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Station # 12

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Page 1 of 1

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| 1 | 1 | Cog. Mgr. R. C. Roos | R C Roos | 2/19/93 | H6-04 | W. G. Cox | | | H6-23 | 3 | |
| 1 | 1 | QA G. S. Corrigan | R Hand for | 2/19/93 | H6-16 | D. J. Hoff | | | H6-23 | 3 | |
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|---|---|---|
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6. Author

Name: I. D. Jacques

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7. Abstract

This plan describes the sampling and analysis procedures that will be used to conduct a soil-gas survey at the Nonradioactive Dangerous Waste Landfill (NRDWL). The NRDWL is an inactive Treatment, Storage, and Disposal (TSD) unit assigned to the 200-U-3 Operable Unit. The soil-gas survey data will be used to assess if hazardous substances are present in the vadose zone at levels warranting further study or remedial action.

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# 1.0 INTRODUCTION

## 1.1 SCOPE OF WORK

This document defines the sampling and analytical procedures to be used to conduct a soil-gas survey of the Nonradioactive Dangerous Waste Landfill (NRDWL). The NRDWL is a treatment, storage, and disposal (TSD) unit assigned to the 200-IU-3 Operable Unit. The soil-gas survey will be conducted in accordance with Section 7.1.1 of the *Nonradioactive Dangerous Waste Landfill Closure/Postclosure Plan* (DOE/RL 1990).

The objective of the soil-gas sampling program is to assess the extent of detectable gaseous or volatile organic contamination within the vadose zone associated with the NRDWL. Soil-gas samples will be collected from the vadose zone within the boundary of the NRDWL as well as from the immediate vicinity of the NRDWL. These samples will be analyzed for gases and/or organic vapors, which may indicate contamination in the vadose zone. Gases such as methane or carbon dioxide may be generated by decomposition of organic waste material. Organic vapors may result from disposal of fuels, solvents, degreasers, cleaners, or other materials within the landfill.

## 1.2 SITE DESCRIPTION

The NRDWL is an inactive TSD located northeast of the Central Landfill in the 600 Area of the Hanford Site (Figure 1). The NRDWL was operated from 1975 through 1985. As part of the formal closure of this unit, certain investigations must be conducted. Westinghouse Hanford Company (WHC) Environmental Restoration Engineering was requested to conduct soil-gas sampling at the site to detect and assess the gaseous contamination within the vadose zone.

During operation, the NRDWL received and disposed nonradioactive dangerous waste from process operations, research and development laboratories, and maintenance functions throughout the Hanford Site. Hazardous waste transport vehicles delivered containerized dangerous waste to the site. Depending on the waste type, waste was disposed in one of three types of trenches. The trenches were designated to receive either chemical, asbestos, or sanitary solid waste. The normal procedure for disposal of liquid wastes was to absorb all free liquid with absorbent materials or use lab-packs before shipment to the NRDWL. No containers holding free liquid are known to have been placed in the NRDWL. Asbestos and sanitary solid wastes were also disposed in the NRDWL; these wastes generally were not containerized. The wastes were placed in the landfill trenches and then covered with 6 to 10 ft of soil.

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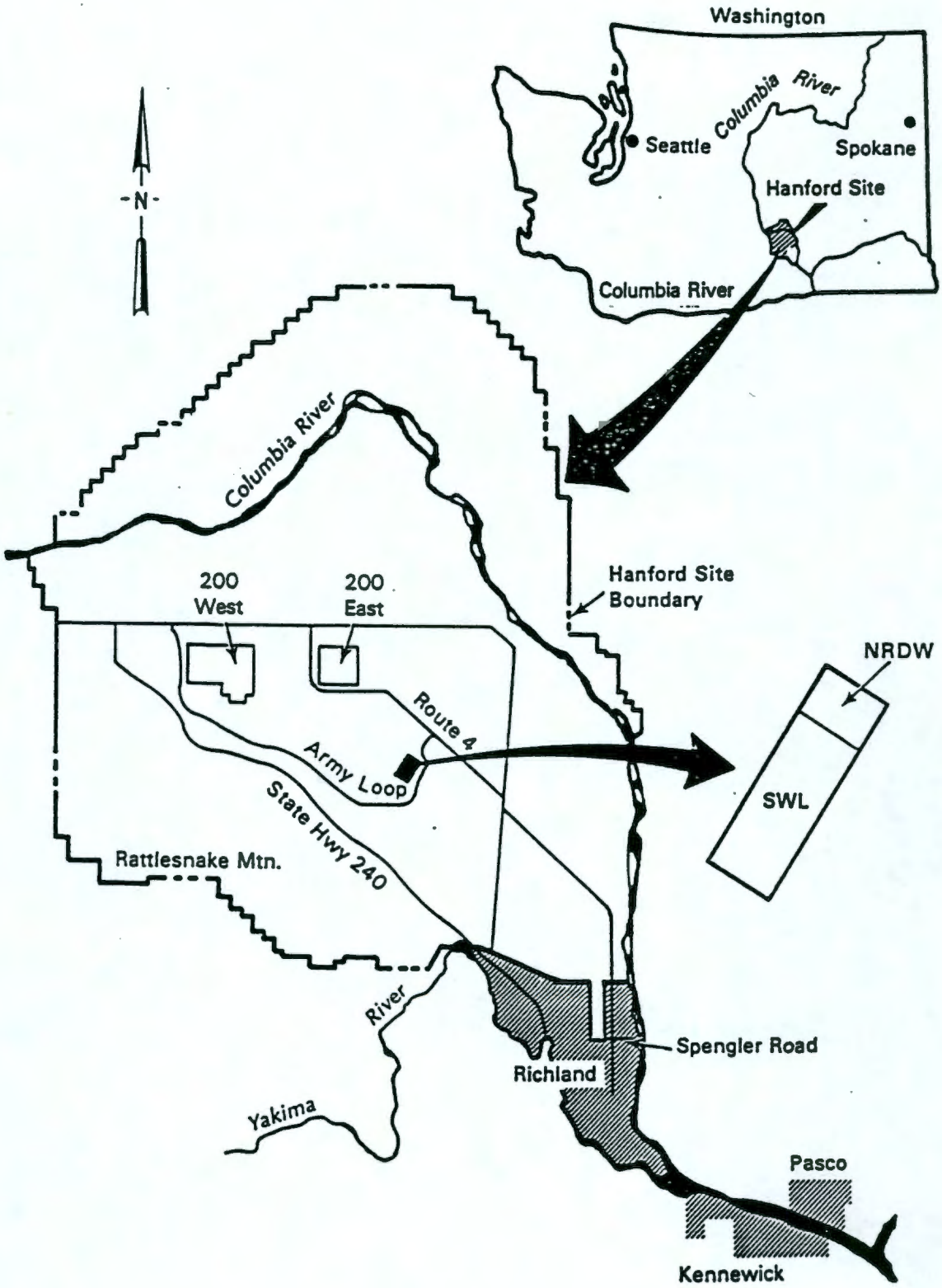


Figure 1. Location of the Solid Waste Landfill and Nonradioactive Dangerous Waste Landfill on the Hanford Site, Washington.

# 2.0 GENERAL REQUIREMENTS

## 2.1 APPLICABLE PROCEDURES

All personnel following this sampling and analysis plan will perform work in accordance with the following procedures.

- WHC-EP-0383, *Environmental Engineering, Technology, and Permitting Function Quality Assurance Program Plan* (WHC 1990)
- WHC-CM-4-11, *ALARA Program Manual* (WHC 1988a)
- WHC-CM-4-3, *Industrial Safety Manual*, Volumes 1 through 3, (WHC 1987)
- WHC-CM-7-5, *Environmental Compliance Manual* (WHC 1988b)
- WHC-CM-7-7, *Environmental Investigations and Site Characterization Manual* (WHC 1988c)
- Site-specific Hazardous Waste Operations Plan.

## 2.2 DATA QUALITY OBJECTIVES

The data obtained by this sampling effort will be used to determine if hazardous substances are present in the vadose zone at levels warranting further study or remedial action. Specific objectives are contained in Section 7.1 of DOE/RL (1990). The field screening/analytical work performed for this task will correspond to the requirements for U.S. Environmental Protection Agency (EPA) Level I and Level II analytical methods. The QA/QC requirements specified in this sampling plan correspond to EPA Level I and Level II analytical methods.

# 3.0 SAMPLING AND FIELD ACTIVITIES

## 3.1 SAMPLING METHODOLOGY

Soil-gas probes will be installed in accordance with Environmental Investigations Instruction (EII) 5.9, Soil-gas Sampling (WHC 1988c). The soil-gas sampling probe will consist of an expendable stainless-steel point driven to a depth of 4 to 6 ft. The sampling point will be driven using a pneumatic post-pounder. Each soil-gas point is connected to a ¼-in. OD teflon tube (a trademark of E.I. DuPont De Nemours Company), which extends to the soil surface. Native soil or clean silica sand is packed around the tubing to fill the annular space between the tubing and the emplacement hole. The tubing will be sealed at the surface using a plastic cap.

In rocky soil conditions, it may be necessary to pre-drill the hole using a 1-in. carbide bit. These "pilot holes" are drilled to a depth of about 2 ft. In these cases the probe will be driven at least 1 ft beyond the



9 3 1 2 8 9 8 0 8 8 1

bottom of the pilot hole. After the sampling tube is in place, any drill holes will be filled with clean silica sand. The actual depth of sampling will depend on field conditions and will be documented in the field logbook. The probes will be allowed to equilibrate with the soil conditions for at least 24 hr before they are sampled.

### 3.2 SAMPLE LOCATIONS

The soil-gas survey will be conducted on two inter-related grids, one inside the NRDWL site and the second grid around the site perimeter (see Figure 2). The inside grid will follow the grid used for the ground-penetrating radar (GPR) survey. This grid is comprised of a series of lines oriented along the center lines of the landfill trenches, with soil-gas probes installed at 100-ft intervals along each grid line. The sampling locations will be determined using the GPR data to select locations which are most likely to encounter vapors, while minimizing the potential to penetrate buried waste with the sampling probes.

The second grid area extends about 200 ft outside the perimeter of the facility boundary. The sampling points in the second grid will be installed on 100-ft centers. Sample points will be numbered by north and east coordinates based on the GPR survey grid. If evidence of contamination is detected, additional soil-gas probes may be installed to locate the source of the contamination or to define the extent of any contaminant plume.

### 3.3 SAMPLE NUMBERING

The Hanford Environmental Information System (HEIS) will be used to track sample data obtained during this soil-gas survey. Each quantitative sample will be identified by a unique HEIS sample number. HEIS numbers will be assigned in the field and documented in the field logbook.

## 4.0 SAMPLE ANALYSIS

Proposed analytes for soil-gas sampling were determined using the following criteria.

- The analyte occurs as a component or degradation product of compounds or mixtures disposed of in amounts greater than 25 Kg
- The analyte has a boiling point of less than 150°C and a vapor pressure greater than 10-mm mercury at 20°C (Tolman 1989)
- The analyte was detected in a previous soil-gas survey at the Solid Waste Landfill (Evans et al. 1989)
- The analyte is known to be commonly encountered at landfills.



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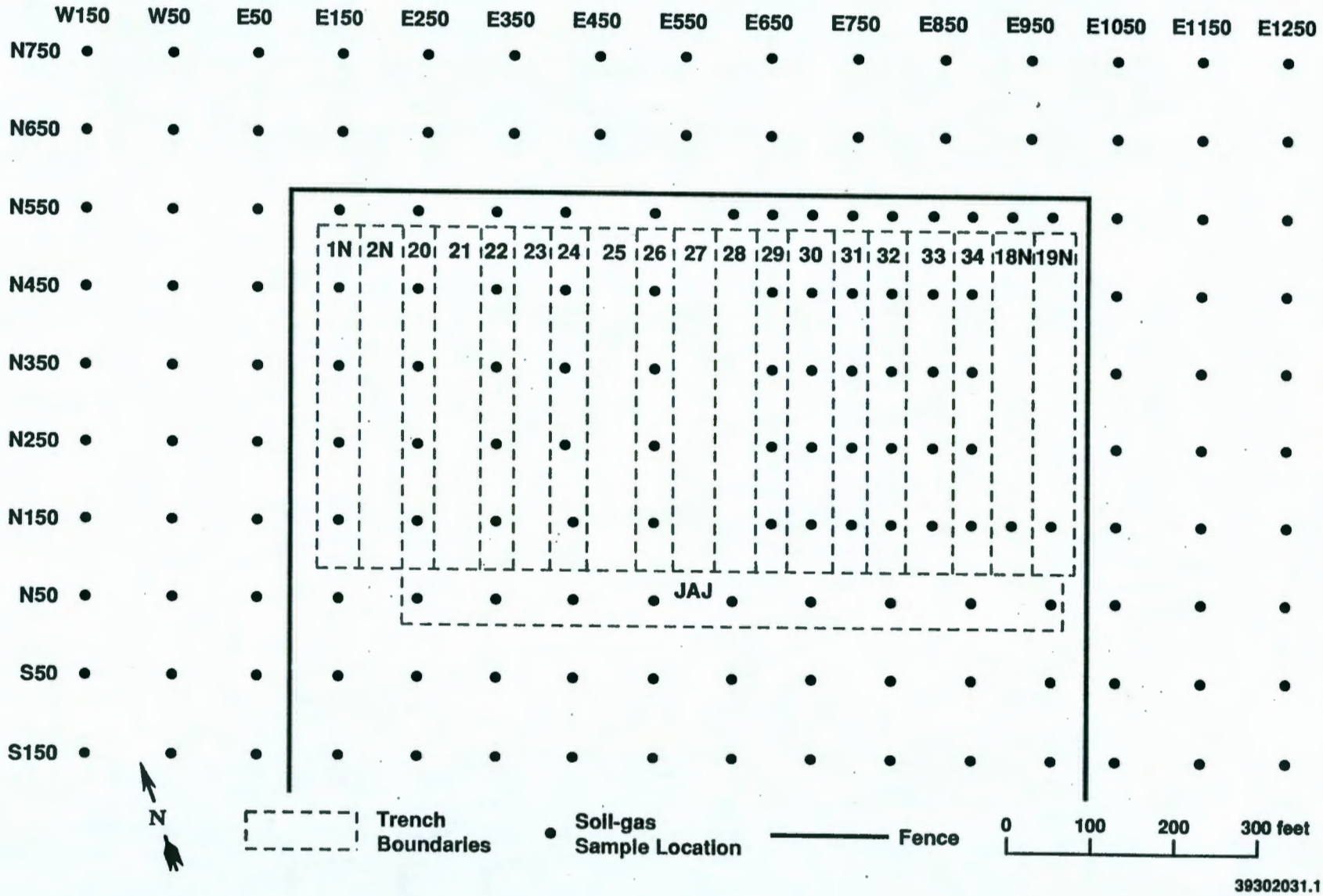


Figure 2. Soil-gas Sampling Locations for the NRDWL.

The proposed analytes for gas chromatograph (GC) analysis are listed in Table 1. Methane and carbon dioxide have been included because they are commonly associated with decomposition of organic material in landfills.

Each sample point will be purged before samples are collected. A minimum of three tube-volumes will be withdrawn to ensure the sample is representative of the vadose zone vapors. For ¼-in. tubing, the tube-volume is approximately 10 ml/ft of tubing. Purge times will be determined by taking into account the length of tubing and flow rate of the instrument or sampling pump used. The purge time for each instrument or pump will be documented in the field logbook. If measurements are made with a second instrument immediately after the first measurement or sample collection, a second purging will not be required.

Table 2 lists instruments available for onsite soil-gas analysis. All instruments will be operated in accordance with vendor manuals by trained individuals. Soil-gas sampling and analysis will follow a hierarchical approach in which instruments with broad measurement capability will be used to focus sample collection and analysis by more sensitive and/or selective instruments. Initial screening measurements will be made at all sample locations using a combustible gas indicator, organic vapor monitor, and infrared gas analyzer. These instruments will provide data regarding the distribution of combustible gas, oxygen, methane, carbon dioxide, and total organic vapor in the vadose zone. The results will be recorded in the field logbook.

After initial screening, soil-gas samples will be collected from sample points located on the NRDWL trenches. Samples will be analyzed using a portable GC. Sample collection and analysis will be conducted in accordance with EII 5.9, Soil-gas Sampling (WHC 1988c). Results of GC analyses will be compared with field screening data to correlate screening results with detected analytes of concern. Based on this relationship, field screening data will be used to delineate areas of potential contamination outside the NRDWL boundary. Additional soil-gas samples will be collected from these areas (as well as some "clean" areas for verification) and analyzed by GC. As a minimum, 20% of soil-gas points outside the NRDWL will be analyzed by GC. Because each soil-gas point is a dedicated, permanent sampling tube, additional samples may be analyzed by GC depending on the nature, extent, and variability of contaminants detected by the soil-gas survey.

## 5.0 QA/QC REQUIREMENTS

Quality control samples or measurements will be made to ensure the overall reliability of the soil-gas data. Quality control samples will include blanks, equipment blanks, ambient samples, and duplicate samples in accordance with DOE/RL (1990). Calibration standards will be run on a regular basis to ensure instrument accuracy and precision. In addition, split samples will be collected and analyzed by a second laboratory. The QA/QC samples to be used for the NRDWL soil-gas survey are summarized on Table 3. The QA/QC samples will be documented in the field logbook.

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

| Analyte | CAS | Formula | MW | $V_p$ @ 20°C mm Hg | $T_B$ °C | IP eV | qty Kg |
|---|---|---|---|---|---|---|---|
| acetone | 67-64-1 | $CH_3COCH_3$ | 58.08[a] | 180[b] | 56[b] | 9.69[b] | 24.5 |
| benzene | 71-43-2 | $C_6H_6$ | 78.11[b] | 76[b] | 80[b] | 9.56[b] | 111.75 |
| carbon tetrachloride | 56-23-5 | $CCl_4$ | 153.82[b] | 90[b] | 77[b] | 11.47[b] | 94 |
| chloroform | 67-66-3 | $CHCl_3$ | 119.38[b] | 160[b] | 62[b] | 11.42[b] | 48.75 |
| 1,1-dichloroethane | 74-34-3 | $CHCl_2CH_3$ | 98.96[b] | 182.1[b] | 57.3[b] | 11.06[b] | |
| dichloromethane (methylene chloride) | 75-09-2 | $CH_2Cl_2$ | 84.93[b] | 349[b] | 40[b] | 11.35[b] | 49 |
| 1,4-dioxane | 123-91-1 | $OCH_2CH_2OCH_2CH_2$ | 88.20[b] | 30[c] | 101[c] | 9.19[c] | 79.5 |
| tetrachloroethylene | 127-18-4 | $Cl_2C{=}CCl_2$ | 165.83[b] | 14[b] | 121[b] | 9.71[b] | 205 |
| tetrahydrofuran | 109-99-9 | $C_4H_8O$ | 72.1[c] | 132[c] | 56[c] | 9.45[c] | 157 |
| 1,1,1-trichloroethane | 71-55-6 | $CH_3CCl_3$ | 133.40[b] | 100[b] | 74[b] | N/A | 3000 |
| 1,1,2-trichloroethane | 79-00-5 | $CHCl_2CH_2Cl$ | 133.40[b] | 19[b] | 114[b] | N/A | |
| trichloroethylene | 79-01-6 | $ClCH{=}CCl_2$ | 131.39[b] | 58[b] | 87[b] | 9.94[b] | 632 |
| methane | 74-82-8 | $CH_4$ | 16.04 | | -162 | | |
| carbon dioxide | 124-38-9 | $CO_2$ | 44.0 | | -78 | | |

[a]Montgomery, J.H. and L.M. Welkom (1989); Groundwater Chemicals Desk Reference; Lewis Publishers, Inc., Chelsea, Michigan.
[b]Verschueren, K. (1983); Handbook of Environmental Data on Organic Chemicals, 2nd, Edn; Van Nostrand Reinhold, New York.
[c]NOISH (1990); Pocket Guide to Chemical Hazards; National Institute for Occupational Safety and Health, U.S. Department of Health and Human Service, Washington D.C.

Table 2. Field Screening Instruments Used for Soil-Gas Surveys.

| Type | Instrument | Measurement principle | Comments |
|---|---|---|---|
| CGI[a] | GasTech Model 1314 | Flammable gas by increase in heat of platinum filament. Oxygen content by electrochemical cell | Detects methane and all flammable gases. Readings may be low if $O_2$ content is depleted. Reports combustible gas in %LEL or ppm (hexane equivalent). Oxygen content reported in %. |
| | GasTech "Trace-Tector" vapor detector | Catalytic measurement | Detects all flammable gases. The operating voltage of the sensor can be modified to eliminate or reduce response to methane. Results reported in ppm. |
| PID[b] | Thermo Environmental Model 580B OVM | Uses ultraviolet lamp to ionize sample and measures ions produced. | Responds well to aromatics and many alkenes. Response is lower for aliphatics. Does not respond to methane. Results are total organic vapor concentration in ppm. Typically calibrated to isobutene. |
| | PHOTOVAC Microtip | | |
| FID[c] | Foxboro Century OVA128-GC | Burns compound in hydrogen flame and measures carbon ions produced. | Responds well to most organic carbon compounds. Results are total organic vapor concentration in ppm. Generally calibrated to methane. Does not detect $CO_2$. Affected by high relative humidity. May not operate in depleted oxygen. |
| IRA[d] | Geotechnical Instruments GA 90 Infrared Gas Analyzer | Measures infrared absorption of both $CH_4$ and $CO_2$. $O_2$ measurement by electrochemical cell | Detects methane and carbon dioxide. Oxygen measurement also. Not affected by low $O_2$. Measurements are compensated for water vapor and temperature. Results are $\%CH_4$, $\%CO_2$, $\%O_2$ and differential pressure in inches of water. |
| | Colorimetric tubes | Compound-specific chemical reactions produce a color change when the gas or vapor is drawn through the tube. | Generally compound-specific, but may be subject to interference or cross-sensitivity. When a required volume of air is drawn through the tube, the length of color development can be used to estimate concentration. For soil-gas, results are typically qualitative. |
| GC PID[e] | PHOTOVAC 10S Plus portable GC | Sample is collected in a sample loop or injected. Dual PID's are available for both total vapor and GC analysis. | A capillary column and PID provide compound separation and identification. A second PID provides total vapor concentration, and can be used to trigger a chromatograph run. The PHOTOVAC has a nominal ionization potential of 10.6 eV, but compounds such as $CCl_4$ (IP = 11.47 eV) can be detected. |
| GC AID[f] | SENTEX "SCENTOGRAPH" portable GC | Sample is drawn over a Tenax trap by an internal pump and desorbed onto a packed column for compound separation. | A packed column provides compound separation. The AID is a broad-spectrum detector with an effective ionization potential of 11.7 eV. If necessary, it can be re-configured to function as an electron capture detector (ECD) for increased sensitivity to halogenated compounds. The Sentex GC can be configured to draw a soil-gas sample directly from the soil-gas tube onto the preconcentrator, eliminating the need for sample collection and handling. |
| GC | SRI Model 8610 gas Chromatograph | A sample is collected in a syringe, glass serum vial, or Tedlar bag and taken to the GC. | A 30m wide-bore capillary column provides compound resolution. The GC is capable of temperature programming. The GC is equipped with a PID, an FID and an ECD. The instrument can be configured with either PID/FID or PID/ECD detector combinations. |

[a]Combustible gas indicator.
[b]Photo ionization detector.
[c]Flame ionization detector.
[d]Infrared analyzer.
[e]Gas chromatograph.
[f]Gas chromatograph with argon ionization detector.

Table 3. Quality Control Samples for NRDWL Soil-Gas Survey.

| Sample | Description | Purpose | Frequency |
|---|---|---|---|
| Blank | Clean air analyzed as a sample | Evaluate potential for cross contamination from instrument flow line or trap or preconcentrator on GC | Minimum of once per day or 1 per 20 samples. The equipment blank may serve both purposes if no compounds of interest are detected |
| Equipment Blank | Ambient air drawn through probe and sampling equipment | Evaluate potential for contamination from sampling equipment | |
| Ambient Sample | Ambient air analyzed as sample | Evaluate presence of compounds of interest in ambient air | Minimum of once per day. The equipment blank may also serve this purpose if no compounds of interest are detected |
| Duplicate Sample | Second sample from the same soil-gas point | Demonstrate repeatability of sampling method | Minimum of once per day or 1 per 20 samples. Also for any anomalous result |
| Split Sample | Second sample from the same soil-gas point sent to a second laboratory for analysis | Demonstrate reliability of field analytical data | Minimum of 1 per 20 samples collected |
| Calibration Standard | Measurement of a known analyte at known concentration | Demonstrate ability of instrument to detect a specific compound and determine response factor. Determine correct retention time and detector response for GC under field conditions | Daily and as required to confirm instrument calibration and/or analyte identification |

## 6.0 SCHEDULE

Installation of the dedicated soil-gas probes is to begin during the first week of March, 1993. Analysis of soil vapors will begin after the probes have been installed. This will ensure the soils are relatively dry and warm. It is anticipated the soil-gas analysis will begin by early May, 1993.

## 7.0 CHANGES TO SAMPLING PLAN

Changes to this sampling plan will be submitted on the project change form (Attachment 1). The change will require, as a minimum, the verbal approval of the field team leader and NRDWL Closure/Postclosure Plan coordinator. The change will be filed as an Engineering Change Notice and a copy inserted into the project file. Copies will be submitted to the regulatory agencies and appropriate personnel.

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**ATTACHMENT 1**

NRDWL SAMPLING AND ANALYSIS PLAN CHANGE FORM

Date: _____

Person Initiating Change: _____

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_____APPROVAL

Field Team Leader: _____

_____Closure Plan Coordinator: _____

_____Other: _____

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Date Release Required: 2-17-93

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Unclassified Category: UC- N/A

Impact Level: 3Q

New or novel (patentable) subject matter? [X] No [] Yes
If "Yes", has disclosure been submitted by WHC or other company?
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Title of Conference or Meeting: N/A

Group or Society Sponsoring: N/A

Date(s) of Conference or Meeting: N/A

City/State: N/A

Will proceedings be published? [] Yes [X] No
Will material be handed out? [] Yes [X] No

Title of Journal: N/A

CHECKLIST FOR SIGNATORIES

| Review Required per WHC-CM-3-4 | Yes | No | Reviewer - Signature Indicates Approval: Name (printed) | Signature | Date |
|---|---|---|---|---|---|
| Classification/Unclassified Controlled Nuclear Information | [] | [X] | | | |
| Patent - General Counsel | [X] | [] | SW BERGLIN | SW Berglin | 2/12/93 |
| Legal - General Counsel | [X] | [] | | | |
| Applied Technology/Export Controlled Information or International Program | [] | [X] | | | |
| WHC Program/Project | [] | [X] | | | |
| Communications | [] | [X] | | | |
| RL Program/Project | [] | [X] | | | |
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| Other Program/Project | [] | [X] | | | |

Information conforms to all applicable requirements. The above information is certified to be correct.

| | Yes | No |
|---|---|---|
| References Available to Intended Audience | [X] | [] |
| Transmit to DOE-HQ/Office of Scientific and Technical Information | [] | [X] |

Author/Requestor (Printed/Signature): I. D. Jacques Duane Jacques Date: 2-8-93 ~~11/23/92~~

Intended Audience: [] Internal [] Sponsor [X] External

Responsible Manager (Printed/Signature): R. C. Roos R C Roos Date: 2/8/93

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