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Draft A

Nonradioactive Dangerous Waste Landfill Sampling and Analysis Plan

Environmental Excellence
HANFORD

Prepared for the U.S. Department of Energy
Office of Environmental Restoration

Bechtel Hanford, Inc.
Richland, Washington

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Nonradioactive Dangerous Waste Landfill Sampling and Analysis Plan

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ACRONYMS

BHI	Bechtel Hanford, Inc.
bgs	below ground surface
COC	contaminants of concern
DOE-RL	U.S. Department of Energy, Richland Operations Office
DQO	data quality objectives
Ecology	Washington State Department of Ecology
EIP	*Environmental Investigation Procedures*
ERC	Environmental Restoration Contractor
EPA	U.S. Environmental Protection Agency
FSP	field sampling plan
FSR	Field Sample Requirements
GC	chromatograph
HEIS	Hanford Environmental Information System
NRDWL	Nonradioactive Dangerous Waste Landfill
PCE	perchloroethylene
RCRA	*Resource Conservation and Recovery Act of 1976*
SAF	Sample Authorization Form
SAP	sampling and analysis plan
SWL	Solid Waste Landfill
TCE	trichloroethylene
T.D.	treatment, storage, and disposal
QAPjP	quality assurance project plan
QA	quality assurance
QC	quality control
VOC	volatile organic compounds

1.0 INTRODUCTION

This sampling and analysis plan (SAP) defines the sampling and analytical activities, and associated procedures, that will be used to support the Nonradioactive Dangerous Waste Landfill (NRDWL) soil-gas investigation. This SAP consists of three sections: this introduction (Section 1.0), the field sampling plan (FSP) (Section 2.0), and the quality assurance project plan (QAPjP) (Section 3.0). The FSP defines the sampling and analytical methodologies to be performed. The QAPjP provides information on the quality assurance/quality control (QA/QC) parameters related to the sampling and analytical methodologies.

1.1 PURPOSE

Previous shallow (1.5 - 1.8 m [5-6 ft] deep) soil gas and groundwater monitoring data have indicated the presence of volatile organic compounds (VOCs) within and/or adjacent to the NRDWL. The purpose of this investigation is to collect additional soil gas data to assess the extent of VOC contamination, contaminant movement and potential impacts to groundwater. Soil gas is the media of concern because it is considered to be a likely VOC transport mechanism to groundwater at the NRDWL. Deep soil gas samples will be taken to assess the vertical extent of contamination and potential impacts to groundwater. Shallow soil gas samples will be taken from existing sampling points installed and sampled in 1993 (Jacques 1993). Comparisons between the proposed (1997) and existing (1993) shallow soil gas data will be used to assess contaminant changes and movement.

This SAP defines the strategy and the methods that will be used to sample and analyze the soil gas in the subsurface soil within, and in the vicinity of, the NRDWL. The resulting data will be used to assess the nature and extent of soil-gas contamination, and may also indicate potential sources of the contaminants in the soil gas and underlying groundwater. The resulting data will help support NRDWL closure under the *Resource Conservation and Recovery Act of 1976* (RCRA).

1.2 DATA QUALITY OBJECTIVES

The objectives and goals for this investigation were defined in a U.S. Department of Energy, Richland Operations Office (DOE-RL), data quality objectives (DQO) process workshop. The DQO was conducted following the U.S. Environmental Protection Agency's (EPA) *Guidance for the Data Quality Objectives Process* (EPA 1994). The DQO participants included the DOE-RL NRDWL Project Manager, the Washington State Department of Ecology (Ecology) NRDWL Project Manager, an Environmental Restoration Contractor (ERC) DQO facilitator, and ERC project and functional personnel. The team utilized the ERC's DQO process template to accomplish the following objectives:

- Identify and resolve key project issues related to the purpose of the investigation
- Determine parameters of interest (i.e., contaminants of concern [COC])
- Determine analytical methods, data quality needs, and data uses
- Design (optimize) the sample collection strategy (location and frequency)
- Define the uncertainties associated with the project.

The Draft DQO Summary Report documenting the DQO process are included in Appendix A. This SAP represents a resource-effective sampling and analytical effort that was mutually agreed upon by the DOE-RL, Ecology, and the ERC project team. This SAP also satisfies the requirements identified in the DQO process for sampling and analyzing the soil gas in the subsurface soil within, and in the vicinity of, the NRDWL to support site closure.

1.3 SAMPLING AND ANALYSIS OBJECTIVE

Contaminants of concern for this SAP are based on previous soil gas data from the NRDWL. Jacques (1993) reported detections of trichloroethylene (TCE), perchloroethylene (PCE), 1,1,1-trichloroethane (1,1,1-TCA), chloroform and carbon tetrachloride in association with the chemical trenches.

The objective of the sampling and analysis activities is to provide soil-gas data to support decisions related to site-closure for NRDWL. The resulting data will be used to address three questions:

1. Are the COCs within the NRDWL, identified in the DQO process (i.e., the VOC -- carbon tetrachloride, chloroform, PCE, 1,1,1-TCA, and TCE), moving? This question will be addressed by comparing the VOC concentrations collected under this SAP to those measured in 1993.

2. Where are the COCs now? This question will be addressed by determining the distribution of VOC contaminants in the subsurface focusing on the vertical extent of VOCs.

3. Do the results of this sampling effort merit changing NRDWL's priority for closure? This question will be addressed by evaluating the levels of VOC concentrations in the vadose zone and the potential impact of the detected VOCs on the underlying groundwater.

1.4 FACILITY DESCRIPTION

The NRDWL is an inactive disposal facility regulated under RCRA as a Treatment, Storage, and Disposal (T.D.) facility. It is located adjacent to and northeast of the Solid Waste Landfill (SWL) in the 600 Area of the Hanford Site (Figure 1-1). The southern boundary of the NRDWL is defined as halfway between the southern border of NRDWL trenches 20-34 and the northern edge of the J. A. Jones trench, which is within the SWL. 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 1-2). 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.

According to the *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. Geophysical survey data, however, has revealed some discrepancies from this reported information (Mitchell et al. 1993). It appears that both trench 23 and trench 24 (not just trench 24 as reported in DOE-RL [1990]) are 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 14 m (46 ft) centers to a depth of about 4.6 m (15 ft). The trenches were about 4.9 m (16 ft) wide at the base and about 121.9 m (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 209-L (55-gal) drums before disposal in the trenches. The waste drums were placed on end in rows in the unlined trenches. Occasionally when a 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 1.8 to 3 m (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 consist of small quantities of laboratory chemicals, waste oils, waste solvents, and empty chemical containers. 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 3.8-L (1-gal) glass or 19-L (5-gal) plastic or metal containers packed in at least twice their volume of absorbent. The final lab-pack disposal-container was generally a 209-L (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 1.2 to 1.8 m (4 to 6 ft) thick (DOE-RL 1990).

The NRDWL is currently managed by Bechtel Hanford, Inc. (BHI) 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) was a soil-gas survey to assess detectable gaseous vapors in the vadose zone. The results of this initial near-surface survey were reported in Jacques (1993).

1.5 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 (Weekes et al. 1987). 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 depths of about 38.4 to 40.8 m (126 to 134 ft) below ground surface. The general groundwater flow direction is from northwest to southeast. The hydraulic gradient under the SWL and NRDWL is very low, approximately 3 cm/396 m (0.1 ft/1,300 ft) (0.00001). Estimates of groundwater flow rates range from 0.6 to 1.5 m (2 to 5 ft) per day (Weekes et al. 1987).

The surficial dune sand layer is about 0.9 to 1.2 m (3 to 4 ft) thick. Beneath the surface sand is a narrow horizontal silt layer about 7.6 to 10 cm (3 to 4 in.) thick that marks the top of the sand subunit of the Hanford formation (Weekes et al. 1987). This silt layer was 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, Jacques 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.

Based on drilling at the NRDWL, the unsaturated zone consists of an upper, unconsolidated sand subunit with occasional thin silt layers underlain by a gravel subunit consisting of pebbles and cobble with a variable matrix of silt and sand (Weekes et al. 1987). The contact between the sand and gravel throughout the NRDWL averages 19.2 m (63 ft) below ground surface; in wells 699-25-34B and 699-25-34D at the southeast corner of the NRDWL, the contact is 25.9 m (85 ft) below ground surface (Weekes et al. 1987, WHC 1993). Clastic dikes were observed to cross-cut vertically through the sand in some of the trenches at the NRDWL.

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

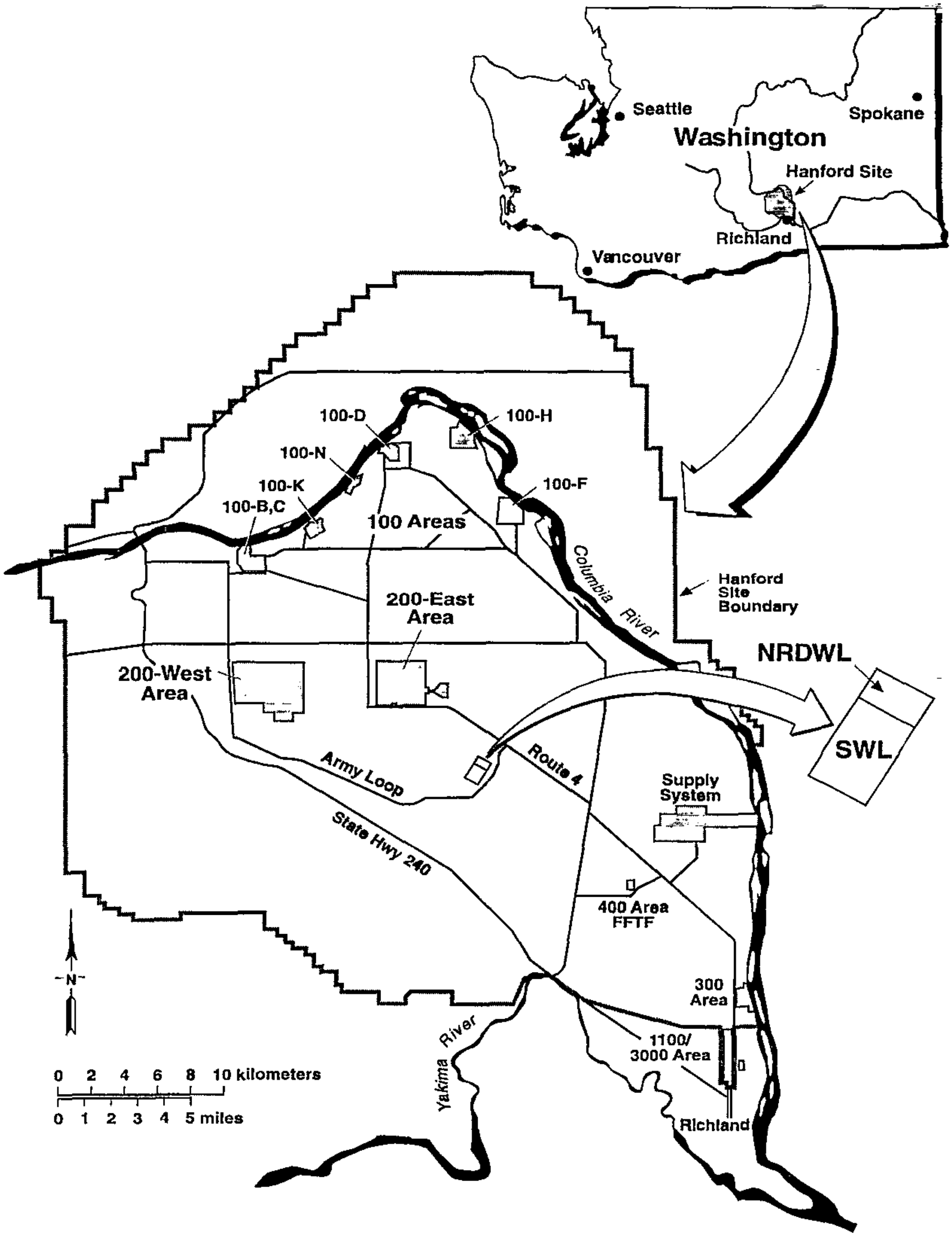

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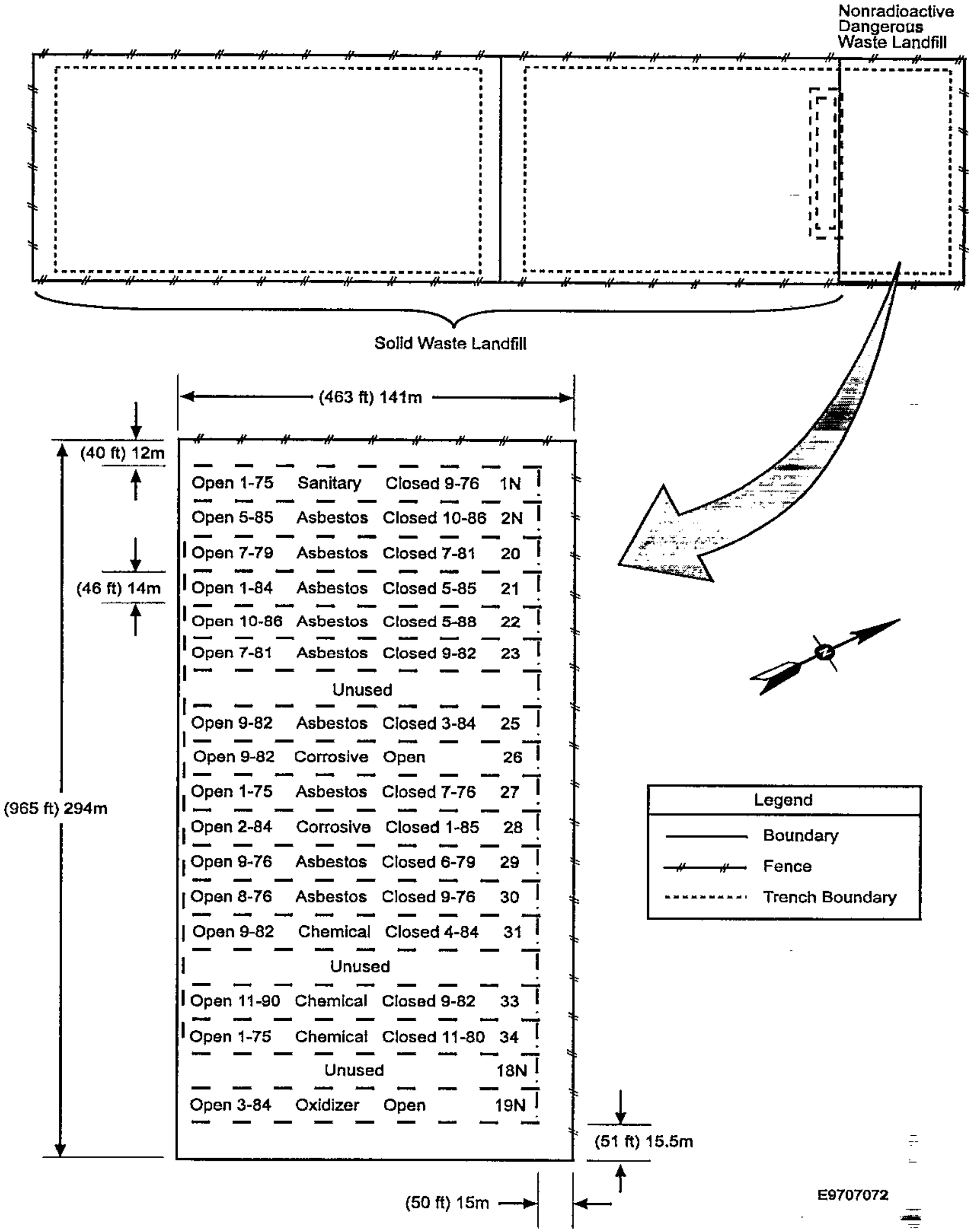
Figure 1-2. Design of Nonradioactive Dangerous Waste Landfill



2.0 FIELD SAMPLING PLAN

The FSP outlines the strategy and procedures to be used for soil-gas collection and sample analysis to provide information to support site-closure. The selection of analytical parameters, laboratory arrangements, sample locations and frequencies, sampling equipment selection, and QC measures are based on the DQOs, and the sampling and analysis objectives described in subsection 1.3 of this SAP. Samples will be analyzed for the specified VOCs (Section 1.3).

2.1 SCOPE OF WORK

The scope of this FSP is sampling and analysis of subsurface concentrations of VOCs that have been identified in a previous soil-gas investigation of the shallow vadose zone associated with the NRDWL facility (Jacques 1993) and defined in the DQO process. The objective of this investigation is to assess and map contaminant concentrations.

As a result of budgetary and schedule constraints, the workscope for this investigation is limited and has been prioritized to optimize the data collected. Sampling will be performed in three phases. Table 2-1 summarizes the proposed sampling by phase, and Figures 2-1 and 2-2 depict the sample locations. Phases II and III of this investigation will be conducted if justified by the results of Phase I.

2.2 GENERAL REQUIREMENTS

This soil-gas investigation will be performed by BHI or BHI subcontractor personnel. All work performed in this investigation will be conducted in accordance with the following general requirements:

- BHI-EE-01, *Environmental Investigation Procedures* (EIP) (BHI 1994)
- BHI-EE-02, *Environmental Requirements* (BHI 1995a)
- BHI-EE-05, *Field Screening Procedures* (BHI 1995b)
- BHI-FS-01, *Field Support Administration* (BHI 1995c)
- BHI-QA-03, Plan 5.1, *Field Sampling Quality Assurance Plan* (BHI 1996a)
- BHI-QA-03, Plan 5.2, *Onsite Measurements Quality Assurance Plan* (BHI 1996b)
- BHI-SH-01, *Hanford ERC Environmental, Safety, and Health Program* (BHI 1995d)
- BHI-SH-02, *Safety and Health Procedures* (BHI 1995e)

- Site-specific health and safety plan.

2.3 SAMPLING LOCATION AND FREQUENCY

The sampling design was developed jointly by the ERC, DOE-RL and Ecology based on historical soil gas data, site geohydrology, budget limitations, and professional judgement (Appendix A). Historical VOC soil gas contamination was generally associated with the chemical trenches (east side of the NRDWL) with some apparent tendency to move southeast outside the NRDWL. VOC contamination was also shown to be present in a sanitary solid waste trench on the west side of the NRDWL, but was not considered to be significant by the DQO participants to warrant further investigation. The selection of the horizontal locations was made on this basis. The depth intervals of 9.1, 18.3, 27.4, 36.6 m (30, 60, 90 and 120 ft) were considered to be reasonably close to each other to be able to establish vertical concentration profiles and sufficiently deep to assess potential impacts on groundwater, but still be cost-effective with the limits of the budget.

The sampling purpose, sample locations, and frequencies for each phase are described below. Table 2-1 summarizes the proposed sampling by phase, and Figures 2-1 and 2-2 depict the sample locations. Phase I sampling is considered the minimum effort necessary to meet the DQOs, has the highest priority, and will proceed as described. Phase II sampling can be adjusted based on contaminant concentrations and distribution patterns, and potential difficulties encountered with probe installation at depth in Phase I efforts. Phase III is lowest in priority and may or may not be performed based on the results of Phase I and II sampling and budget limitations.

2.3.1 Phase I Soil-Gas Sampling (16 total sampling locations; 37 total sampling points)

1. Confirm selected previous shallow soil-gas survey data (Jacques 1993), which indicated carbon tetrachloride, chloroform, PCE, 1,1,1-trichloroethane, and TCE contamination within, and south and east of, the NRDWL facility, by representative sampling at six pre-selected locations (S1 - S6).

2. Probe for VOCs at greater depths in the vadose zone within the NRDWL facility to detect potential contaminant movement through the vadose zone and to the groundwater table. Place soil-gas sampling probes at depths of 9.1 m (30 ft), 18.3 m (60 ft), 27.4 m (90 ft), and 36.6 m (120 ft) at two locations inside the NRDWL boundaries. Samples from these probes will be used to assess the extent of downward VOC movement under the NRDWL facility. One probe location (D1) will be near the edge of the NRDWL trenches and the other location (D2) will be in chemical trench 19N. It is assumed that the deepest probe depth (36.6 m [120 ft]) will be within 3 m (10 ft) of the groundwater table.

3. Place soil-gas sampling probes at two other locations within the NRDWL fence line: at depths of 9.1 m (30 ft), 18.3 m (60 ft), and 27.4 m (90 ft) at one location (D3) and at

depths of 9.1 m (30 ft) and 18.3 m (60 ft) at the other location (D4). These probes will be used to evaluate potential VOC contamination beneath the NRDWL over a broader area. The remaining sample depths at these locations are discussed in the Phase II and III sampling.

4. Probe for VOCs at greater depths in the vadose zone outside the NRDWL facility. Place soil-gas sampling probes at depths of 9.1 m (30 ft), 18.3 m (60 ft), 27.4 m (90 ft), and 36.6 m (120 ft) at two locations (D6 and D7) outside the NRDWL boundaries. These locations will be downgradient of the NRDWL and aligned with the southeastward flow of the groundwater in the area. These probes will be used to help determine if VOCs have migrated vertically toward the groundwater table, and if the VOCs have migrated laterally beyond the NRDWL boundaries.

5. Examine the lateral extent of downgradient migration by placing soil-gas sampling probes at depths of 18.3 m (60 ft), 27.4 m (90 ft), and 36.6 m (120 ft) at two locations (D8 and D9) close to the presumed vector of groundwater flow beneath the NRDWL trenches, as defined by the sampling locations defined in No. 4 above. An additional two locations (D10 and D11) will be probed at depths of 27.4 m (90 ft) and 36.6 m (120 ft) to further delineate the potential lateral extent of contamination away from the groundwater flow vector.

2.3.2 Phase II Soil-Gas Sampling (8 total sampling locations; 18 total sampling points)

1. At the previously sampled locations (D10, and D11) outside the NRDWL boundaries (see No. 5 above), probes will be pushed to 18.3 m (60 ft). Place soil-gas sampling probes at depths of 18.3 m (60 ft), 27.4 m (90 ft), and 36.6 m (120 ft) at three new locations (D12, D13, and D14) outside the NRDWL boundaries.

2. At the previously sampled locations (D3 and D4) inside the NRDWL boundaries (see Phase I, No. 3 above), probes will be pushed to depths that were not sampled as part of Phase I: 36.6 m (120 ft) for location D3, and 27.4 m (90 ft) and 36.6 m (120 ft) for location D4. Place soil-gas sampling probes at depths of 9.1 m (30 ft), 18.3 m (60 ft), 27.4 m (90 ft), and 36.6 m (120 ft) at one new location (D5) inside the NRDWL boundaries.

2.3.3 Phase III Soil-Gas Sampling (28 total sampling locations; 28 total sampling points)

1. Those probe locations (D8, D9, D10, D11, D12, D13, and D14; see Phase I, No. 5 and Phase II, No. 1 above) outside the NRDWL not previously sampled in Phases I or II at the 9.1-m (30-ft) depth will be sampled.

2. To evaluate near-surface soil column VOC concentrations, the shallow probe locations (S7 - S27) from the previous soil-gas survey (Jacques 1993) will be sampled provided the sampling tubes are still intact.

2.4 INSTALLATION OF SOIL-GAS PROBES

Soil-gas probes will be installed following the guidelines of BHI-EE-01, EIP 5.1, "Soil Gas Sampling." Sample points will be installed using a Geoprobe Model 5400 hydraulic probe driver (a trademark of Geoprobe Systems). Each sample point will consist of a dedicated stainless steel screen implant connected to a length of 0.635 cm (0.25 in.) outside diameter (OD) polyethylene tubing. The proposed sampling depths for this investigation range from 1.8 m (6 ft) to 36.6 m (120 ft). Figure 2-3 depicts the cross section of a typical soil-gas sampling point.

Only one attempt will be made to reach the desired depth at each location and no additional attempts will be made to drive to that depth or deeper depths at that location. In the event that a probe cannot be driven to the target depth because of refusal, the technical lead or designee will determine if the depth at refusal should be sampled or the probe abandoned. The technical lead or designee may adjust the horizontal position of the preselected sampling location (Figure 2-1) within 15.2 m (50 ft) to ensure waste is not penetrated in the chemical trenches or to accommodate field conditions. Other than the depth at refusal, adjustments to the deep sampling intervals in the field will be limited to ± 3 m (10 ft). Any changes in the relative depth and location of the sample point from the proposed plan will be documented in the field logbook at the time of probe installation.

Observations regarding the relative ease of probe installation and measurement of the actual probe depth below ground surface will also be noted in the field logbook at the time of installation.

2.5 SAMPLE DESIGNATION, HANDLING, AND CUSTODY

The ERC's Sample Data Tracking database will be used to track the samples and the analytical data. Prior to initiating field sampling activities, Hanford Environmental Information System (HEIS) sample numbers for this project will be issued to the field sampler in accordance with BHI-EE-01, EIP 2.0, "Sample Event Coordination." Each sample will be identified and labeled with a unique HEIS sample number, and each sample container will be labeled with the following information: HEIS number, sample collection date and time, name or initials of sampler, analyses required, and preservation method, if applicable.

Sample custody and handling will be performed in accordance with BHI-QA-03, Plan 5.1, *Field Sampling Quality Assurance Plan* and BHI-QA-03, Plan 5.2, *Onsite Measurements Quality Assurance Plan* (BHI 1996a, 1996b). Samples will be documented in the field logbook at the time they are collected. Each sample will be logged into the onsite mobile laboratory vehicle on a laboratory custody sheet at the time of delivery.

Soil-gas samples collected for gas chromatograph (GC) analysis will be analyzed as soon as possible after they are received by the onsite mobile laboratory. Samples will not be held longer than 8 hours prior to analysis.

All information pertinent to field sampling, including sample location and HEIS number, will be recorded in bound field logbooks in accordance with BHI-EE-01, EIP 1.5, "Field Logbooks." The sampler(s) will be responsible for recording all relevant sampling information. Entries to the logbook will be dated and signed by the individual making the entry.

2.6 SAMPLE COLLECTION AND SAMPLE ANALYSIS

Under normal work conditions, sample collection and sample analysis will be performed at a rate of approximately 10 to 20 sample points per day. Following probe installation, a minimum of 24 hours will be allowed for sample points to equilibrate before sample collection and sample analysis are performed. The sampling schedule will also provide allowances for unscheduled interruptions caused by unstable weather conditions. Sample collection will be performed during periods of stable atmospheric pressure.

Samples obtained for GC analysis will be collected in 1-L (0.26-gal) tedlar bags, using a portable vacuum sampling apparatus to fill the bag. Each sample point will be purged approximately two to three tubing volumes prior to sample collection. Purge volumes will be determined for the general tubing lengths and documented in the field logbook.

Onsite GC analyses will be performed in a mobile laboratory vehicle using BHI-EE-05, Field Screening Procedure 1.6, "Analysis of Volatile Organic Compounds in Soil Gas." Table 2-2 identifies the analytical instruments that will be used in this investigation.

Sample analysis methods, preservation, hold times, and volume requirements will be identified through the process defined by EIP 2.0, "Sample Event Coordination," and documented on the Sample Authorization Form/Field Sample Requirements (SAF/FSR) form prepared by the sample management organization.

2.7 HEALTH AND SAFETY

The ERC will prepare a site-specific health and safety plan incorporating the job-specific hazard analysis for the Geoprobe.

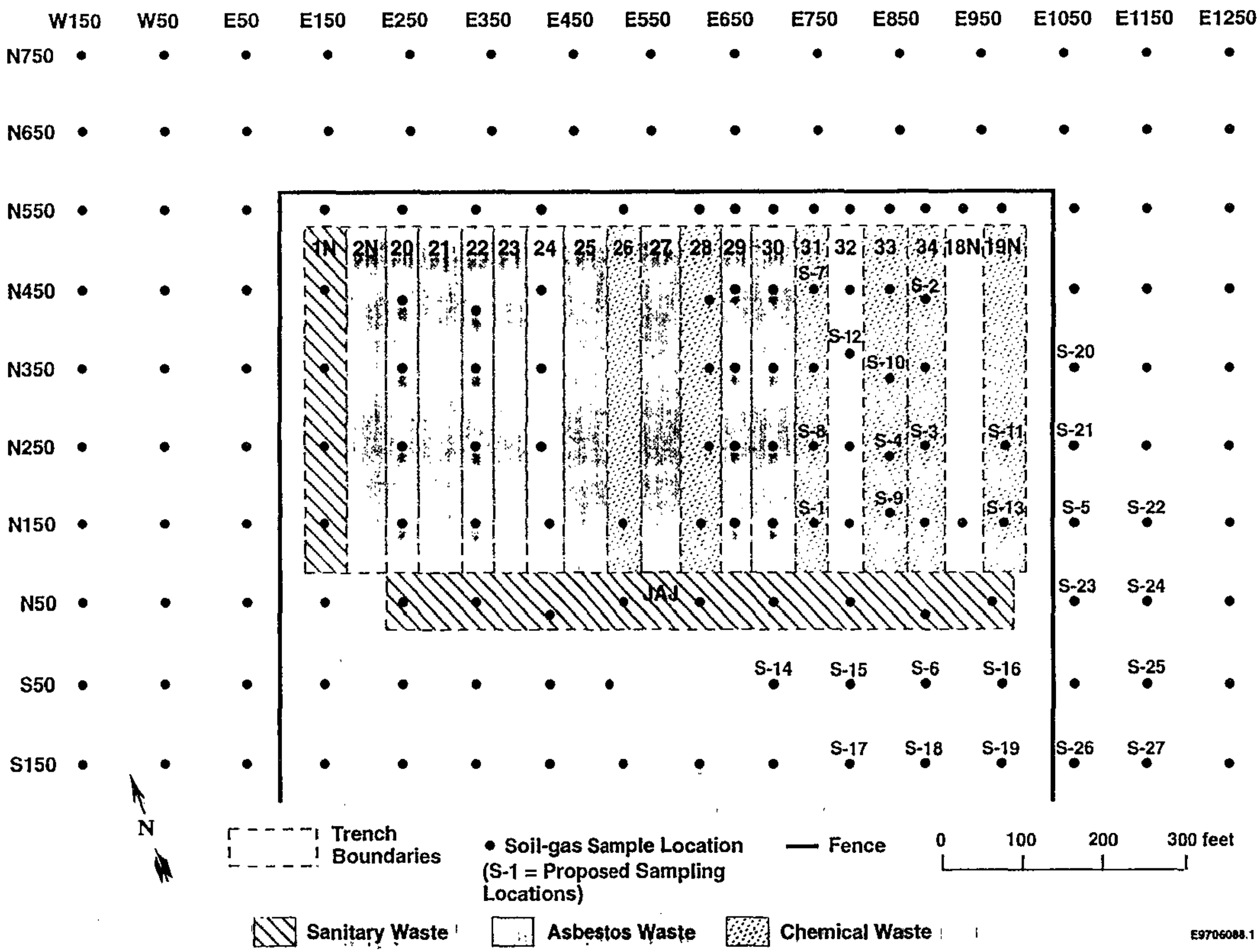


Figure 2-1. Proposed Shallow Soil-Gas Sampling Locations

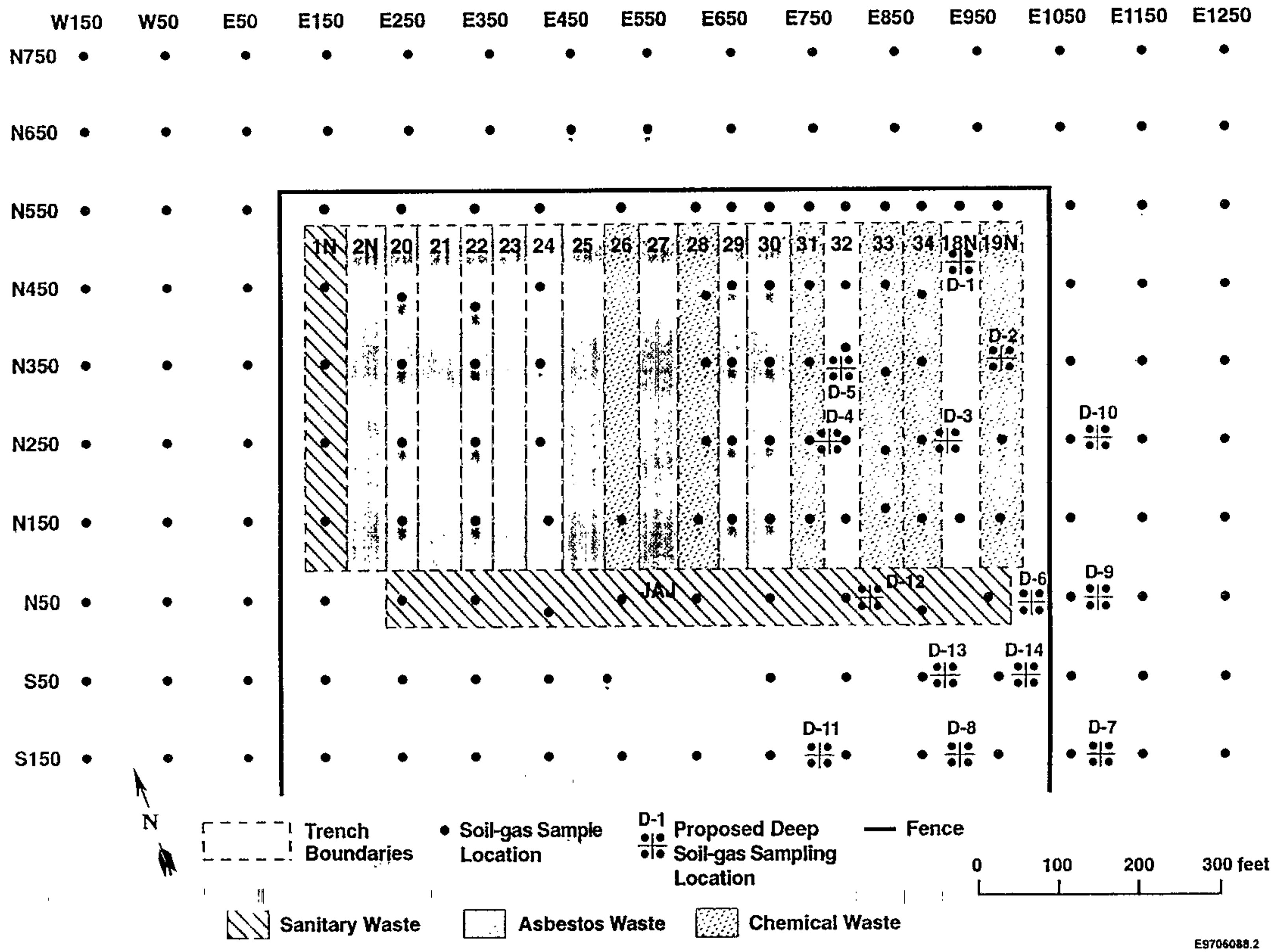


Figure 2-2. Proposed Deep Soil-Gas Sampling Locations

Figure 2-3. Typical Soil-Gas Probe-Sample Point at the Nonradioactive Dangerous Waste Landfill

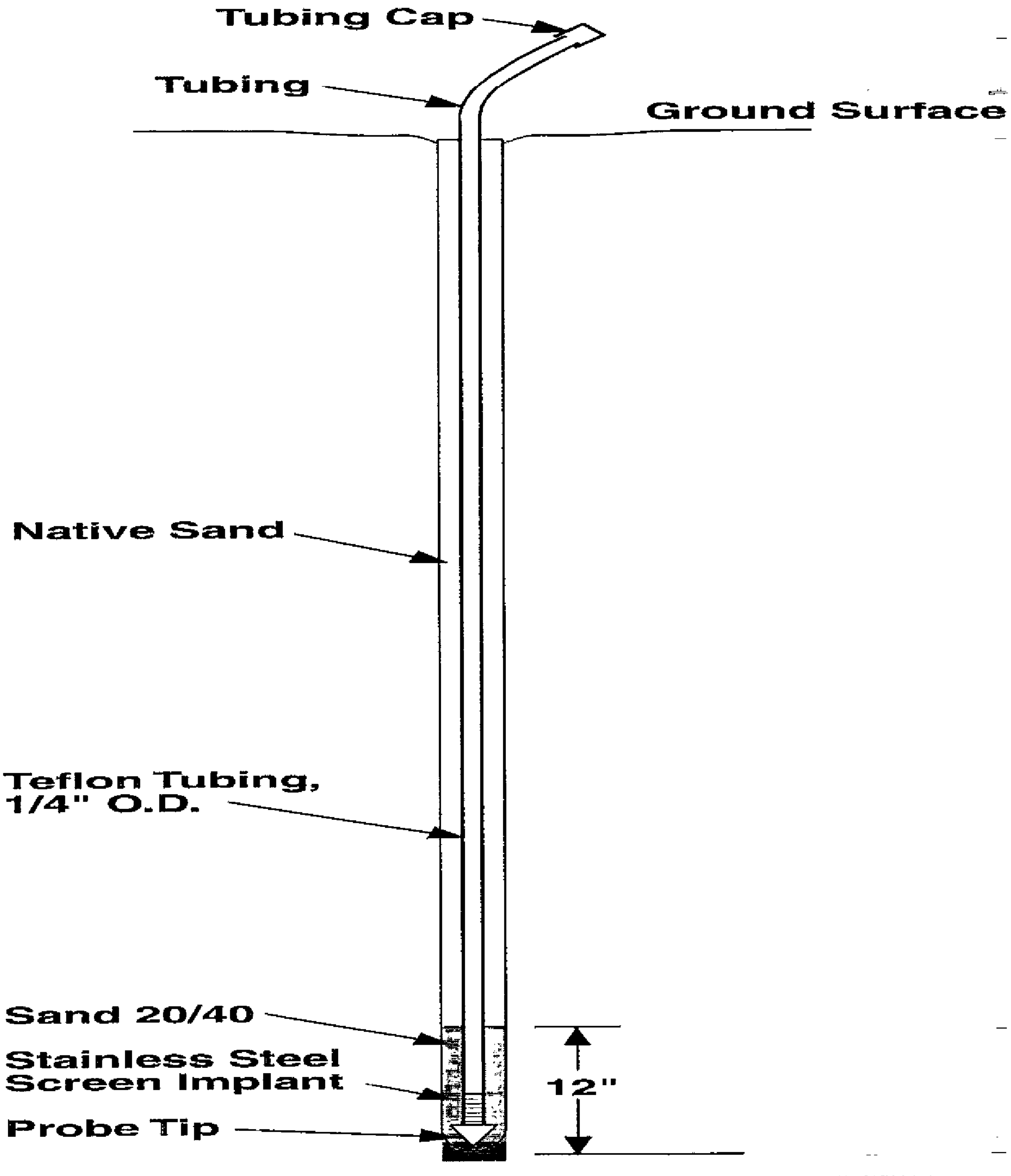


Table 2-1. Summary of Sample Locations and Depths by Phase (Page 1 of 2)

Phase	Priority	Probe Type "S" = Shallow "D" = Deep	Location "I" = Inside "O" = Outside Facility	Probe Target Depths	Location Identifier Code
I	1	S	I	6'	S-1
	2	S	I	6'	S-2
	3	S	I	6'	S-3
	4	S	I	6'	S-4
	5	S	O	6'	S-5
	6	S	O	6'	S-6
	7	D	I	30',60',90',120'	D-1
	8	D	I	30',60',90',120'	D-2
	9	D	I	30',60',90'	D-3
	10	D	I	30',60'	D-4
	11	D	O	30',60',90',120'	D-6
	12	D	O	30',60',90',120'	D-7
	13	D	O	60',90',120'	D-8
	14	D	O	60',90',120'	D-9
	15	D	O	90',120'	D-10
	16	D	O	90',120'	D-11
II	4	D	O	60'	D-10
	5	D	O	60'	D-11
	6	D	O	60',90',120'	D-12
	7	D	O	60',90',120'	D-13
	8	D	O	60',90',120'	D-14
	1	D	I	120'	D-3
	2	D	I	90',120'	D-4
	3	D	O	30',60',90',120'	D-5
III	1	D	O	30'	D-8
	2	D	O	30'	D-9

Table 2-1. Summary of Sample Locations and Depths by Phase (Page 2 of 2)

Phase	Priority	Probe Type "S" = Shallow "D" = Deep	Location "I" = Inside "O" = Outside Facility	Probe Target Depths	Location Identifier Code
	3	D	O	30'	D-10
	4	D	O	30'	D-11
	5	D	O	30'	D-12
	6	D	O	30'	D-13
	7	D	O	30'	D-14
	8	S	I	6'	S-7
	9	S	I	6'	S-8
	11	S	I	6'	S-10
	12	S	I	6'	S-11
	13	S	I	6'	S-12
	14	S	I	6'	S-13
	15	S	I	6'	S-14
	16	S	I	6'	S-15
	17	S	I	6'	S-16
	18	S	I	6'	S-17
	19	S	I	6'	S-18
	20	S	I	6'	S-19
	21	S	O	6'	S-20
	22	S	O	6'	S-21
	23	S	O	6'	S-22
	24	S	O	6'	S-23
	25	S	O	6'	S-24
	26	S	O	6'	S-25
	27	S	O	6'	S-26
	28	S	O	6'	S-27

Table 2-2. Analytical Instruments Used for Soil-Gas Survey

Instrument	Type	Measurement Principle	Comments
PHOTOVAC 10S Plus portable GC	GC PID[1]	Sample is collected in a sample loop or injected. PID is available for GC analysis.	Uses a capillary column and ultra-pure air carrier gas for compound separation. The PHOTOVAC can be equipped for ionization potential of 10.6 eV, or 11.7 eV by changing the PID lamp.

[1] Gas chromatograph with photo ionization detector

3.0 QUALITY ASSURANCE PROJECT PLAN

The QA/QC established for this sampling and analysis activity are identified in this QAPjP. The total error in the analytical results will be controlled to ensure that an acceptable level of confidence is maintained in the decisions resulting from a review of the data.

3.1 PROJECT ORGANIZATION AND RESPONSIBILITY

3.1.1 Technical Lead Responsibility

The NRDWL soil-gas investigation technical lead is primarily responsible for directing and approving all technical aspects of this sampling and analysis task. Additional responsibilities include coordinating efforts of functional and support organizations.

3.1.2 Support Responsibilities

The ERC's Field Analytical Services organization will be responsible for all field work associated with this FSP including the installation of soil-gas probes and the performance of sample collection and sample analysis.

3.2 SAMPLING PROCEDURES

All sampling will be performed in accordance with procedures identified in BHI-EE-01. Procedures for sampling activities not covered in this document will be prepared by project personnel and attached to the work control package. Procedures will be carefully followed during the field sampling activities to ensure that the samples collected are representative of the soil gas in the subsurface in and around NRDWL.

Logbook entries will be performed in compliance with BHI-EE-01, EIP 1.5. Custody will be maintained in accordance with BHI-EE-01, EIP 3.0.

3.3 SAMPLE CUSTODY

Sample custody and handling will be performed in accordance with BHI-QA-03, Plan 5.1, *Field Sampling Quality Assurance Plan* and BHI-QA-03, Plan 5.2, *Onsite Measurements Quality Assurance Plan* (BHI 1996a, 1996b). Samples will be documented in the field logbook at the time they are collected. Each sample will be logged into the onsite mobile laboratory vehicle on a laboratory custody sheet at the time of delivery.

All relevant documents, records, reports, logs, field notebooks, pictures, subcontract reports, and analytical reports will be submitted, secured, and stored in accordance with the Document and Information Services section of BHI-MA-02, *ERC Project Procedures.*

3.4 ANALYTICAL PROCEDURES

Samples obtained for gas chromatograph (GC) analysis will be collected in 1-L (0.26-gal) tedlar bags, using a portable vacuum desiccator to fill the bag. Each sample point will be purged approximately two to three tubing volumes prior to sample collection. Purge volumes will be determined for the general tubing lengths and documented in the field logbook.

The onsite GC analyses will be performed in a mobile laboratory vehicle using BHI-EE-05, Field Screening Procedure 1.6, "Analysis of Volatile Organic Compounds in Soil Gas."

Each sample will be analyzed for the target VOCs using a Photovac 10S Plus (a trademark of Photovac International, Inc.) portable gas chromatograph (10S Plus) operated in accordance with Field Screening Procedure 1.6, "*Analysis of Volatile Organic Compounds in Soil Gas.*" The 10S Plus is a self-contained, battery-powered portable gas chromatograph that uses a 10-meter, non-polar, wide-bore, capillary column and a photoionization detector with a 11.7 eV lamp. The 500 µL soil gas samples will be directed to the analytical column using an on-board sample pump and sample loop. The 10S Plus will be operated isothermally at 40 °C using ultra high-purity air carrier gas at a flow rate of 5 mL per minute.

The 10S Plus is equipped with a library to detect a variety of compounds based on retention time. Identified compounds are quantified based on peak area, with appropriate response factors for each compound of interest. Three-point calibration curves for the VOCs of interest will be developed using prepared calibration gas standards. The calibration gas standards have a concentration tolerance of ± 2 percent.

At the beginning of each sampling day, the 10S Plus calibrations will be updated using a gas calibration standard containing the VOCs of interest. An ambient air/equipment blank sample will be collected each sampling day and analyzed to establish the instrument baseline response and ensure the sampling train is not contaminated. At the end of sampling day, the calibration gas standard will be analyzed as a sample to determine the calibration drift and ensure the quality of the data.

Method detection limits for the COCs are: carbon tetrachloride, 0.10 ppm; chloroform, 0.13 ppm; PCE, 0.10 ppm; 1,1,1-trichloroethane, 0.13 ppm; and TCE, 0.10 ppm. Precision, measured as relative percent difference, will be set at ± 20 percent and accuracy, measured as percent recovery, will be set at ± 25 percent.

3.5 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS AND SAMPLES

Quality assurance/quality control requirements and samples ensure the overall reliability of the data. The QA/QC requirements specified for this investigation correspond to Quality Assurance level "QA-2" for the GC instruments, as defined in BHI-QA-03, Plan 5.1, *Field Sampling Quality Assurance Plan* and BHI-QA-03, Plan 5.2, *Onsite Measurements Quality Assurance Plan* (BHI 1996a, 1996b). All instruments will be calibrated and operated in accordance with the referenced field screening/analysis procedures and/or the manufacturer's recommendations. Instrument response will be checked on a routine basis to ensure the instrument operates within an acceptable range. Instrument calibration data will be recorded in the instrument logbook for the GCs.

Quality control samples for the GC analyses will include instrument blanks (method blanks), equipment blanks, ambient air samples, duplicate samples, replicate samples, calibration standards, and spiked samples. Calibration standards will be run on a regular basis to ensure instrument accuracy and precision. All QC samples will be documented in the instrument logbook and will be reported with the sample analysis data. Table 3-1 defines the purpose of the QC samples and their frequency.

3.6 DATA REPORTING AND MANAGEMENT

3.6.1 Reporting

A letter report will be issued as summarizing the analytical results. Data summaries shall include, at a minimum, sample identity (location and depth), sampling and analysis dates and times, data results, and QC sample data.

3.6.2 Data Management

Data generated as a result of analyses for the NRDWL soil-gas investigation will be managed and stored by the ERC's Sample Management organization, as outlined in BHI-EE-01, Section 2.0, "Sample Management." Data packages will be managed in accordance with BHI-EE-05, Procedure 1.7 "Preparation, Control, and Review of Organic/Inorganic Data Packages." Data will be maintained in the HEIS.

Table 3-1. Quality Control Samples for the Nonradioactive Dangerous Waste Landfill Soil-Gas Investigation

Sample	Description	Purpose	Frequency
Instrument (method) Blank	Clean air or ambient air analyzed as a sample	Evaluate potential for contamination from syringe, instrument flow line, or trap 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	Clean air or ambient air collected through sampling equipment	Evaluate potential for contamination from sampling equipment	
Duplicate Sample	Second sample collected from the same sampling point	Demonstrate repeatability (precision) of sampling method	Minimum of once per day or 1 per 20 samples. Also as required to confirm anomalous results
Replicate Sample	Subsequent sample collected from a previously sampled point	Demonstrate repeatability (precision) of sampling method	Minimum of one sample location, one sample depth resampled each day
Calibration Standard (spiked sample)	Measurement of a known analyte at a known concentration	Demonstrate ability of instrument to identify and quantify a specific compound under field conditions (accuracy)	Daily and as required to confirm instrument calibration and/or analyte identification

4.0 REFERENCES

BHI, 1994, *Environmental Investigations Procedures*, BHI-EE-01, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1995a, *Environmental Requirements*, BHI-EE-02, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1995b, *Field Screening Procedures*, BHI-EE-05, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1995c, *Field Support Administration*, BHI-FS-01, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1995d, *Hanford ERC Environmental, Safety, and Health Program*, BHI-SH-01, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1995e, *Safety and Health Procedures*, BHI-SH-02, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1996a, *Field Sampling Quality Assurance Plan*, BHI-QA-03, Plan 5.1, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1996b, *Onsite Measurements Quality Assurance Plan*, BHI-QA-03, Plan 5.2, Bechtel Hanford, Inc., Richland, Washington.

DOE-RL, 1990, *Nonradioactive Dangerous Waste Landfill Closure/Postclosure Plan*, DOE/RL-90-17, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA, 1994, *Guidance for the Data Quality Objectives Process*, EPA-QA/G-4, U.S. Environmental Protection Agency, Washington, D.C.

Jacques, I. D., 1993, *Nonradioactive Dangerous Waste Landfill Soil-Gas Survey: Final Data Report*, WHC-SD-EN-TI-199, Westinghouse Hanford Company, Richland Washington.

Mitchell, T. H., K. A. Bergstrom, and D. J. Hoff, 1993, *Geophysical Investigation of the Nonradioactive Dangerous Waste Landfill (NRDWL)*, WHC-SD-EN-TI, 116, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Weekes, D. C., Luttrell, S. P., and M. R. Fuchs, 1987, *Interim Hydrogeologic Characterization Report and Groundwater Monitoring System for the Nonradioactive Dangerous Waste Landfill (NRDWL), Hanford Site, Washington*, WHC-EP-0021, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993, *Borehole Completion Data Package for the Nonradioactive Dangerous Waste Landfill (NRDWL) RCRA Facility Wells 699-25-34D and 699-25-34B*, WHC-SD-EN-DP-055, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

DRAFT
Data Quality Objectives Process Summary Report
for
Nonradioactive Dangerous Waste Landfill Project

DRAFT
Data Quality Objectives Process Summary Report for Nonradioactive Dangerous Waste Landfill Project

July, 28 1997

EXECUTIVE SUMMARY

Ecology requested additional data for the Nonradioactive Dangerous Waste Landfill (NRDWL) facility to support closure/post closure plan decisions. While additional data were not necessarily required for closure, it was agreed that data regarding potential contaminant movement from the site would improve the certainty of closure/post closure decisions. The project budget/schedule would not allow traditional soil or groundwater sampling but could support soil gas sampling/analysis. The soil gas results would have no regulatory compliance implications, but could be used to determine if contaminants were moving from NRDWL and if NRDWL closure should receive a higher priority.

1.0 SCOPE AND OBJECTIVES

1.1 Project Objectives

The objective of this project is to support the closure/post closure of the Nonradioactive Dangerous Waste Landfill (NRDWL), a RCRA Treatment, Storage, and/or Disposal (T.D.) facility in the 600 Area. The soil gas data will be used to determine if contaminants are moving from NRDWL and if NRDWL closure should receive a higher priority.

1.2 Data Quality Objectives

The soil vapor data collected must be of sufficient quality to support NRDWL closure priority decisions and post closure monitoring requirement decisions (e.g. contaminants of concern, soil vapor, groundwater).

1.3 Exclusions

It was agreed by the decisionmakers that this Data Quality Objectives (DQO) would only address soil vapor sampling. Sampling other media (e.g. soil, groundwater, NRDWL waste) was excluded from this effort, primarily due to cost considerations/budget constraints. It was also agreed that sampling would be conducted only on the eastern portion of the NRDWL, where previous soil gas sampling indicated higher contaminant concentrations.

2.0 FACILITY AND PROJECT BACKGROUND

2.1 Physical Description

NRDWL was operated from 1975 through 1985 as part of the Central Landfill. The landfill is composed of a series of unlined parallel trenches that are 4.9 to 6.1 m (16 to 20 ft) deep. The NRDWL received primarily chemical and asbestos wastes, and some sanitary solid wastes. The chemical wastes were packaged according to U.S. Department of Energy, Richland Operations Office (RL) specifications (sealed in containers containing absorbent materials). An inventory of wastes disposed in NRDWL are in the disposal records.

The NRDWL facility is regulated under RCRA as a T.D. facility. The initial RCRA Part A permit application was submitted in 1980. The Part B permit application was submitted in 1985. A draft closure/post closure plan was submitted to the Washington State Department of Ecology (Ecology) in 1990 and includes a revised Part A permit application. Notice of Deficiency (NOD) comments were received from Ecology in 1994 and 1997.

Based on the draft plan submitted in 1990, three field activities were undertaken: two new wells, one upgradient and one downgradient, were installed in 1992 to complement the existing groundwater monitoring network; a ground penetrating radar (GPR) survey was conducted in 1993 to define the buried waste zones; and a shallow (1.5 m [5 ft] deep) soil gas survey was conducted in 1993.

The Solid Waste Landfill (SWL) is adjacent to NRDWL and contains municipal (non-hazardous) wastes.

2.2 Discharges and Process Knowledge

The contaminants of concern (COC) detected at NRDWL are trichloroethylene (TCE) and tetrachloroethylene (PCE), with additional detections of carbon tetrachloride, chloroform, and 1,1,1-trichloroethane (TCA).

2.3 Plan for Project Task Action

The plan for this project is to design ($16K) and implement ($32K) soil gas sampling within the time (complete by end of FY97) and budget ($48K) constraints to evaluate the status of COC movement through the soil away from the facility.

2.4 Existing Sources of Data

A list of data references has been developed for this project by V. J. Rohay/CHI. The existing data for NRDWL include the 1993 GPR data, 1993 soil gas survey results, data from local groundwater wells, the facility disposal inventory, the 1985 Part B permit application, the revised 1990 Part A permit application, the 1990 draft closure/post closure plan, and the 1994/1997 NOD comments from the Ecology.

3.0 PARTICIPANTS AND RESPONSIBILITIES

The participants for this effort are listed as the workshop attendees in Table A-1. The project decisionmakers were RL and Ecology. Environmental Restoration Contractor (ERC) staff (Bechtel Hanford, Inc. [BHI] and CH2M HillHanford Inc. [CHI]) participated in the workshops as technical support. The U.S. Environmental Protection Agency (EPA) did not participate because Ecology has primary decisionmaking responsibility for this facility.

4.0 PROJECT ASK SCOPING AND ISSUES SUMMARY

4.1 Scoping Summary Report

This project has a relatively long history at Hanford. The decisionmakers and the technical staff were all very familiar with the project and the issues related to it. For this reason, a typical DQO Scoping Summary Report was not prepared for this effort. Instead, a project overview was presented by ERC at the first workshop (6/9/97) to remind the participants about outstanding issues and past concerns.

4.2 Scoping Process Issues

The data collected through this effort will be used to support decisions regarding site closure. The principal issues associated with the project are:

a. There is no regulatory requirement to collect additional data to close this site

b. The COC source has not been validated

c. An adequate sampling approach to address potential NRDWL contaminant offsite movement (given budget/schedule constraints) must be identified

d. Soil gas COC concentrations have no regulatory (compliance) basis

4.3 Interview Process Issues

The decisionmakers were already familiar with the project, so interviews were not conducted. Initial discussions and agreements on the scope of this effort were conducted at the June, 1997 Unit Managers Meeting.

4.4 Global Issues Meeting Summary

No global issues were identified for this project and a Global Issues Meeting was not held.

5.0 DQO PROCESS SUMMARY

5.1 Step 1: State the Problem

The NRDWL facility is scheduled for closure. Ecology is concerned that contaminants (volatile organics) may be migrating from the site such that closure plans and/or post closure monitoring plans may need to be modified to ensure adequate site closure actions are implemented and groundwater is protected. Also, NRDWL may require a higher priority for closure.

5.2 Step 2: Identify the Decisions

One decision was identified during the DQO workshops:

a. Are NRDWL contaminants migrating offsite to a degree that current closure/post closure actions must be modified and/or the NRDWL priority for closure should be altered?

5.3 Step 3: Identify Inputs to the Decisions

The inputs required to address the decision identified in Section 5.2 include:

a. What is the regulatory basis for collecting additional data to close this site?

   Site closure could proceed without the additional data requested by Ecology. However, the additional soil gas data will add to the certainty that closure/post closure decisions are correct.

b. What contaminants are associated with the NRDWL facility?

   There was uncertainty concerning the source of local groundwater contamination because NRDWL and SWL are located adjacent to each other and both have volatile organic soil gas contamination in near-surface soils. The NRDWL and SWL records were reviewed to establish the potential contaminants they contain. The COC detected at NRDWL are all volatile organic chemicals: trichloroethylene (TCE), tetrachloroethylene (PCE), carbon tetrachloride, chloroform, and 1,1,1-trichloroethane (TCA). These same contaminants are associated with the SWL. No volatile contaminants unique to NRDWL were identified. Therefore, given the proximity of the two landfills, it is not possible to differentiate between the potential waste sources with respect to local groundwater impacts.

c. Are the existing data for the NRDWL facility sufficient to make decisions regarding site closure/post closure requirements?

The existing data indicate that contaminants are distributed within NRDWL shallow soils (<3 m [<10 ft]). Local groundwater data and some limited data from previous sampling efforts suggest that NRDWL contaminants are also present at depth. Ecology is concerned that the limited contamination detected in deep soils indicates that groundwater could be affected by NRDWL contaminant movement. It was agreed that additional soil gas data will add to the certainty that closure/post closure decisions are correct.

d. How do these contaminants move in the environment?

All the COCs are volatile organic chemicals that can move downward through the vadose zone toward groundwater. The local groundwater flow direction is generally toward the southeast. The working hypothesis is that soil gas COC concentrations are greater in the immediate vicinity of the NRDWL facility and are reduced with distance and depth from the site. It was agreed that the contaminants would be in shallow soils near the site but would move deeper into the vadose zone away from the site. This conceptual model was used to develop a sampling approach to address concerns regarding potential contaminant movement away from the site.

Four target depths for soil gas collection were developed using local geological information, geoprobe depth-of-penetration expectations, contaminant movement information from existing local soil gas data, and the literature concerning volatile organic movement through soils. The depth intervals agreed-to were 9.1, 18.3, 27.4, 36.6 m (30, 60, 90, and 120 ft) below the local surface elevation. It was agreed that these depths were goals and that if they could not be achieved due to geological constraints or geoprobe limitations, that the maximum depths the geoprobe could achieve would be acceptable for decisionmaking purposes.

e. What concentrations in soil gas indicate an unacceptable contaminant concentration in regulated media (soil and groundwater)?

Soil gas contaminant concentrations cannot be converted to regulated media ARARs (e.g. water, soil) without assumptions regarding temperature, pressure, etc. However, it was agreed that soil gas sample results would be acceptable to address NRDWL issues/decisions. It was also agreed that DOE, Ecology, and ERC would mutually develop soil gas contaminant "guidelines" to use in making decision rules for this project. While the soil gas guidelines would have no regulatory compliance implications, they could be used to determine whether contamination was moving from NRDWL such that closure/post closure action/priority modifications were merited.

5.4 Step 4: Define the Boundaries of the Decisions

The geographical boundary for this effort is the general vicinity of the NRDWL facility.

This sampling must be completed prior to the end of FY97 (September 30, 1997).

A further constraint on this project is the budget provided for sampling and analysis ($32K). This budget would not allow soil/groundwater sampling and is marginal for soil gas sampling and analysis. To help ensure the adequacy of the data collected, considerable time was spent optimizing the study approach/design.

5.5 Step 5: Develop Decision Rules

One general decision rule was developed for this project:

> If the soil gas COC concentrations exceed the guidelines developed by DOE, Ecology, and ERC, then modifications (higher closure priority, closure action changes) will be considered for the NRDWL closure/post closure plan.

DOE, Ecology, and ERC will mutually develop soil gas contaminant "guidelines" to use in this decision rule. The contaminant soil gas concentration guidelines will be tied to groundwater protection (e.g. MTCA-B criteria, MCL concentrations).

5.6 Step 6: Specify Acceptable Decision Errors (Uncertainty)

It was agreed that the limited existing data for the NRDWL area (plume size, potentially affected area) precluded the use of a statistical sampling approach to fill the data gaps identified. Therefore, professional judgement was used to develop the sampling approach, identify sampling locations, and establish sampling depths.

5.7 Step 7: Optimization

Information concerning the cost per geoprobe push, the expected depth of contamination relative to the contaminant source, and the aerial coverage believed to be necessary to establish offsite contaminant movement were used to select sampling locations and depths. This information was also used to prioritize the sampling locations/depths to help ensure that the more important samples (those defining the probable lateral/depth extent of contamination) were collected first. Samples to fill gaps between the more important sampling location/depth sites were scheduled for the second phase of sampling to ensure the budget would be applied toward the key data needs. A third sampling phase could be implemented, contingent on the success of the first two phases, for lower priority sampling locations/depths.

6.0 SUMMARY OF DQO OUTPUTS

The materials/decisions made during this DQO process will be used to support the development of a Sampling and Analysis Plan (SAP) that will be reviewed and approved by the project decision makers (DOE-RL and Ecology) prior to sampling.

7.0 COST AND SCHEDULE SAVINGS

Soil gas sampling/analysis is an order of magnitude less expensive than the cost of sampling soil. The majority of this cost savings is due to the reduced labor involved in placing soil gas sample tubes with a geoprobe rather than drilling boreholes to sample deep soils.

Additional savings were realized by using the site conceptual contaminant plume model to determine sample locations/depths relative to the expected plume location/depth rather than sample the entire NRDWL area. This exercise enabled the project team to reduce the number of samples by a factor of 3.0.

8.0 LESSONS LEARNED

No lessons learned to report for this project.

Table A-1. DQO Meeting Attendees

Participant	Organization	Meeting Date	
		6/9/97	6/26/97
J. W. Badden	CHI	X	
L. J. Cusack	Ecology	X	X
B. L. Foley	DOE	X	X
P. E. Krueger	CHI	X	X
S. Leja	Ecology	X	X
E. M. Mattlin	Ecology	X	X
G. B. Mitchem	BHI	X	X
S. Mohan	Ecology	X	X
R. W. Ovink	CHI	X	X
V. J. Rohay	CHI	X	X
C. D. Wittreich	CHI	X	X
J. W. Yokel	Ecology	X	X