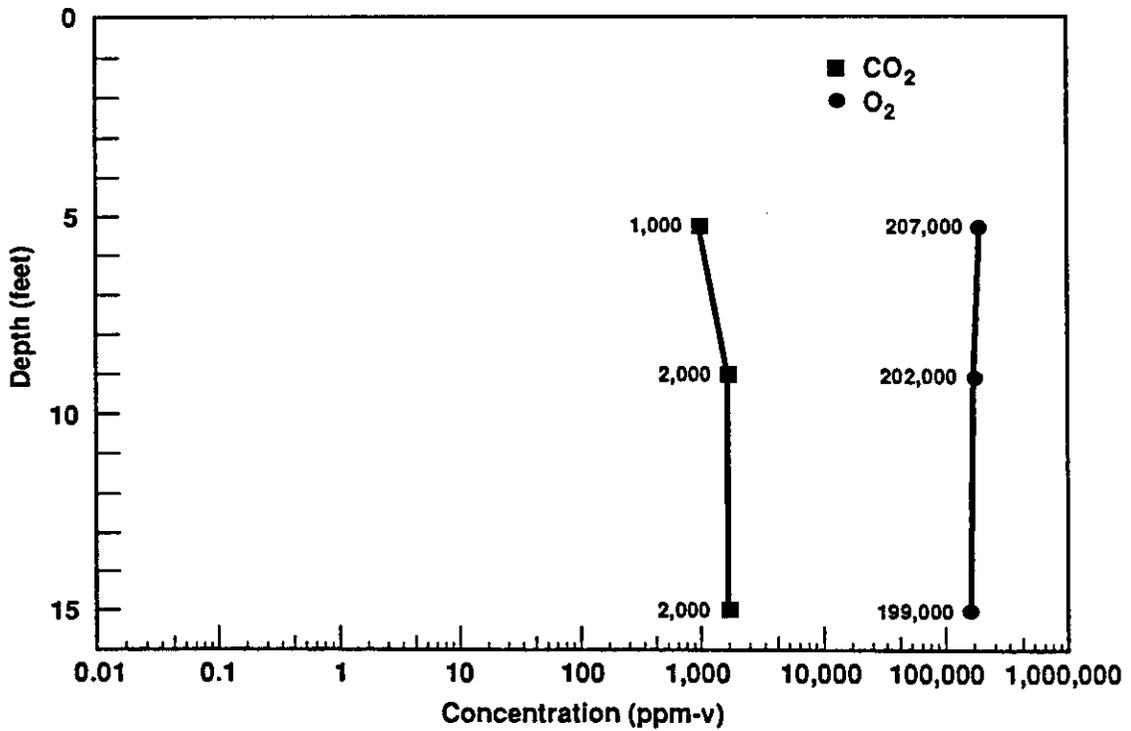


Figure 5-14. Deep Probe Results for Grid Location N750 W149.



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6.0 CONCLUSIONS AND RECOMMENDATIONS

The field-screening data collected helped define the general areas of potential VOC contamination on the NRDWL site and were used to focus sample collection and GC analysis. The data also showed positive correlation to less-than-detectable background VOC values measured in the area outside of the NRDWL site. These field-screening data were used to decrease the number of background samples needed to characterize the soil gas outside the NRDWL site.

Several volatile organic compounds disposed in the NRDWL were detected in the soil vapors collected from the site. The highest concentration and diversity of contaminants was detected in the chemical disposal trench region. The contaminants detected show a high correlation to trench location and waste inventories. The diversity and quantity of contaminants detected was greatest in the older trenches. Chemical trenches that operated in later years, when waste disposal regulations were more stringent, appeared to contain fewer volatile organic constituents. Even within a single waste trench, the distribution of detected vapors is not uniform. This may indicate the vapors are emanating from a point source such as a drum or single type of disposed waste.

Three volatile organic compounds appear to have a relatively wide distribution throughout the study area. One of the compounds, acetone, appears to be related to disposal of sewage wastes along the western fence of the NRDWL and the eastern fence of the Phase I portion of the SWL. Relatively low concentrations of TCE were also detected in several locations throughout the study area. These vapors appear to be related to wastes disposed in both the NRDWL and the SWL.

Perchloroethylene had the widest distribution and highest concentration of the contaminants detected. The distribution of PCE appears to be related to wastes disposed in the NRDWL chemical trenches and in sanitary trench 1N. Some PCE vapors may also originate from portions of the SWL outside of the soil-gas network. Perchloroethylene appears to be one of the more persistent organic chemicals detected in this study. The concentration of PCE vapors detected in soil gas outside the NRDWL boundary were at low levels.

Three chlorinated hydrocarbons detected in this study--1,1,1-TCA, PCE, and carbon tetrachloride--have been detected in low concentrations in groundwater collected from monitoring wells downgradient of the NRDWL. The source of these contaminants is not clear. Perchloroethylene and 1,1,1-TCA are detected in high concentrations in groundwater wells located downgradient of the SWL. The source of these groundwater contaminants is thought to be from liquid wastes disposed in the Phase I portion of the SWL (Fruiland 1988). The shallow nature of this soil-gas study makes extrapolation of these data to sources of groundwater contamination inappropriate.

Most of the soil-gas probes used in this study were placed at a shallow depth (4 to 6 ft). The data represent the distribution of soil-gas contaminants in the shallow portions of the vadose zone only. It is not appropriate to attempt to predict the extent of vapor contamination in the deeper portions of the vadose zone. It is therefore not possible to draw conclusions about potential soil or groundwater contamination from these data. The limited distribution of soil-gas contaminants detected in this study

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suggests the source of VOCs is confined to specific wastes disposed in the NRDWL.

Four sets of deep probes were installed around the borders of the study area. Three sets of deep probes were located along the interface between the SWL and the NRDWL. Concentrations of carbon dioxide and oxygen detected in these probes were characteristic of soil-gas collected near a landfill. Carbon dioxide levels were elevated and increased with depth. Oxygen levels were reduced and decreased with depth. The compound PCE was also detected in these probes. The concentrations of PCE appeared to increase with depth. This trend may be related to downward dispersion of this dense, persistent vapor. There is not sufficient data to evaluate the possibility of soil or groundwater contamination.

One set of deep probes was placed outside the NRDWL in the northwest corner of the study area. The PCE concentrations in these probes were less than the detection limits of the instruments used. The levels of carbon dioxide were slightly elevated, while the oxygen concentrations were slightly reduced. The levels of gases measured in these probes appear to represent ambient soil-gas levels in this study area.

Finally, based on the results of this study and the planned closure of the NRDWL, three recommendations for future study are presented.

- Additional shallow soil-gas probes should be installed along the centerline of trench 1N and the centerlines of trenches 28 through 34. The probes should be installed at close intervals, such as 25 ft apart, to better characterize volatile wastes disposed in these trenches.
- Permanent soil-gas monitoring stations should be installed at selected high-concentration sites near the chemical trenches. These stations may be vadose zone monitoring wells or soil-gas probes. If soil-gas probes are used, some of the probes should be installed at various depths to better characterize the vadose zone under the trenches.
- The soil-gas grid of the NRDWL study area should be extended south throughout the Phase I portion of the SWL. This action should help to determine the source of contaminants that do not appear to originate at the NRDWL.

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APPENDIX A

ANALYTICAL DATA FOR THE NONRADIOACTIVE DANGEROUS WASTE LANDFILL
SOIL-GAS MONITORING NETWORK

9413146-0877

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Table A-1. Photovac 10S Plus GC Results (ppm-V) for the NRDL
Soil-Gas Network. (sheet 1 of 4)

Coordinates (ft)	Depth (ft)	PID	FID	Sample Date	HEIS Number	Acetone	Chloroform	Carbon tetrachloride	cis-1,2-DCE	TCE	1,1,1-TCA	1,1,2-TCA	PCE
S 150 W 51	5.2	ND	ND	07/15/93	B08KF6	0.037	ND	ND	<0.010	ND	ND	ND	ND
S 150 E 51	5.3	ND	ND	07/15/93	B08KF5	0.31	ND	ND	0.028	<0.010	ND	ND	<0.010
S 151 E 145	5.6	0.2	NA	06/21/93	B08JV1	0.020	ND	0.13	ND	0.034	ND	ND	0.064
S 151 E 227	5.5	0.1	NA	07/13/93	B08K83	0.032	ND	ND	<0.010	0.013	ND	ND	0.022
S 145 E 329	5.7	0.2	NA	06/21/93	B08JV0	0.014	ND	2.1	ND	<0.010	ND	ND	0.024
S 151 E 421	5.3	ND	NA	06/21/93	B08JT9	0.039	ND	ND	ND	0.020	ND	ND	0.047
S 151 E 513	5.5	0.3	NA	06/17/93	B08JT6	0.031	ND	ND	0.012	<0.010	ND	ND	0.065
S 151 E 605	5.6	0.4	NA	06/17/93	B08JT2	0.044	ND	ND	0.026	0.014	ND	ND	0.14
S 151 E 697	5.6	0.3	NA	06/17/93	B08JT1	0.018	ND	ND	0.011	<0.010	ND	ND	0.082
S 151 E 775	5.7	0.3	NA	06/17/93	B08JT0	0.011	ND	ND	0.010	0.032	ND	ND	0.046
S 151 E 881	5.7	ND	NA	06/17/93	B08JS9	ND	ND	ND	<0.010	<0.010	ND	ND	0.018
S 151 E 973	5.8	0.1	NA	06/17/93	B08JS8	ND	ND	ND	0.015	0.022	ND	ND	0.023
S 151 E 1060	5.3	ND	0.1	06/29/93	B08K59	0.24	ND	ND	<0.010	0.014	ND	ND	>0.010
S 151 E 1150	5.2	ND	ND	07/14/93	B08KL0	0.020	ND	ND	ND	<0.010	ND	ND	ND
S 50 W 149	5.3	ND	ND	07/15/93	B08KF8	0.079	ND	ND	0.024	<0.010	ND	ND	ND
S 51 E 50	5.5	ND	ND	07/15/93	B08KF7	0.37	ND	ND	0.016	ND	ND	ND	ND
S 51 E 145	5.7	0.2	NA	07/13/93	B08K85	0.014	ND	ND	>0.010	0.051	0.19	ND	0.053
S 51 E 237	5.6	0.1	NA	07/13/93	B08K84	0.024	ND	ND	<0.010	<0.010	0.099	ND	0.023
S 56 E 329	5.6	0.3	NA	06/21/93	B08JV9	0.058	ND	2.5	ND	0.021	ND	ND	0.036
S 51 E 421	5.6	0.1	NA	06/21/93	B08JV8	0.070	ND	ND	ND	<0.010	ND	ND	0.033
S 51 E 493	5.6	0.3	NA	06/21/93	B08JV7	ND	ND	ND	ND	0.010	ND	ND	0.089
S 45 E 697	5.6	1.5	NA	06/21/93	B08JV5	0.026	ND	ND	ND	0.042	ND	ND	0.061
S 51 E 805	5.6	0.5	NA	06/21/93	B08JV4	0.039	ND	ND	ND	0.015	ND	ND	0.023
S 56 E 885	4.7	0.5	NA	06/21/93	B08JV3	0.077	ND	ND	0.028	0.043	ND	ND	0.084
S 51 E 973	5.4	1.0	NA	06/21/93	B08JV2	ND	ND	ND	ND	0.27	ND	ND	0.054
S 51 E 1060	5.2	ND	0.4	07/14/93	B08KK6	0.16	ND	ND	0.010	0.019	ND	ND	0.020
S 51 E 1250	5.4	ND	ND	07/14/93	B08KK9	0.088	ND	ND	0.030	<0.010	ND	ND	>0.010
N 49 W 50	5.4	ND	ND	07/15/93	B08KG0	0.084	ND	ND	0.025	<0.010	ND	ND	ND
N 51 E 50	5.4	ND	ND	07/15/93	B08KF9	0.46	ND	ND	0.030	<0.010	ND	ND	>0.010
N 39 E 145	5.2	0.2	ND	07/13/93	B08K86	0.015	ND	ND	<0.010	ND	ND	ND	0.015
N 39 E 237	4.9	0.2	ND	07/13/93	B08K87	0.017	ND	ND	<0.010	<0.010	ND	ND	<0.010
N 37 E 329	5.2	ND	ND	07/13/93	B08K88	0.014	ND	ND	<0.010	ND	ND	ND	0.021
N 24 E 421	5.2	0.1	ND	07/13/93	B08K89	0.014	ND	ND	<0.010	ND	ND	ND	0.013
N 39 E 513	5.1	0.3	ND	07/13/93	B08K90	0.013	0.082	ND	<0.010	<0.010	ND	ND	0.038
N 39 E 600	5.4	0.4	0.2	07/13/93	B08K99	0.012	0.15	ND	<0.010	<0.010	ND	ND	0.10
N 39 E 697	5.3	0.5	0.4	07/13/93	B08K96	0.012	0.19	ND	ND	<0.010	ND	ND	0.11
N 34 E 789	5.0	0.3	ND	07/13/93	B08K97	0.015	ND	ND	ND	0.017	ND	ND	0.032
N 20 E 881	5.3	0.9	ND	07/13/93	B08K96	0.017	ND	ND	ND	0.044	ND	ND	0.19
N 39 E 973	4.9	0.2	ND	07/13/93	B08K95	0.026	0.14	ND	0.011	0.017	ND	ND	0.043
N 37 E 1062	4.9	ND	ND	07/14/93	B08KK7	0.041	ND	ND	<0.010	<0.010	ND	ND	0.019

Table A-1. Photovac 10S Plus GC Results (ppm-v) for the NRDWL
Soil-Gas Network. (sheet 2 of 4)

Coordinates (ft)			Depth (ft)	PID	FID	Sample Date	HEIS Number	Acetone	Chloroform	Carbon tetrachloride	cis-1,2-DCE	TCE	1,1,1-TCA	1,1,2-TCA	PCE
N	39 E	1149	5.3	ND	ND	07/14/93	B08KK8	0.077	ND	ND	0.014	<0.010	ND	ND	<0.010
N	150 W	151	5.5	ND	ND	07/15/93	B08KG2	0.038	ND	ND	0.030	<0.010	ND	ND	ND
N	151 E	50	5.2	ND	ND	07/15/93	B08KG1	0.30	ND	ND	ND	ND	ND	ND	ND
N	147 E	145	5.0	1.3	1.6	07/13/93	B08K94	0.018	0.090	ND	<0.010	0.017	0.19	ND	0.58
N	149 E	237	5.1	ND	ND	07/13/93	B08K93	<0.010	ND	ND	ND	ND	ND	ND	<0.010
N	159 E	329	5.3	ND	ND	07/13/93	B08K92	0.016	0.045	ND	<0.010	<0.010	0.35	ND	<0.010
N	149 E	409	5.2	ND	ND	07/13/93	B08K91	0.030	ND	ND	0.014	<0.010	ND	ND	<0.010
N	149 E	513	5.3	ND	ND	06/30/93	B08K70	ND	ND	ND	<0.010	<0.010	ND	ND	>0.010
N	159 E	605	5.7	ND	ND	06/30/93	B08K72	0.041	ND	ND	0.025	<0.010	ND	ND	>0.010
N	159 E	651	5.3	ND	ND	06/30/93	B08K71	0.053	ND	ND	0.029	<0.010	ND	ND	0.011
N	149 E	697	5.0	ND	ND	06/30/93	B08K73	0.014	ND	ND	<0.010	<0.010	ND	ND	0.015
N	149 E	743	5.4	ND	ND	06/30/93	B08K75	0.016	ND	ND	0.017	ND	ND	ND	0.017
N	149 E	789	5.3	ND	0.1	06/30/93	B08K76	0.023	0.049	0.091	0.018	0.051	0.53	ND	0.042
N	159 E	835	5.4	ND	2.6	06/30/93	B08K77	0.080	ND	4.0	0.056	0.19	5.4	0.13	ND
N	154 E	881	5.3	ND	1.0	06/30/93	B08K78	0.018	0.80	0.090	0.012	0.038	1.1	ND	0.017
N	149 E	927	5.2	ND	ND	06/30/93	B08K79	0.038	0.44	ND	0.022	0.013	ND	ND	0.027
N	149 E	973	4.8	ND	ND	06/30/93	B08K80	0.096	ND	ND	0.027	0.013	ND	ND	0.27
N	151 E	1060	5.4	ND	ND	07/14/93	B08KC6	0.045	ND	ND	0.010	<0.010	ND	ND	>0.010
N	151 E	1250	5.0	ND	ND	07/14/93	B08KC7	0.046	ND	ND	0.016	<0.010	ND	ND	>0.010
N	250 W	49	5.4	ND	ND	07/15/93	B08KG4	0.013	ND	ND	ND	ND	ND	ND	>0.010
N	250 E	50	5.3	ND	ND	07/15/93	B08KG3	0.25	ND	ND	<0.010	<0.010	ND	ND	>0.010
N	239 E	145	5.2	ND	ND	07/13/93	B08KB4	0.030	ND	ND	>0.010	>0.010	ND	ND	0.23
N	239 E	237	5.2	ND	ND	07/13/93	B08KB3	0.073	ND	ND	0.034	0.012	ND	ND	>0.010
N	254 E	329	5.1	ND	ND	07/13/93	B08KB2	0.065	ND	ND	<0.010	<0.010	ND	ND	0.010
N	249 E	409	5.0	ND	ND	07/13/93	B08KB1	0.056	ND	ND	0.019	<0.010	ND	ND	0.015
N	249 E	631	5.4	ND	ND	06/30/93	B08K69	0.021	ND	ND	<0.010	<0.010	ND	ND	0.010
N	249 E	651	5.3	ND	ND	06/30/93	B08K68	0.031	ND	ND	0.015	<0.010	ND	ND	0.015
N	249 E	697	5.2	ND	ND	06/30/93	B08K67	ND	ND	ND	ND	<0.010	ND	ND	0.048
N	249 E	743	5.3	ND	ND	06/30/93	B08K66	0.069	ND	ND	0.017	<0.010	ND	ND	0.087
N	249 E	789	5.2	ND	ND	06/30/93	B08K65	0.034	ND	ND	0.019	0.017	ND	ND	0.32
N	239 E	835	5.0	10.2	2.7	06/30/93	B08K64	0.019	ND	ND	<0.010	0.028	ND	ND	5.0
N	249 E	881	5.2	ND	2.3	06/30/93	B08K63	ND	3.0	4.5	ND	0.018	ND	ND	0.39
N	249 E	973	5.3	ND	ND	06/30/93	B08K62	ND	ND	ND	0.014	<0.010	ND	ND	0.018
N	251 E	1060	5.4	ND	ND	07/14/93	B08KC8	0.070	ND	ND	0.027	<0.010	ND	ND	<0.010
N	251 E	1150	5.2	ND	ND	07/14/93	B08KC9	0.065	ND	ND	0.027	<0.010	ND	ND	ND
N	351 W	50	5.2	ND	ND	07/15/93	B08KG7	0.047	ND	ND	<0.010	<0.010	ND	ND	ND
N	349 E	50	5.5	ND	ND	07/15/93	B08KG5	ND	ND	ND	ND	ND	ND	ND	>0.010
N	349 E	145	5.2	ND	ND	07/13/93	B08KB7	0.026	0.39	ND	<0.010	<0.010	ND	ND	0.064
N	339 E	237	5.1	ND	ND	07/13/93	B08KB6	0.024	ND	ND	<0.010	<0.010	ND	ND	<0.010
N	339 E	329	5.2	ND	ND	07/13/93	B08KB5	0.057	ND	ND	0.020	<0.010	ND	ND	<0.010

Table A-1. Photovac 10S Plus GC Results (ppm-v) for the NRDWL Soil-Gas Network. (sheet 3 of 4)

Coordinates (ft)	Depth (ft)	PID	FID	Sample Date	HEIS Number	Acetone	Chloroform	Carbon tetrachloride	cis-1,2-DCE	TCE	1,1-TCA	1,1,2-TCA	PCE
N 349 E 409	4.8	ND	ND	06/28/93	B08K21	0.060	ND	ND	0.027	<0.010	ND	ND	ND
N 349 E 628	5.8	ND	0.2	06/29/93	B08K55	0.018	ND	ND	<0.010	<0.010	0.27	ND	0.013
N 349 E 651	5.3	ND	ND	06/29/93	B08K54	0.024	ND	0.46	<0.010	<0.010	ND	ND	<0.010
N 349 E 697	5.4	ND	ND	06/29/93	B08K53	0.039	ND	ND	0.022	ND	ND	ND	0.042
N 349 E 743	5.3	ND	ND	06/29/93	B08K51	0.013	0.099	0.47	0.011	<0.010	0.19	ND	0.027
N 359 E 789	5.1	ND	ND	06/29/93	B08K50	0.035	ND	ND	0.022	<0.010	ND	ND	0.099
N 339 E 835	5.2	0.1	0.5	06/29/93	B08K49	0.046	ND	0.18	<0.010	<0.010	ND	ND	0.42
N 349 E 881	5.1	0.2	ND	06/29/93	B08K48	0.045	ND	0.62	ND	<0.010	ND	ND	0.51
N 351 E 1060	5.1	ND	ND	07/14/93	B08KD0	0.032	0.070	0.38	0.011	<0.010	ND	ND	0.011
N 351 E 1250	5.1	ND	ND	07/14/93	B08KD1	0.029	0.042	ND	0.012	<0.010	ND	ND	>0.010
N 450 W 49	5.4	ND	ND	07/15/93	B08KG8	0.033	ND	ND	<0.010	<0.010	ND	ND	>0.010
N 450 E 51	5.1	ND	ND	07/15/93	B08KG6	ND	ND	ND	0.016	<0.010	ND	ND	<0.010
N 454 E 145	5.1	ND	0.2	07/14/93	B08KC5	0.20	ND	ND	<0.010	ND	ND	ND	0.20
N 439 E 237	5.3	ND	ND	07/14/93	B08KC4	0.019	ND	ND	<0.010	ND	ND	ND	>0.010
N 429 E 329	5.4	ND	ND	07/14/93	B08KC3	0.23	ND	ND	ND	ND	ND	ND	>0.010
N 449 E 409	5.2	ND	ND	07/14/93	B08KC2	0.26	ND	ND	<0.010	ND	ND	ND	>0.010
N 429 E 628	5.6	ND	0.2	06/29/93	B08K42	0.052	ND	1.1	<0.010	0.075	ND	0.15	0.013
N 449 E 651	5.5	ND	ND	06/29/93	B08K41	0.036	ND	ND	0.016	0.017	ND	ND	0.010
N 449 E 697	5.4	ND	ND	06/29/93	B08K43	0.027	ND	2.7	ND	ND	ND	ND	0.042
N 449 E 743	5.1	ND	ND	06/29/93	B08K44	0.030	0.10	0.75	ND	0.006	ND	ND	0.046
N 449 E 789	5.6	1.6	0.6	06/29/93	B08K45	0.049	ND	1.1	0.014	<0.010	ND	ND	0.54
N 449 E 835	5.5	1.4	0.6	06/29/93	B08K46	0.071	ND	0.14	0.028	0.15	0.18	ND	0.61
N 439 E 881	4.8	4.7	2.5	06/29/93	B08K47	0.034	ND	ND	ND	0.013	0.12	ND	0.62
N 450 E 1061	5.2	ND	ND	07/14/93	B08KD2	0.015	0.043	ND	<0.010	<0.010	ND	ND	0.049
N 451 E 1150	5.3	ND	ND	07/14/93	B08KD3	0.013	ND	ND	ND	<0.010	ND	ND	0.010
N 551 W 150	5.3	ND	ND	07/15/93	B08KH0	0.067	ND	ND	0.028	<0.010	ND	ND	>0.010
N 551 E 50	5.4	ND	ND	07/15/93	B08KG9	0.028	ND	ND	0.020	<0.010	ND	ND	ND
N 539 E 145	5.2	ND	ND	06/28/93	B08K22	0.053	ND	ND	<0.010	<0.010	ND	ND	0.044
N 549 E 237	5.0	ND	ND	06/28/93	B08K25	0.050	ND	ND	ND	ND	ND	ND	ND
N 549 E 327	4.8	ND	ND	06/28/93	B08K23	0.062	ND	ND	<0.010	<0.010	ND	ND	>0.010
N 549 E 409	5.3	ND	ND	06/28/93	B08K26	0.060	ND	ND	0.028	<0.010	ND	ND	>0.010
N 549 E 513	5.4	ND	ND	06/28/93	B08K24	0.071	ND	2.9	0.015	ND	ND	ND	>0.010
N 549 E 605	5.6	ND	ND	06/28/93	B08K27	0.029	ND	ND	0.016	0.002	ND	ND	0.041
N 549 E 651	5.5	ND	ND	06/28/93	B08K29	0.041	ND	ND	0.010	0.003	ND	ND	<0.010
N 549 E 697	5.4	ND	ND	06/28/93	B08K28	0.021	ND	ND	ND	ND	ND	ND	<0.010
N 549 E 743	5.3	ND	ND	06/28/93	B08K30	0.027	ND	ND	0.011	<0.010	ND	ND	<0.010
N 549 E 789	5.3	ND	ND	06/28/93	B08K32	0.036	ND	1.5	<0.010	ND	ND	ND	0.024
N 549 E 835	5.4	ND	ND	06/28/93	B08K33	0.027	ND	0.12	<0.010	ND	ND	ND	0.053
N 549 E 881	5.4	ND	ND	06/28/93	B08K34	0.047	ND	2.0	0.019	ND	ND	ND	0.085
N 549 E 927	5.5	ND	ND	06/28/93	B08K35	0.037	ND	0.66	0.018	<0.010	ND	ND	0.075

Coordinates (ft)			Depth (ft)	PID	FID	Sample Date	HEIS Number	Acetone	Chloroform	Carbon tetrachloride	cis-1,2-DCE	TCE	1,1,1-TCA	1,1,2-TCA	PCE
N	549 E	973	5.6	ND	ND	06/28/93	B08K36	0.028	ND	2.1	0.027	ND	ND	ND	0.050
N	549 E	1060	5.4	ND	ND	07/14/93	B08KD4	0.010	ND	ND	0.045	<0.010	ND	ND	0.021
N	550 E	1150	5.3	ND	ND	07/14/93	B08KD5	0.039	ND	ND	0.016	<0.010	ND	ND	<0.010
N	551 E	1250	5.3	ND	ND	07/14/93	B08KD6	0.024	ND	ND	<0.010	<0.010	ND	ND	<0.010
N	650 W	51	5.5	ND	ND	07/15/93	B08KH1	0.070	ND	ND	0.031	<0.010	ND	ND	<0.010
N	650 E	149	4.8	ND	ND	07/15/93	B08KH5	0.023	ND	ND	<0.010	<0.010	ND	ND	<0.010
N	650 E	349	5.2	ND	ND	07/15/93	B08KH7	ND	ND	ND	0.014	<0.010	ND	ND	<0.010
N	650 E	549	5.2	ND	ND	07/15/93	B08KH9	0.043	ND	ND	0.021	<0.010	ND	ND	<0.010
N	650 E	749	5.6	ND	ND	07/15/93	B08KJ1	ND	ND	ND	<0.010	<0.010	ND	ND	<0.010
N	651 E	850	5.4	ND	ND	07/15/93	B08KJ2	0.068	ND	ND	0.036	0.010	ND	ND	<0.010
N	650 E	949	5.3	ND	ND	07/15/93	B08JX6	0.069	ND	ND	0.047	0.012	ND	ND	0.030
N	650 E	1051	5.5	ND	ND	07/15/93	B08JX9	<0.010	ND	ND	ND	ND	ND	ND	0.011
N	650 E	1149	5.1	ND	ND	07/14/93	B08KD9	<0.010	ND	ND	<0.010	<0.010	ND	ND	>0.010
N	750 W	149	5.2	ND	ND	07/15/93	B08KH2	ND	ND	ND	0.012	<0.010	ND	ND	>0.010
N	750 E	51	5.3	ND	ND	07/15/93	B08KH3	0.040	ND	ND	0.011	<0.010	ND	ND	>0.010
N	750 E	249	5.3	ND	ND	07/15/93	B08KH6	ND	ND	ND	0.014	<0.010	ND	ND	>0.010
N	750 E	449	5.4	ND	ND	07/15/93	B08KH8	0.046	ND	ND	0.025	<0.010	ND	ND	>0.010
N	749 E	650	5.1	ND	ND	07/15/93	B08KJ0	0.047	ND	ND	0.016	<0.010	ND	ND	>0.010
N	749 E	850	5.2	ND	ND	07/15/93	B08KJ3	0.033	ND	ND	0.029	<0.010	ND	ND	>0.010
N	750 E	951	5.4	ND	ND	07/15/93	B08JX8	0.021	ND	ND	0.016	<0.010	ND	ND	>0.010
N	750 E	1049	4.0	ND	ND	07/14/93	B08KD8	0.027	ND	ND	0.014	>0.010	ND	ND	>0.010
N	751 E	1250	4.3	ND	ND	07/14/93	B08KFO	0.013	ND	ND	<0.010	ND	ND	ND	>0.010

NA - Not Analyzed
 ND - Not Detected

Table A-1. Photovac 10S Plus GC Results (ppm-v) for the NRWL Soil-Gas Network. (sheet 4 of 4)

Table A-2. QA/QC Results for the NRDWL Soil-Gas Network.

Sample/Location	Sample Type	Sample Date	HEIS Number	Acetone	Chloroform	Carbon tetrachloride	cis-1,2-DCE	TCE	1,1,1-TCA	1,1,2-TCA	PCE
NRDWL Ambient Air	Ambient Air	06/17/93	B08JS6	ND	ND	ND	ND	ND	ND	ND	<0.010
Equipment Blank	Ambient Air	06/17/93	B08JS7	ND	ND	ND	ND	ND	ND	ND	ND
DCE, TCE, PCE	Standard	06/17/93	B08JT5	ND	ND	ND	1.04	1.3	ND	ND	1.12
S 151 E 973	Duplicate	06/17/93	B08JT7	0.019	ND	ND	<0.010	0.25	ND	ND	0.042
Equipment Blank	Ambient Air	06/21/93	B08JT8	ND	ND	ND	ND	ND	ND	ND	ND
GC Blank	Carrier Gas	06/21/93	B08JV6	ND	ND	ND	ND	ND	ND	ND	ND
GC Blank	Carrier Gas	06/22/93	B08JW0	ND	ND	ND	ND	ND	ND	ND	ND
S 56 E 329	Duplicate	06/22/93	B08JW4	0.11	ND	ND	0.018	0.015	ND	ND	0.033
GC Blank	Carrier Gas	06/23/93	B08JX6	ND	ND	ND	ND	ND	ND	ND	ND
Equipment Blank	Ambient Air	06/23/93	B08JX7	ND	ND	ND	ND	ND	ND	ND	ND
N 20 E 881	Duplicate	06/23/93	B08JX8	0.060	ND	ND	ND	0.039	ND	ND	0.14
N 159 E 835	PNL Split	06/23/93	B08JY2	ND	ND	ND	ND	0.22	4.6	ND	0.22
N 249 E 881	PNL Split	06/23/93	B08JY3	ND	5.7	5.3	ND	<0.010	ND	ND	0.43
N 149 E 329	Duplicate	06/23/93	B08JZ4	0.15	ND	ND	ND	ND	ND	ND	>0.010
GC Blank	Carrier Gas	06/28/93	B08K19	ND	ND	ND	ND	ND	ND	ND	ND
Equipment Blank	Ambient Air	06/28/93	B08K20	ND	ND	ND	ND	ND	ND	ND	ND
GC Blank	Carrier Gas	06/28/93	B08K31	ND	ND	ND	ND	ND	ND	ND	ND
N 549 E 513	Duplicate	06/28/93	B08K37	0.029	ND	0.26	0.017	<0.010	ND	ND	>0.010
GC Blank	Carrier Gas	06/29/93	B08K38	ND	ND	ND	ND	ND	ND	ND	ND
1 ppm DCE, TCE, PCE	Standard	06/29/93	B08K39	ND	ND	ND	1.1	1.3	ND	ND	1.2
Equipment Blank	Ambient Air	06/29/93	B08K40	ND	ND	ND	ND	ND	ND	ND	ND
GC Blank	Carrier Gas	06/29/93	B08K52	ND	ND	ND	ND	ND	ND	ND	ND
N 149 E 329	Duplicate	06/29/93	B08K57	0.36	ND	1.1	0.016	<0.010	0.26	ND	0.010
Equipment Blank	Ambient Air	06/30/93	B08K61	ND	ND	ND	ND	ND	ND	ND	ND
GC Blank	Carrier Gas	06/30/93	B08K74	ND	ND	ND	ND	ND	ND	ND	ND
GC Blank	Carrier Gas	07/13/93	B08K81	ND	ND	ND	ND	ND	ND	ND	ND
Equipment Blank	Ambient Air	07/13/93	B08K82	<0.010	ND	ND	ND	ND	ND	ND	ND
N 147 E 145	Duplicate	07/13/93	B08KB0	0.022	0.13	ND	<0.010	0.016	0.11	ND	0.56
N 20 E 881	Duplicate	07/13/93	B08KB8	0.022	ND	ND	ND	0.054	ND	ND	0.25
GC Blank	Carrier Gas	07/13/93	B08KB9	ND	ND	ND	ND	ND	ND	ND	ND
GC Blank	Carrier Gas	07/14/93	B08KC0	ND	ND	ND	ND	ND	ND	ND	ND
Equipment Blank	Ambient Air	07/14/93	B08KC1	0.16	ND	ND	<0.010	ND	ND	ND	ND
N 450 E 1061	Duplicate	07/14/93	B08KD7	0.011	ND	ND	<0.010	ND	ND	ND	ND
N 751 E 1250	Duplicate	07/14/93	B08KF1	0.028	ND	ND	<0.010	<0.010	ND	ND	>0.010
GC Blank	Carrier Gas	07/14/93	B08KF2	ND	ND	ND	ND	ND	ND	ND	ND
GC Blank	Carrier Gas	07/15/93	B08KF3	ND	ND	ND	ND	ND	ND	ND	ND
Equipment Blank	Ambient Air	07/15/93	B08KF4	0.012	ND	ND	ND	ND	ND	ND	ND
N 51 E 50	Duplicate	07/15/93	B08KH4	0.070	ND	ND	0.043	<0.010	ND	ND	<0.010
N 651 E 850	Duplicate	07/15/93	B08JX7	0.022	ND	ND	<0.010	<0.010	ND	ND	<0.010

ND- Not Detected

Table A-3. PNL Duplicate Sample Results (ppm-v) for the NRDWL Soil-Gas Network.

Sample/Location	Sample Type	Sample Date	HEIS Number	Acetone	Chloroform	Carbon tetrachloride	cis-1,2-DCE	TCE	1,1,1-TCA	1,1,2-TCA	PCE
Equipment Blank	Ambient Air	06/23/93	B08KJ4	ND	ND	ND	ND	ND	ND	ND	ND
N 159 E 835	Duplicate	06/23/93	B08KJ5	ND	0.03	0.85	ND	0.07	7.31	ND	0.14
N 56 E 885	Duplicate	06/23/93	B08KJ6	ND	ND	ND	ND	ND	ND	ND	0.14
N 249 E 881	Duplicate	06/23/93	B08KJ7	ND	6.1	6.07	ND	ND	ND	ND	0.43
DCE, TCE, PCE	Standard	06/23/93	B08KJ8	ND	ND	ND	1.41	1.32	ND	ND	1.18
1.1 ppm Carbon et	Standard	06/24/93	B08KK4	ND	ND	2.97	ND	ND	ND	ND	ND
Equipment Blank	Ambient Air	06/24/93	B08KJ9	ND	ND	0.13	ND	ND	ND	ND	ND
S 151 E 775	Duplicate	06/24/93	B08KK0	ND	ND	0.02	ND	0.07	0.18	ND	ND
N 147 E 145	Duplicate	06/24/93	B08KK1	ND	ND	ND	ND	ND	ND	ND	0.41
N 339 E 329	Duplicate	06/24/93	B08KK2	ND	ND	ND	ND	ND	ND	ND	ND
N 449 E 697	Duplicate	06/24/93	B08KK3	ND	ND	ND	ND	ND	ND	ND	ND
1.1 ppm Carbon et	Standard	06/28/93	B08KL5	ND	ND	4.78	ND	ND	ND	ND	ND
Equipment Blank	Ambient Air	06/28/93	B08KL4	ND	ND	ND	ND	ND	ND	ND	ND
S 51 E 145	Duplicate	06/28/93	B08KL3	ND	ND	ND	ND	0.03	0.47	ND	0.02
N 250 W 49	Duplicate	06/28/93	B08KL2	ND	ND	ND	ND	ND	ND	ND	ND
N 349 E 409	Duplicate	06/28/93	B08KK5	ND	ND	ND	ND	ND	ND	ND	ND
N 550 E 1150	Duplicate	06/28/93	B08KL1	ND	ND	ND	ND	ND	ND	ND	ND

WHC/PNL Split Analysis Results (ppm-v)

Sample/Location	Sample Type	Sample Date	HEIS Number	Acetone	Chloroform	Carbon tetrachloride	cis-1,2-DCE	TCE	1,1,1-TCA	1,1,2-TCA	PCE
N 159 E 835	WHC Split	06/23/93	B08JY2	ND	ND	ND	ND	0.22	4.6	ND	0.22
N 159 E 835	PNL Split	06/23/93	B08KJ5	ND	0.03	0.85	ND	0.07	7.31	ND	0.14
N 249 E 881	WHC Split	06/23/93	B08JY3	ND	5.7	5.3	ND	<0.010	ND	ND	0.43
N 249 E 881	PNL Split	06/23/93	B08KJ7	ND	6.1	6.07	ND	ND	ND	ND	0.43

ND - Not Detected

Table A-4. Scentograph GC Results (ppm-v) for the NRDWL Soil-Gas Network.

Coordinates (ft)	Sample Date	HEIS Number	Chloroform	Carbon tetrachloride	TCE	1,1,1-TCA	1,1,2-TCA	PCE
N 159 E 605	07/29/93	B08K72-S	ND	ND	ND	ND	ND	ND
N 159 E 651	07/29/93	B08K71-S	ND	ND	ND	ND	ND	ND
N 149 E 697	07/29/93	B08K73-S	ND	ND	ND	ND	ND	ND
N 149 E 743	07/29/93	B08K75-S	<0.010	ND	<0.010	0.11	ND	0.18
N 149 E 789	07/29/93	B08K76-S	0.064	ND	0.048	1.2	ND	0.064
N 159 E 835	07/29/93	B08K77-S	0.14	ND	0.20	8.7	ND	0.050
N 154 E 881	07/29/93	B08K78-S	0.93	1.6	0.022	2.1	ND	0.035
N 149 E 927	07/29/93	B08K79-S	0.16	ND	ND	0.071	ND	0.073
N 149 E 973	07/29/93	B08K80-S	ND	ND	ND	ND	ND	0.39
N 249 E 631	07/29/93	B08K69-S	ND	ND	ND	ND	ND	ND
N 249 E 651	07/30/93	B08K68-S	ND	ND	<0.010	ND	ND	0.019
N 249 E 697	07/30/93	B08K67-S	ND	ND	<0.010	ND	ND	0.052
N 249 E 743	07/30/93	B08K66-S	ND	ND	<0.010	ND	ND	0.073
N 249 E 789	07/30/93	B08K65-S	0.050	ND	<0.010	ND	ND	0.16
N 239 E 835	07/30/93	B08K64-S	0.56	0.30	0.035	0.12	ND	8.1
N 249 E 881	07/30/93	B08K63-S	8.8	8.0	0.071	ND	ND	0.73
N 249 E 973	07/30/93	B08K62-S	0.050	ND	<0.010	ND	ND	0.021
N 349 E 628	07/30/93	B08K55-S	ND	ND	0.15	5.9	ND	0.17
N 349 E 651	07/30/93	B08K54-S	ND	ND	ND	ND	ND	0.13
N 349 E 697	07/30/93	B08K53-S	ND	ND	ND	ND	ND	0.24
N 349 E 743	07/30/93	B08K51-S	ND	ND	ND	ND	ND	0.27
N 359 E 789	07/30/93	B08K50-S	0.017	ND	ND	ND	ND	0.38
N 339 E 835	07/30/93	B08K49-S	0.086	ND	ND	ND	ND	0.66
N 349 E 881	07/30/93	B08K48-S	0.12	ND	<0.010	ND	ND	ND
N 429 E 628	07/30/93	B08K42-S	ND	1.1	0.075	ND	ND	0.013
N 449 E 651	07/30/93	B08K41-S	ND	0.016	0.010	ND	ND	ND
N 444 E 697	08/02/93	B08K43-S	ND	ND	ND	ND	ND	0.028
N 449 E 743	08/02/93	B08K44-S	ND	ND	ND	ND	ND	0.095
N 449 E 789	08/02/93	B08K45-S	ND	ND	ND	ND	ND	0.92
N 449 E 835	08/02/93	B08K46-S	0.24	ND	0.12	ND	ND	1.1
N 439 E 881	08/02/93	B08K47-S	0.065	ND	0.025	ND	ND	2.38
N 549 E 513	08/02/93	B08K24-S	ND	<0.010	<0.010	ND	ND	0.21
N 549 E 605	08/02/93	B08K27-S	ND	ND	<0.010	ND	ND	0.17
N 549 E 651	08/02/93	B08K29-S	ND	ND	ND	ND	ND	0.13
N 549 E 697	08/02/93	B08K28-S	ND	ND	ND	ND	ND	0.13
N 549 E 743	08/02/93	B08K30-S	ND	ND	ND	ND	ND	0.18
N 549 E 789	08/02/93	B08K32-S	ND	ND	ND	ND	ND	0.14
N 549 E 835	08/02/93	B08K33-S	ND	ND	ND	ND	ND	0.16
N 549 E 881	08/02/93	B08K34-S	ND	ND	0.033	ND	<0.01	0.18
N 549 E 927	08/02/93	B08K35-S	ND	ND	0.014	ND	ND	0.19
N 549 E 973	08/02/93	B08K36-S	ND	ND	<0.010	ND	ND	0.13

Quality Control Samples

Sample/Location	Sample Date	HEIS Number	Chloroform	Carbon tetrachloride	TCE	1,1,1-TCA	1,1,2-TCA	PCE
NRDWL Ambient Air	07/29/93	B08JY2	ND	ND	ND	ND	ND	ND
Equipment Blank	07/29/93	B08JY3	ND	ND	ND	ND	ND	ND
N 159 E 835	07/30/93	B08JY7	0.12	ND	0.15	5.8	ND	0.17
NRDWL Ambient Air	07/30/93	B08JY5	ND	ND	ND	ND	ND	ND
Equipment Blank	07/30/93	B08JY6	ND	ND	ND	ND	ND	ND
N 249 E 881	07/30/93	B08JY8	9.5	8.5	ND	ND	ND	0.47
NRDWL Ambient Air	08/02/93	B08JZ0	ND	ND	ND	ND	ND	ND
Equipment Blank	08/02/93	B08JZ1	ND	ND	ND	ND	ND	ND
N 439 E 881	08/02/93	B08JY9	0.082	ND	ND	ND	ND	2.6

ND - Not Detected

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Table A-5. Deep Soil-Gas Probe Results (ppm-v).

Coordinates			Depth (ft)	CH4 (%)	CO2 (%)	O2 (%)	Sample Date	HEIS Number	Acetone (ppm-v)	cis-1,2-DCE (ppm-v)	TCE (ppm-v)	PCE (ppm-v)
N	39 E	237	4.9	0.0	0.4	20.7	10/12/93	B08K01	ND	ND	ND	
N	39 E	237	9.0	0.0	0.9	20.2	10/12/93	B08K02	ND	ND	<0.010	0.024
N	39 E	237	15.0	0.0	1.6	19.8	10/12/93	B08K03	ND	ND	<0.010	0.030
N	39 E	513	5.1	0.0	3.0	18.5	10/12/93	B08K04	ND	ND	ND	0.060
N	39 E	513	9.0	0.0	4.2	17.8	10/12/93	B08K05	ND	ND	ND	0.065
N	39 E	513	15.0	0.0	4.8	17.2	10/12/93	B08K06	ND	ND	<0.010	0.094
N	20 E	881	5.3	0.0	2.6	19.1	10/12/93	B08K07	ND	ND	0.035	0.16
N	20 E	881	9.0	0.0	3.4	18.5	10/12/93	B08K08	ND	ND	0.037	0.21
N	20 E	881	15.0	0.0	3.9	17.5	10/12/93	B08K09	ND	ND	0.045	0.19
N	750 W	149	5.2	0.0	0.1	20.7	10/12/93	B08JZ8	0.026	ND	ND	ND
N	750 W	149	9.0	0.0	0.2	20.2	10/12/93	B08JZ9	ND	ND	ND	<0.010
N	750 W	149	15.0	0.0	0.2	19.9	10/12/93	B08K00	ND	ND	ND	<0.010

Quality Control Samples

Sample/Location	Sample Type	Sample Date	HEIS Number	Acetone (ppm-v)	cis-1,2-DCE (ppm-v)	TCE (ppm-v)	PCE (ppm-v)
Equipment Blank	Ultra Pure Air	10/12/93	B08JZ6	ND	ND	ND	ND
Method Blank	Ambient Air	10/12/93	B08JZ7	ND	ND	ND	ND
Equipment Blank	Ultra Pure Air	10/12/93	B08K10	ND	ND	ND	ND
1 ppm DCE, TCE, PCE	Standard	10/12/93	B08K11	ND	1.1	1.2	1.2

ND - Not Detected

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