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**Idaho National Engineering Laboratory**

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## *INFORMAL REPORT*

# SAMPLING AND ANALYSIS PLAN FOR BACKGROUND SOIL GAS SAMPLING FROM BOREHOLES 8801D, 78-4, WWW-1, AND 77-1 FY-1989

EG&G Idaho

*Work performed under DOE Contract No. DE-AC07-76ID01570*

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# SAMPLING AND ANALYSIS PLAN

# FOR

# BACKGROUND SOIL GAS SAMPLING FROM

# BOREHOLES 8801D, 78-4, WWW-1, AND 77-1

# FY-1989

Prepared by:
Idaho National Engineering Laboratory
EG&G Idaho
Idaho Falls, Idaho

for:
U.S. Department of Energy
Idaho Operations Office
Idaho Falls, Idaho
Under DOE Contract No. DE-AC07-76ID01570

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# FOR
# BACKGROUND SOIL GAS SAMPLING FROM
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# FY-1989

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EGG-WM-8530

SAMPLING AND ANALYSIS PLAN
FOR
BACKGROUND SOIL GAS SAMPLING FROM
BOREHOLES 8801D, 78-4, WWW-1, AND 77-1
FY-1989

Reviewed by:

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| | |
|---|---|
| ARDC | Administrative Document Control Coordinator |
| BEG | Biology, Environmental, and Geosciences |
| BWP | Burried Waste Program |
| COC | Chain-of-Custody |
| COCA | Consent Order and Compliance Agreement |
| CLP | Contract Laboratory Program |
| CMS | Corrective Measures Study |
| DCQAP | Data Collection Quality Control Plan |
| EE | Electronic Engineering |
| EPA | see USEPA |
| ERP | Environmental Restoration Program |
| GC/MS | Gas Chromatography/Mass Spectrometry |
| IH | Industrial Hygienist |
| INEL | Idaho National Engineering Laboratory |
| OSHA | Occupational Safety and Health Administration |
| PI | Principal Investigator |
| PQAO | Project Quality Assurance Officer |
| PQL | Practical Quantitation Level |
| QA/QC | Quality Assurance/Quality Control |
| RCRA | Resource Conservation and Recovery Act |
| RFI | RCRA Facility Investigation |
| RWMC | Radioactive Waste Management Complex |
| SAP | Sample and Analysis Plan |
| SDA | Subsurface Disposal Area |
| SOP | Standard Operating Procedure |
| SWMU | Solid Waste Management Unit |
| TIC | Tentatively Identified Compound |
| USEPA | United States Environmental Protection Agency (aka EPA) |
| VOA | Volatile Organic Analysis |
| VVED | Vapor Vacuum Extraction Demonstration |

# 1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) was prepared as part of the Buried Waste Project (BWP), RCRA Corrective Action Program at the Radioactive Waste Management Complex (RWMC) of the Idaho National Engineering Laboratory (INEL). The Subsurface Disposal Area (SDA) located at the RWMC, is a solid waste management unit (SWMU) under the Consent Order and Compliance Agreement (COCA), and is being evaluated in accordance with the COCA requirements. Phase I of the Corrective Action Program is the RCRA Facility Investigation (RFI). The purpose of the RFI is to evaluate the nature and extent of the release of volatile organics and to gather data to be used in Phase II of the program.

Corrective Action Program Phase II, the Corrective Measures Study (CMS), will investigate interim and final corrective actions to mitigate the movement of organic compounds from the SDA. The Vapor Vacuum Extraction Demonstration (VVED) Treatability Study is being conducted to support the CMS. The VVED will collect data to evaluate the performance of an organic vapor extraction system and the ability of that system to remove organic vapors from the vadose zone below the SDA. The systems performance, operating parameters, and removal efficiencies will be evaluated during a 4-month test demonstration. The objectives, strategy, and methodology of data collection activities conducted during the VVED test are discussed in detail in a separate Sampling and Analysis Plan (EGG-WM-8381). This SAP will focus on collection of a single set of gas samples designed to provide an indication of background concentration levels for the contaminants of primary concern identified in earlier studies, and to continue a survey for additional compounds (Section 2).

As part of the VVED, six boreholes surrounding the extraction well will be instrumented to contain gas sampling ports at various depths. Boreholes 8801D, 78-4, WWW-1, and 77-1 are presently instrumented with permanent gas sampling ports. Boreholes 8802D and D02 are to be completed and instrumented this summer (FY 89). The locations of the instrumented boreholes are presented in Figure 2.1.

In 1987, Golder Associates performed the initial sampling of the ports in boreholes 77-1, 78-4, and WWW-1 (See the RCRA Facility Investigation Workplan, Volume 2). Samples were collected by removing gas from the access ports using a battery operated vacuum pump. The needle on a gas tight syringe was inserted through a rubber tubing to intercept the gas stream. Once collected, the gas sample was sealed in the syringe to prevent escape and was then transported to the remote field laboratory for gas chromatographic analysis. The analysis was performed on-site with a HNU Model 321 field gas chromatograph (GC).

An extraction Borehole (8901D) for the VVED will be drilled, cased, and screened to approximately 250 ft. Because 8901D is located within 25 meters of 8801D, background gas samples from 8801D will have to be collected within one week of the onset of drilling.

The purpose of this Sample and Analysis Plan (SAP) is to describe the objectives, strategy, and sampling and analysis procedures that will used for a one time sampling of gas ports in wells 8801D, 78-4, WWW-1, and 77-1. The prime goal of this SAP is to define procedures that will ensure the quality and integrity of the gas samples, accuracy and precision of the analyses, representativeness of the results, and completeness of the information.

# 2.0 PROJECT DESCRIPTION

## 2.1 BACKGROUND INFORMATION

One monitoring well within the SDA and three wells outside the SDA contain gas sampling ports permanently installed at various depths (See Table 2.1). The four boreholes were completed in the following manner:

Well 8801D is located in the center of the SDA and was drilled to a depth of 244.7 ft. Nine gas samplers were installed in this well at the depths described in Table 2.1 Gas samplers consist of 2" wire wrapped stainless steel screen 18" long. The samplers are attached to the surface with 3/8" stainless steel tubing. All samplers are closed at land surface with Swagelock quick connect female attachments.

Well 78-4 was drilled about 30 ft. north of well 77-1 in September, 1978. It was drilled to a depth of 350 ft., with 340 ft. remaining open from the time the hole was logged until the installation was started. Five gas samplers were installed in this well at the depths outlined in Table 2.1. The samplers consist of 1.5" by 2 ft. 30-mesh well points connected to the surface through 1/4" galvanized steel pipe with 1/4" NPT barbed fittings with a cap or valve to close the pipe when not in use.

Well WWW-1 is located 1700 ft. northwest of the SDA and was drilled to a depth of 259 ft. Seven gas samplers were installed at the depths outlined in Table 2.1. The gas samplers consist of 3/4" copper tube one foot long and drilled with 1/4" holes. The samplers are attached to the surface by 1/4" copper tube in 50 ft. lengths connected by brass Swagelock compression fittings and soldered to insure gas-tight seals. All samplers are closed with Swagelock caps. The copper tubes are aligned from east to west with decreasing depth toward the west. The tubes are engraved with depth readings, have lead seals attached, and are labeled. A provision for a protective housing was installed on top of the 6" casing.

Well 77-1 is located about 0.25 mi. north of the RWMC, and was continuously cored to a total depth of 600 ft. The hole was cemented from the bottom to a depth of 385 ft. Six gas samplers were installed in this well at the depths outlined in Table 2.1. The screens for this well consist of plastic and are connected to the surface through 1/4" plastic PVC pipe with 1'4" NPT barbed fittings with a cap or valve to close the pipe when not in use. All screens are open with the exception of screens 1 and 3. Screen 1 was plugged tight and is inoperable and screen 3 is sluggish.

Table 2-1 Depths of Existing Gas Sampling Ports in Monitoring Wells

| Well No. | Depth of Port (feet from land surface) | PortD Number |
|---|---|---|
| 8801D | 32.8 | GSP-8801D-9 |
| | 50.5 | GSP-8801D-8 |
| | 77.5 | GSP-8801D-7 |
| | 92.5 | GSP-8801D-6 |
| | 102.5 | GSP-8801D-5 |
| | 131.0 | GSP-8801D-4 |
| | 167.2 | GSP-8801D-3 |
| | 192.5 | GSP-8801D-2 |
| | 230.0 | GSP-8801D-1 |
| 78-4 | 78.0 | GSP-784-5 |
| | 119.0 | GSP-784 4 |
| | 227.5 | GSP-784-3 |
| | 253.0 | GSP-784-2 |
| | 335.0 | GSP-784-1 |
| WWW-1 | 15.3 | GSP-WWW1-7 |
| | 48.0 | GSP-WWW1-6 |
| | 74.0 | GSP-WWW1-5 |
| | 112.0 | GSP-WWW1-4 |
| | 135.0 | GSP-WWW1-3 |
| | 180.0 | GSP-WWW1-2 |
| | 240.0 | GSP-WWW1-1 |
| 77-1 | 66.0 | GSP-771-6 |
| | 104.0 | GSP-771-5 |
| | 112.0 | GSP-771-4 |
| | 151.0 | GSP-771-3 |
| | 191.0 | GSP-771-2 |
| | 371.0 | GSP-771-1 - inoperable |

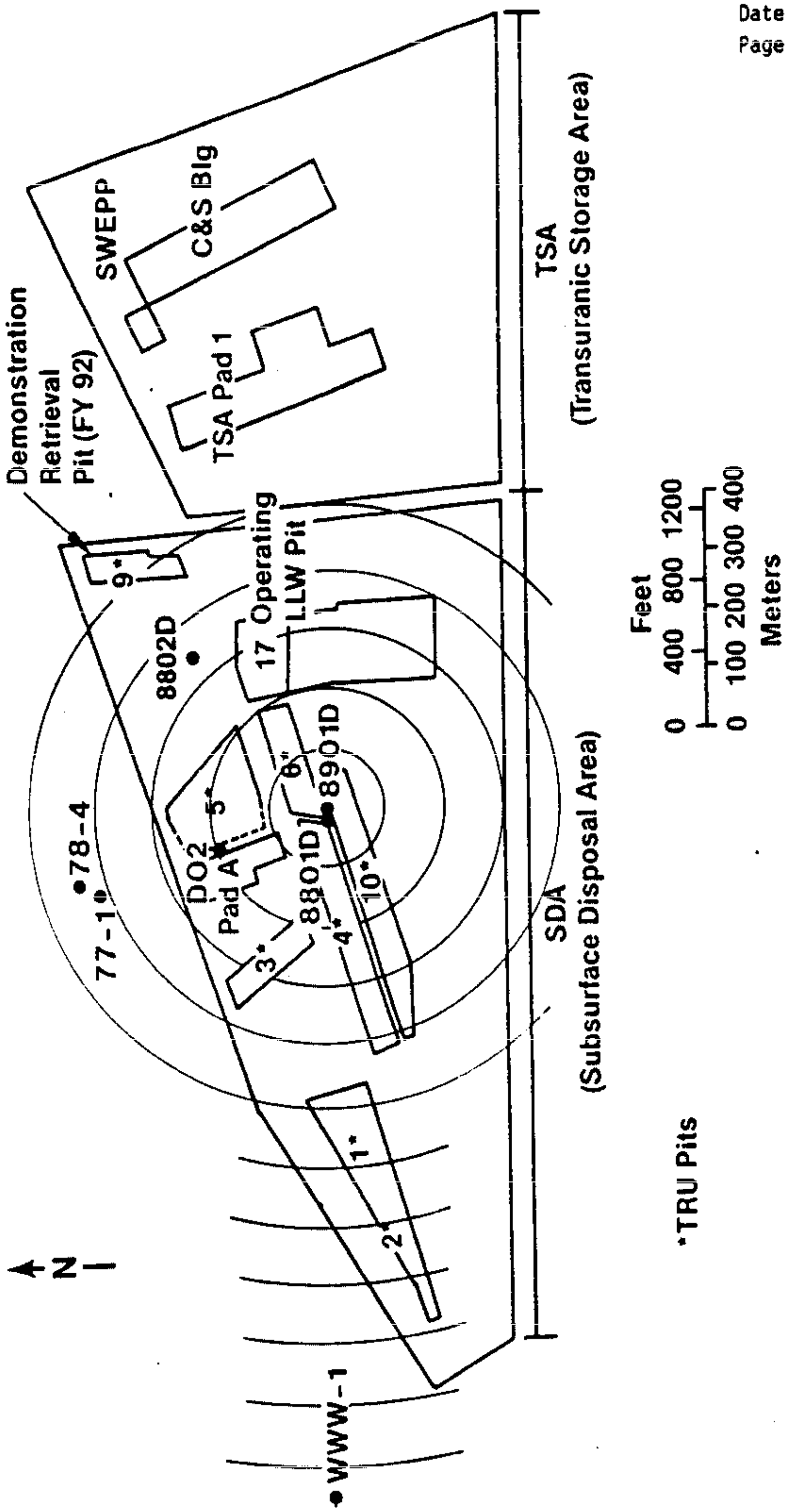



Figure 2-1. Map showing locations of completed boreholes (8801D, 78-4, WWW-1, 77-1) to be sampled under this plan.

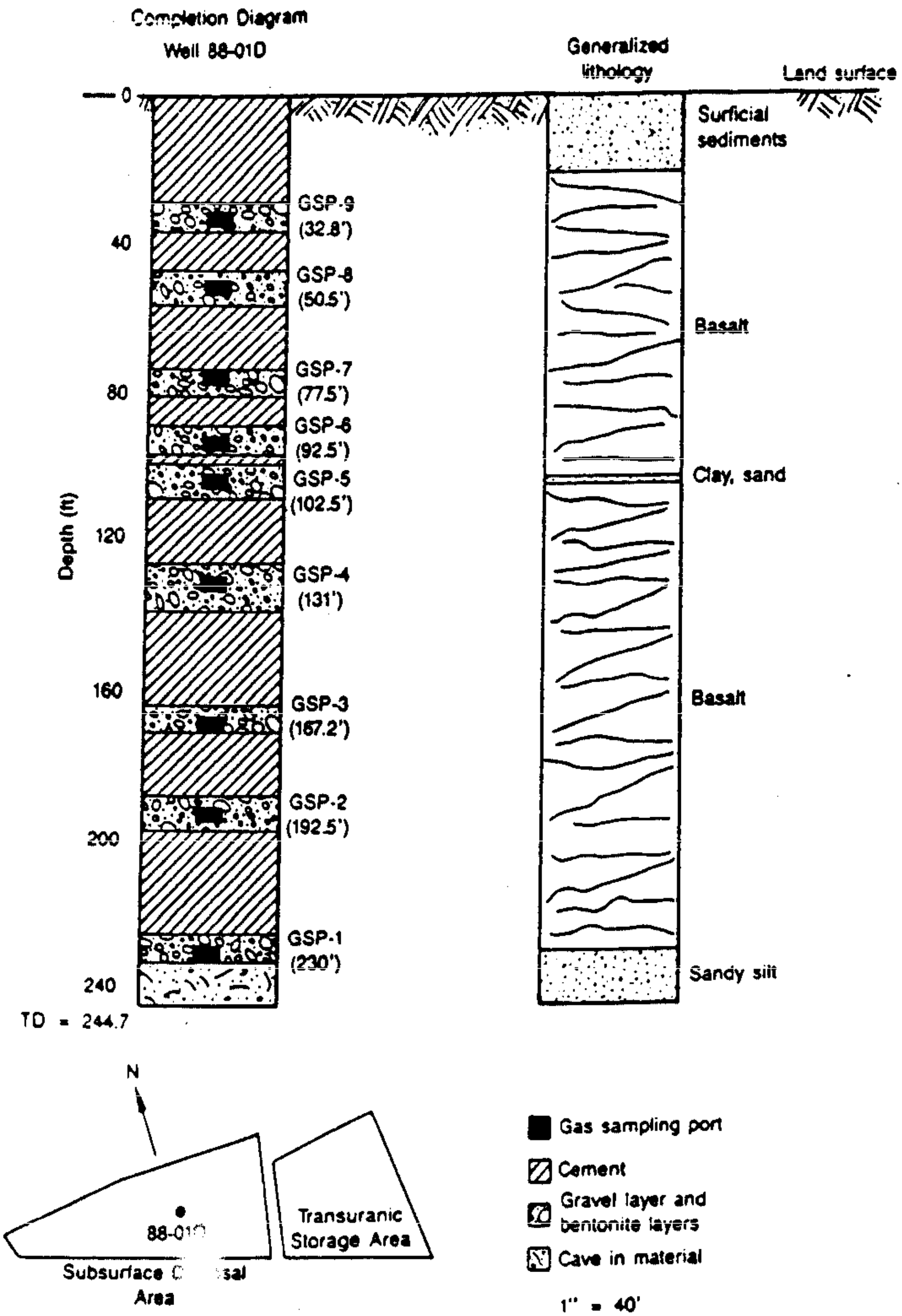
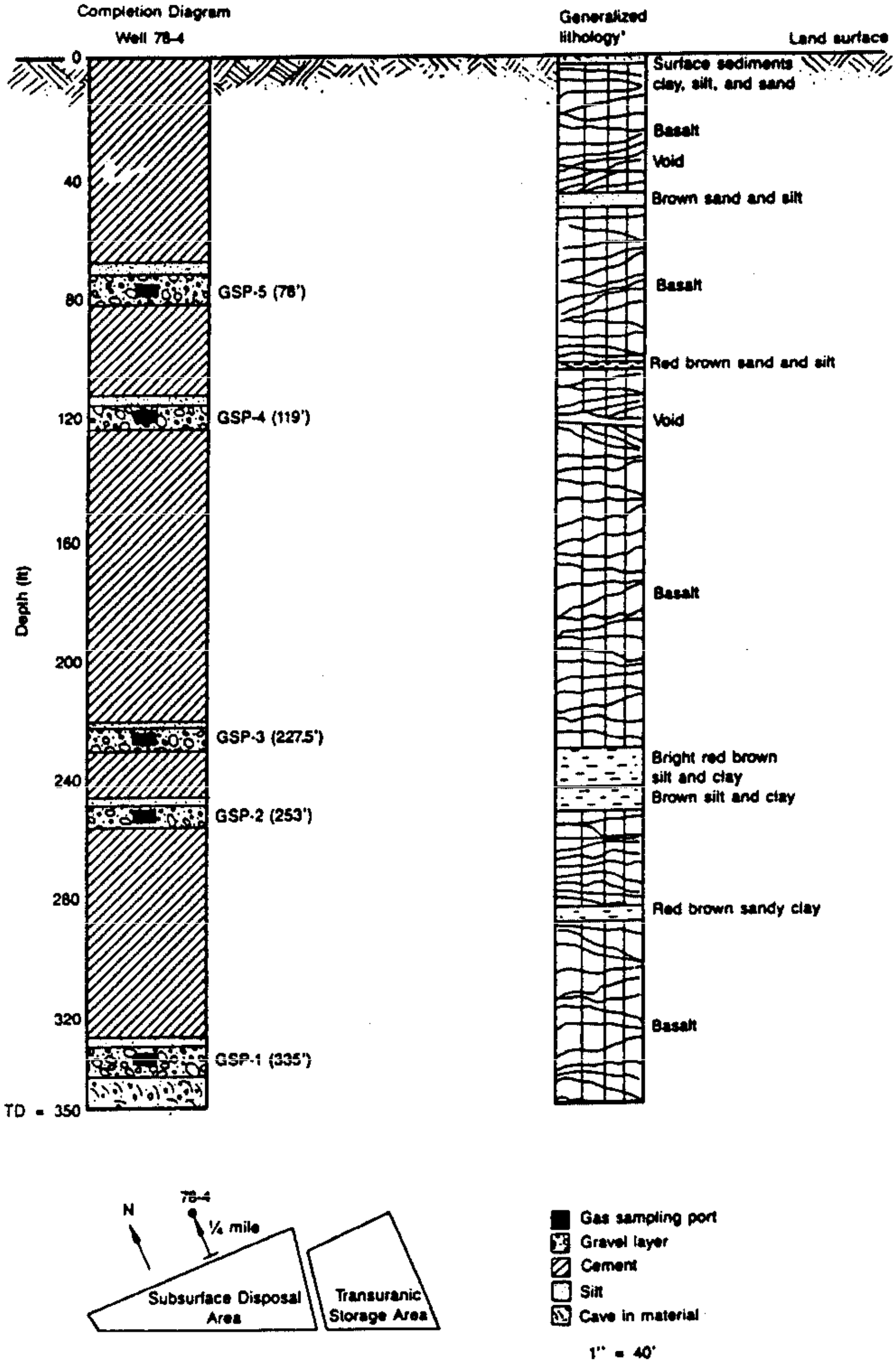



Figure 2-2. Borehole completion diagram for 8801D.




*Generalized lithology taken from well 77-1
approximately 25 ft. south.

Figure 2-3. Borehole completion diagram for 78-4.

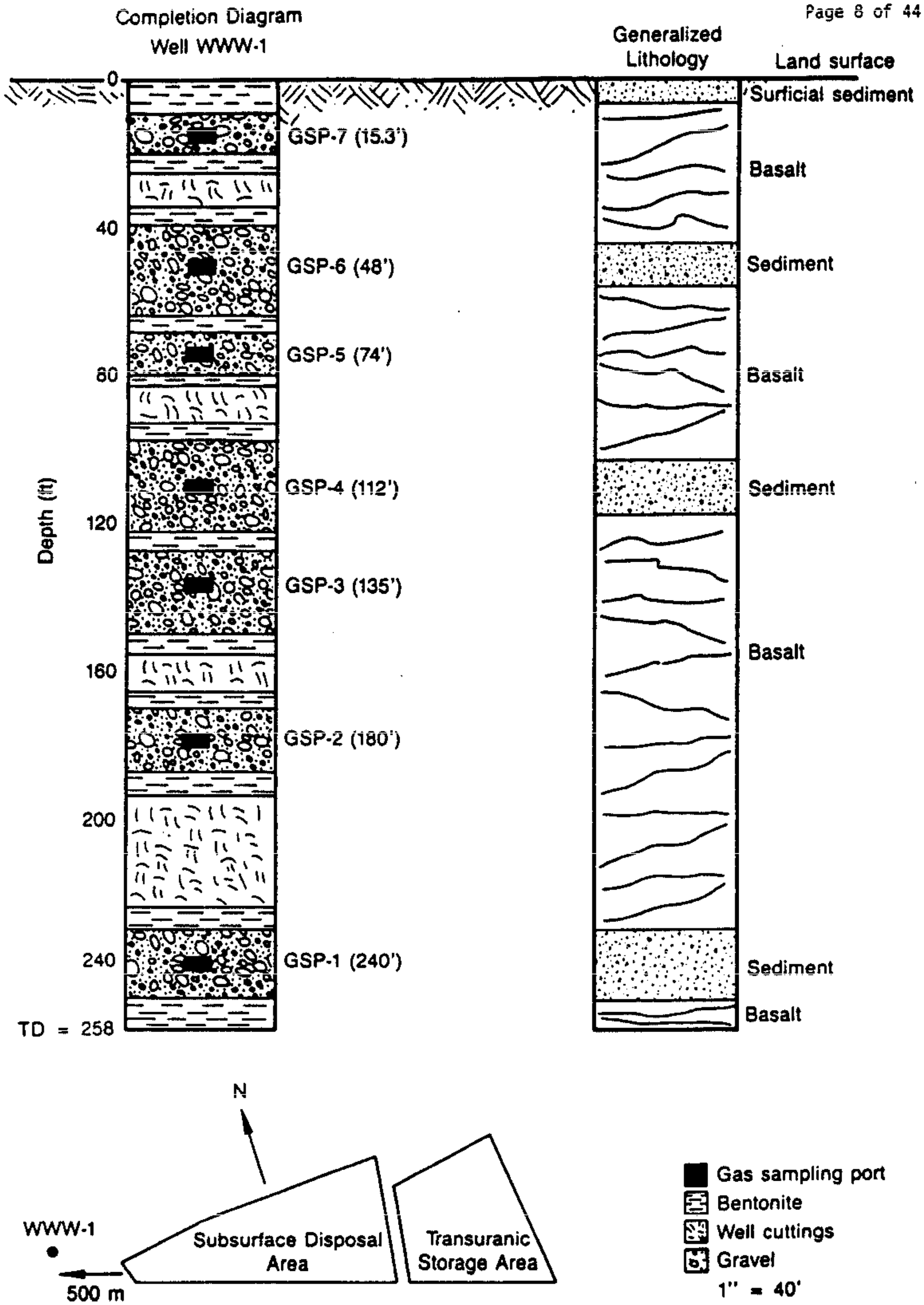



Figure 2-4 Borehole completion diagram for WWW-1.

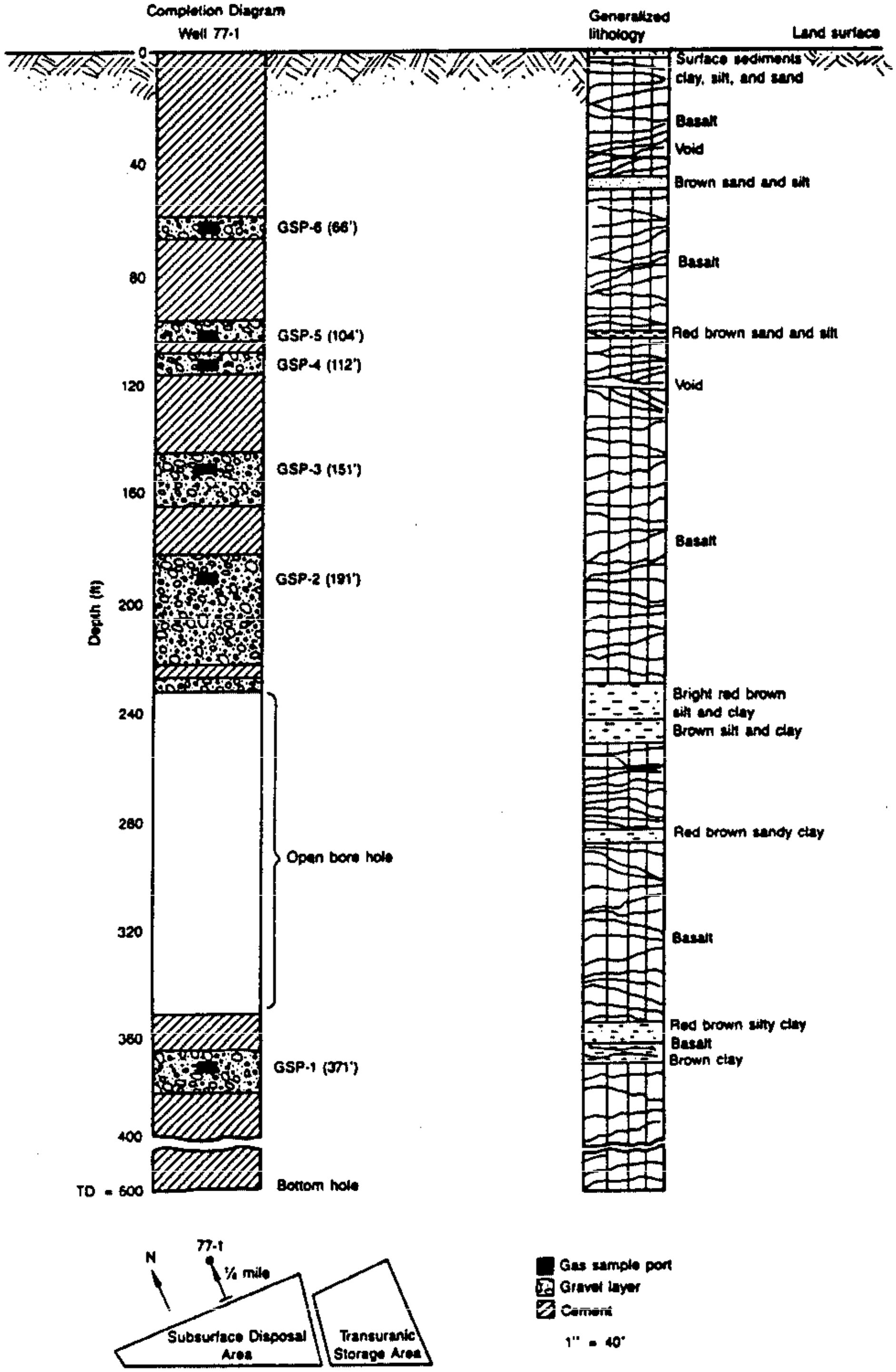



Figure 2-5 Borehole completion diagram for 77-1.

## 2.2 Objectives of the Sampling Effort

The primary objective of the gas sampling effort is to establish baseline data on organic contaminant concentrations to be used in estimation of fluctuation in contaminant concentrations in the soil gas. From these data, it may be possible to evaluate whether active leachate generation is occurring from the buried waste. The soil gas data will also provide an additional tool to investigate the potential for that leachate to invade the aquifer and significantly affect the groundwater quality.

The second objective is to continue a survey for analytical information on Tentatively Identified Compounds (TIC's) that may have to be included in future sampling and analysis efforts.

## 2.3 Data Quality Objectives

Comprehensive quality assurance objectives for the VVED Borehole Soil Gas Sampling project have been developed to provide guidelines for all field and laboratory operations. The goal is to produce data of known and sufficient quality to allow EG&G to estimate baseline concentrations of known contaminants, to assess the effectiveness of vapor vacuum extraction, and to supplement existing and future data to be used in making corrective action and remedial response alternative decisions. During the course of this investigation, all activities and analyses will be conducted using standard procedures so that known and acceptable levels of precision, accuracy, representativeness, comparability, and completeness are documented. The results produced using established methodologies and standard operating procedures will be reproducible and will be comparable to other data reported at similar levels of precision and accuracy.

### 2.3.1 Precision

Precision is a quantitative measure of the variance of a group of measurements from their average value, often stated in terms of standard deviation. Overall precision is a mixture of sampling and analytical factors or relative percent difference. Analytical precision, much easier to quantify, is commonly determined from laboratory replicates and is expressed as relative percent difference or relative standard deviation. Relative percent difference is calculated as follows:

$$\text{Precision} = \text{Relative Percent Differences} = \frac{C1 - C2}{(C1 + C2)/2} \times 100 \text{ percent}$$

where: C1 = Concentration of the analyte in the sample
C2 = Concentration of the analyte in the duplicate/replicate

Overall precision (field + laboratory) can be determined by collecting and analyzing collocated or field duplicate (triplicate, etc.) samples. Analytical precision can be determined by analyzing laboratory replicates of one or more field samples. Subtracting the analytical precision from the overall precision defines the sampling precision.

### 2.3.2 ACCURACY

Accuracy quantifies measurement system bias resulting from the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, or analysis techniques. Sampling accuracy can be maximized by adherence to a strict quality assurance program and by the use of field, trip, and equipment blanks. Analytical accuracy can be evaluated by the use of known and unknown QC samples and matrix spikes. Accuracy is expressed as percent difference from a known or accepted true value or as percent recovery. The equation used to calculate percent difference is presented below:

$$\text{Accuracy} = \text{Percent difference} = \frac{Akwn - Ao}{Akwn} \times 100 \text{ percent}$$

where: Akwn = Total amount in standard
Ao = Amount found in standard

The accuracy of simple, yet fundamental field analyses is difficult to assess quantitatively. Sampling accuracy can be maximized, however, by the adoption and adherence of a strict quality assurance program. Specifically, all procedures must be documented as standard protocol and all equipment and instrumentation must be calibrated properly and well maintained. Trip blanks, ambient condition blanks (field blanks) and blind standards will be included in all sample batches to ensure that all samples represent the particular site from which they were sampled and no cross-contamination has occurred. In addition to equipment operation and standard operating procedures, a high level of accuracy can be maintained by frequent review of field procedures. In this manner, deficiencies can be quickly documented and corrected.

### 2.3.3 REPRESENTATIVENESS

Representativeness is defined by the degree to which the data accurately and precisely represent a characteristic population, parametervariations at a sampling point, a process condition, or an environmental condition. It is addressed by describing sampling techniques and the rationale used to select sampling locations. Satisfying this criterion means ensuring that sampling locations are selected properly and that a sufficient number of samples are collected.

Boreholes used to monitor soil gas concentrations before, during, and after the VVED were selected prior to the initiation of this sampling event. Gas sample ports were placed (as conditions permitted) at interbeds and in adjacent fracture zones in the basalt. Several ports were placed adjacent to unfractured basalt.

### 2.3.4 COMPARABILITY

Comparability is defined by the confidence with which one data set can be compared to another. Field and laboratory procedures greatly affect comparability. To minimize this, only the specific methods and protocols that have been selected or specified will be used to collect and analyze soil gas samples. By using specific sampling and analysis procedures, and by including duplicate and triplicate collocated field samples to estimate precision and accuracy, resulting data will be comparable to soil gas data generated with similar precision and accuracy throughout the duration of the project.

### 2.3.5 COMPLETENESS

Completeness is expressed as the percentage of valid data obtained from a measurement system. For data to be considered valid, it must meet all the acceptance criteria including accuracy, precision, and any other criteria specified by the analytical method used.

Field sampling conditions are unpredictable and nonuniform. The objective of the field sampling program is to obtain samples for all analyses required at each individual site, provide enough quality sample material to complete those analyses, and to produce quality assurance samples that represent possible contamination situations.

The overall goal for completeness of the borehole soil gas sampling is 80 percent. The boreholes are listed in order of priority in table 2-1. Borehole 8801D is located within 25 meters of 8901D giving sampling activity at 8801D the highest priority. Sampling will be time critical and must be conducted within one week of the start of drilling for 8901D. The intent is to minimize potential effects drilling 8901D may have on gas concentrations in 8801D. Borehole 77-1 has the lowest priority and sampling of 77-1 may be eliminated if laboratory schedule or other confilcts place a limit on the total number of samples collected. If a sample cannot be collected (e.g. plugged or inoperable sample port or collection device) or if a sample is lost or destroyed, it must be documented and accounted for in the field or laboratory notebook as appropriate.

### 2.3.6 Quality Control Measurements and Requirements

Table 2.2 lists the Practical Quantitation Levels for target VOC compounds considered in this sampling and analysis effort. A ± 5% precision and accuracy estimate is the optimum for overall precision and accuracy of analytical work conducted under this plan. However, it is recognized that precision and accuracy estimates are concentration level and analyte dependent. Volatile Organic Compound determinations from waters by the Contract Laboratory Program (CLP) protocol have resulted in RSD precision estimates of ≤ 50% and Relative Percent Spike Recovery accuracy estimates of 60% to 170%. Results of VOC analyses must be interpreted in light of past CLP performance measures.

## 2.3 Data Usage

Data derived from samples collected under this plan will be used to estimate baseline organic concentrations in boreholes instrumented to monitor the effectiveness of the VVE demonstration. The data will also become part of a larger data set used by the Environmental Restoration Program to aid in making decisions regarding corrective actions and or choosing between remedial response alternatives. Persons using the data will be the Program Manager, Project Manager, the Principal Investigator, the Technical Leader, and the Analytical Quality Assurance Officer. Additional users of the data will be the Environmental Restoration Unit and the Environmental Safety and Quality managers.

Table 2-2 Quality Control Measurements and Requirements.

Method Sensitivities for Volatile Organic Compounds by Purge and Trap GC/MS Analysis

| Compound | Practical Quantitation Level for Air Samples ($mg/m^3$) 25 ml | 5 ml |
|---|---|---|
| Acetone | 2.0 | 10 |
| Benzene* | 1.0 | 5 |
| Bromodichloromethane | 1.0 | 5 |
| Bromoform | 1.0 | 5 |
| Bromomethane | 2.0 | 10 |
| 2-Butanone | 2.0 | 10 |
| Carbon disulfide | 1.0 | 5 |
| Carbon tetrachloride* | 1.0 | 5 |
| Chlorobenzene | 1.0 | 5 |
| Chloroethane | 2.0 | 10 |
| Chloroform* | 1.0 | 5 |
| Chloromethane | 2.0 | 10 |
| Dibromochloromethane | 1.0 | 5 |
| 1,1-Dichloroethane | 1.0 | 5 |
| 1,2-Dichloroethane | 1.0 | 5 |
| 1,1-Dichloroethene* | 1.0 | 5 |
| 1,2-Dichloroethene (total)* | 1.0 | 5 |
| 1,2-Dichloropropane* | 1.0 | 5 |
| cis-1,3-Dichloropropene | 1.0 | 5 |
| trans-1,3-Dichloropropene* | 1.0 | 5 |
| Ethylbenzene | 1.0 | 5 |
| 2-Hexanone | 2.0 | 10 |
| Methylene chloride* | 1.0 | 5 |
| 4-Methyl-2-pentanone | 2.0 | 10 |
| Styrene | 1.0 | 5 |
| 1,1,2,2-Tetrachloroethane | 1.0 | 5 |
| Tetrachloroethene* | 1.0 | 5 |
| Toluene* | 1.0 | 5 |
| 1,1,1-Trichloroethane* | 1.0 | 5 |
| 1,1,2-Trichloroethane* | 1.0 | 5 |
| Trichloroethene* | 1.0 | 5 |
| Vinyl acetate | 2.0 | 10 |
| Vinyl chloride | 2.0 | 10 |
| Xylenes (total) | 1.0 | 5 |

Practical quantitation level is the lowest concentration reliably measurable (i.e., 33% maximum uncertainty in precision and accuracy at the one standard deviation confidence level) for normal samples during routine laboratory operations.

# 3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Figure 3.1 shows the project organizational structure and key personnel for the baseline borehole soil gas investigation conducted in support of the VVED.

## 3.1 RESPONSIBILITIES

Program Manager - R. R. Piscitella is responsible for senior technical review of all project plans and deliverables.

Project Engineer - N. W. Spang will have the overall responsibility for ensuring that the sampling operation is conducted in accordance with the requirements of the SAP. In addition, he will keep the Program Manager appraised of the project status and any technical, administrative, contractual, and/or financial issues and their proposed resolution.

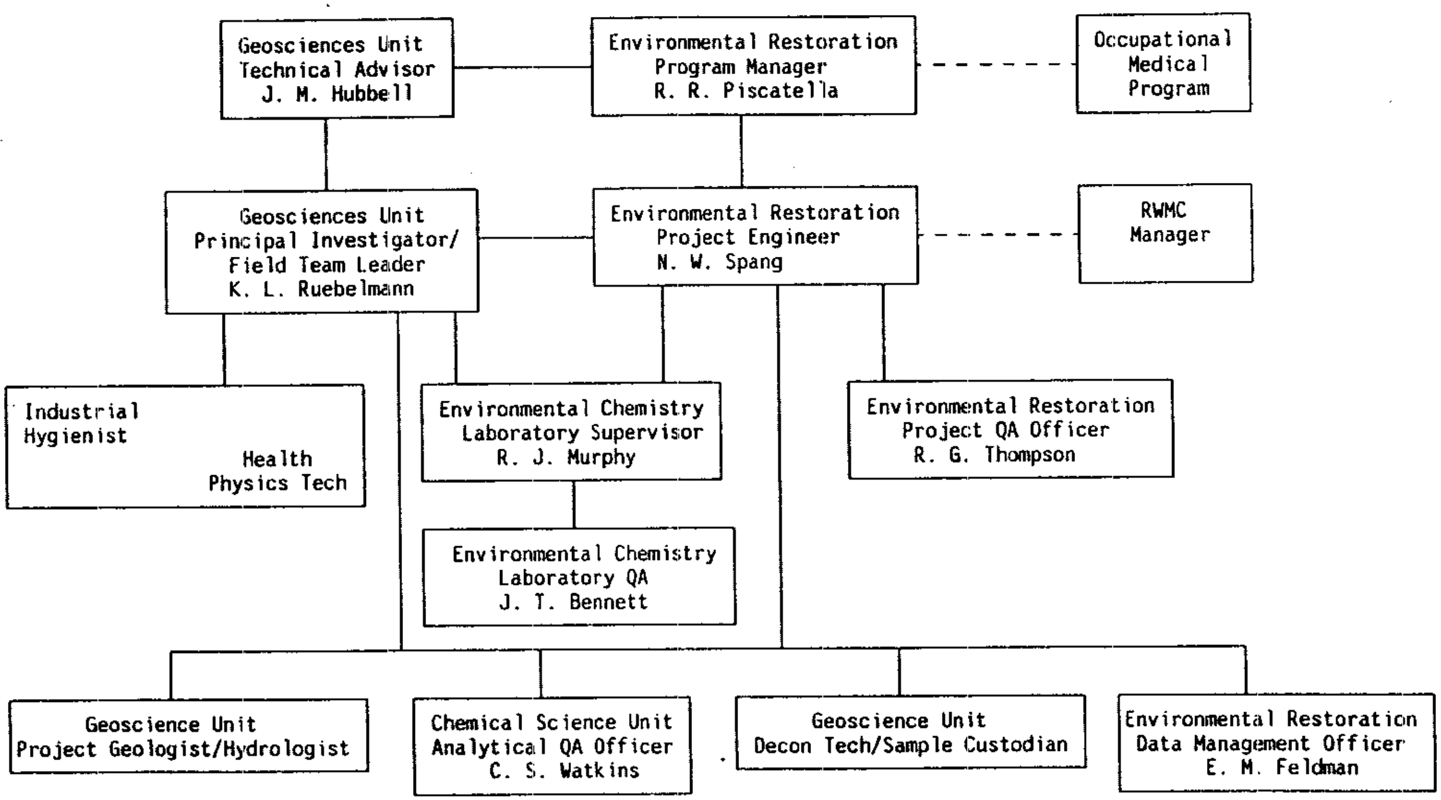
Technical Advisor - J. M. Hubbell is responsible for ensuring that the work is performed according to the standards outlined in the documentation. In addition, he is to provide technical/advisory support during the course of the project.

Principal Investigator-Field Team Leader - The Principle Investigator will be responsible for the coordination of all task efforts within his/her group, will assure the availability and maintenance of all testing and sampling equipment and materials, and provide for shipping and packing materials. He/she will supervise the completion of all field logs, chain-of-custody records, the proper handling and shipping of the samples collected, and be responsible for the accurate completion of field log books. These responsibilities may be relinquished to the Project Geologist/Hydrologist during absences of the Principal Investigator.

Industrial Hygienist - The Industrial Hygienist will be responsible for the adherence to all site safety requirements by the team members. The Industrial Hygienist will assist in conducting site briefing meetings and in performing the final safety check of the area prior to each sampling event. Although he retains principal responsibility for health and safety decisions, he may appoint an alternate if he deems it appropriate. Additional responsibilities are:

- Updating equipment or procedures based upon new information gathered during the site inspection.
- Upgrading the levels of protection based upon site observations.
- Enforcing the "buddy system" where appropriate.
- Determining and posting locations and routes to medical facilities, including poison control centers; arranging for emergency transportation to medical facilities.

Figure 3-1. Lines of Responsibility and Communication



- Examining workers for symptoms of exposure or thermal stress.
- Providing emergency medical care and first aid as necessary on-site. The Industrial Hygienist has the ultimate responsibility to stop any operation that threatens the health or safety of the team or surrounding populace.

Laboratory Supervisor - R. J. Murphy is responsible for ensuring that laboratory and equipment preparation, soil gas analyses, and data reporting are performed according to the SAP, to pertinent EPA methodologies, to and Environmental Chemistry Standard Operating Procedures. He must also ensure that deadlines for deliverables are met.

Laboratory Quality Assurance - J. T. Bennett is responsible for ensuring that laboratory and equipment preparation, soil gas analyses, and data reporting are performed according to the SAP, pertinent EPA methodologies, and to Environmental Chemistry Standard Operating Procedures.

Project Quality Assurance Officer - The Project Quality Assurance Officer (PQAO) will report to the Program Manager, and will have direct responsibility to implement and ensure compliance with the BWP Data Collection Quality Assurance Project Plan (EGG-WM-8220). To accomplish these objectives, the PQAO will have responsibility and authority to conduct quality assurance audits and implement corrective measures, as required, to comply with the Quality Assurance Plan.

Analytical Quality Assurance - C. S. Watkins is responsible for onsite audits of laboratory procedures and records, for reviewing analytical, field data, and compiling corrective action measures. The Analytical Quality Assurance function is separate from and does not report to the laboratory director responsible for analysis of the samples. J. W. Owens is responsible to provide blind samples with the proper levels of analyte to evaluate laboratory performance.

Document Control and Data Management - B. Chantrill (Administrative Document Control Coordinator) is responsible for maintaining project files separate from those kept by the PI or the Project Manager and for ensuring that the documentation is in sufficient and in correct form to withstand quality audits. E. M. Feldman (Data Management Officer) is responsible to maintain the data management system and supporting electronic database.

## 3.2 Training

EG&G Idaho, Inc. field and laboratory personnel must be trained in accordance with OSHA Interim Final Standard 20 CFR, Part 1910, issued 12/19/86, and must be experienced in hazardous waste site and/or laboratory work, use of personal protective equipment, and emergency response procedures.

# 4.0 SAMPLING AND ANALYSIS STRATEGY

## 4.1 Scope of Analysis

The borehole soil gas sampling activity conducted under the guidance of this plan will generate a maximum of 25 samples accompanied by 6 QC samples, and 12 duplicate or triplicate samples. The QC samples will consist of a trip blank, an equipment blank, a field ambient air blank, and a blind standard. One QC sample will be included in each days sampling activity. These samples will be analyzed by the purge and trap method with a GC/MS for the 34 volatile organic constituents listed in Table 2-1. Although there are no approved EPA methods for soil gas analysis, the Environmental Chemistry Laboratory will follow EPA methodology specified in USEPA SOW No. 10/86 (Contract Number WA-87J001, J002, J003) for low level volatiles in water.

## 4.2 Sample Numbers

Sample identification (ID) numbers will be assigned to each sample collected in the field as outlined in the DCQAP. The DCQAP specifically requires:

- A unique number must be established within the first 6 characters
- The sample number will be limited to 12 characters consisting of numeric characters 0-9 and the uppercase alphabetic characters A through Z
- The first character must define the task
- The 7th and 8th characters must define the calender year

Table 4-3 provides the definition of characters that will be used to generate Sample ID Numbers. Table 4-4 lists the sample numbers that will be used for soil gas and QC samples collected under this plan. Note that unforseen circumstances may preclude use of all the numbers in Table 4-4 and likewise may require additional numbers. In the event that additional sample numbers are required they will be generated following the guidelines given in Table 4-3

Table 4-1. Projected Sample Schedule.

| Sampling Events | Well Number | Port to be Sampled | QC Samples Collected |
|---|---|---|---|
| Day 1 | 8801D | 9, 8, 7, 6, 5, 5, 5 | 1 Blind Standard (Triplicate, port 5) |
| Day 2 | 8801D | 4, 3, 3, 3, 2, 1 | 1 Field Ambient Air Blank (Triplicate, port 3) |
| Day 3 | 78-4 | 5, 5, 4, 4, 3, 2 | 1 Equipment Blank (Duplicate, port 5 & 4) |
| Day 4 | WWW-1 | 7, 6, 6, 6, 5, 4, 4 | 1 Blind Standard (Triplicate, port 6) (Duplicate, port 4) |
| Day 5 | WWW-1 | 3, 3, 2, 1, 1 | 1 Field Ambient Air Blank (Duplicate, port 3 & 1) |
| Day 6 | 77-1 | 6, 5, 5, 4 3, 2 | 1 Trip Blank (Duplicate, port 5) |

Total Samples: 43 Total QC Samples: 6 Total Collocated Samples: 12
Immediately after collection samples are placed in a cooler with blue ice.
Samples are transported to the laboratory after each days sampling.
Holding time is 48 hours from the time of collection.

Table 4-2. Table of Calculated Volumes of the Gas Tubes and Estimated Pumping Times to Remove Three Tube Volumes

| GAS PORT # | VOLUME OF TUBE (L) | 3 VOLUME EVACUATION TIME (minutes) |
|---|---|---|
| 8801D-1 | 2.2 | 4.0 |
| 8801D-2 | 1.9 | 3.0 |
| 8801D-3 | 1.6 | 3.0 |
| 8801D-4 | 1.3 | 2.0 |
| 8801D-5 | 1.0 | 2.0 |
| 8801D-6* | 0.9 | 2.0 |
| 8801D-7 | 0.7 | 2.0 |
| 8801D-8 | 0.5 | 1.0 |
| 8801D-9* | 0.3 | 1.0 |
| 784-1 | 6.8 | --- |
| 784-2 | 5.2 | 8.0 |
| 784-3 | 4.6 | 7.0 |
| 784-4 | 2.4 | 4.0 |
| 784-5 | 1.6 | 3.0 |

*Port may be plugged.

Table 4-2. Table of Calculated Volumes of the Gas Tubes and Estimated Pumping Times to Remove Three Tube Volumes

| GAS PORT # | VOLUME OF TUBE (L) | 3 VOLUME EVACUATION TIME (minutes) |
|---|---|---|
| WWW1-1 | 3.7 | 4 |
| WWW1-2 | 2.8 | 3 |
| WWW1-3 | 2.1 | 2 |
| WWW1-4 | 1.7 | 2 |
| WWW1-5 | 1.1 | 2 |
| WWW1-6 | 0.7 | 1 |
| WWW1-7 | 0.2 | 0.5 |
| 771-1* | 7.6 | --- |
| 771-2 | 3.9 | 6.0 |
| 771-3 | 3.1 | 5.0 |
| 771-4 | 2.3 | 4.0 |
| 771-5 | 2.1 | 4.0 |
| 771-6 | 1.4 | 3.0 |

* Port may be plugged

Note: $Pi \times r^2 \times H = Volume$

$$\frac{\text{Volume}(cm^3)}{ft} = Pi \times \left(\frac{\text{I.D. of tubing cm}}{2}\right)^2 \times \text{Depth (ft)} \times \frac{30.48\ cm}{1\ ft}$$

Total Volume ($cm^3$) = volume/ft x length of tubing (ft)

Table 4-3 Soil Gas Sample Numbering System.

| Characters | Definition | Code |
|---|---|---|
| 1 | BWP Task | E |
| 2, 3 & 4 | Borehole ID | 801 = Well 8801D<br>784 = Well 78-4<br>WW1 = Well WWW-1<br>771 = Well 77-1 |
| 5 | Gas Port Number | 1 - 9<br>0 = QC sample |
| 6 | Sample Type | 2-9 = Sequential Collocated Sample Number<br>E = Equipment Blank<br>S = Standard<br>T = Trip Blank<br>X = Other |
| 7 & 8 | Calendar year | 89 |
| 9 & 10 | Monitoring Event | 01-99 = Sequential by event |

Table 4-4 Sample Number Assignment

| Sample Event | Gas Port to Sample | ID Number | Purge Time (Minutes) |
|---|---|---|---|
| Day 1 | GSP-8801D-9 | E8019X8901 | 1 |
| | GSP-8801D-8 | E8018X8901 | 1 |
| | GSP-8801D-7 | E8017X8901 | 2 |
| | GSP-8801D-6 | E8016X8901 | 2 |
| | GSP-8801D-5 | E8015X8901 | 2 |
| | GSP-8801D-5 | E801528901 | * |
| | GSP-8801D-5 | E801538901 | * |
| | QC Standard | E8010S8901 | * |
| Day 2 | GSP-8801D-4 | E8014X8901 | 2 |
| | GSP-8801D-3 | E8013X8901 | 3 |
| | GSP-8801D-3 | E801328901 | * |
| | GSP-8801D-3 | E801338901 | * |
| | GSP-8801D-2 | E8012X8901 | 3 |
| | GSP-8801D-1 | E8011X8901 | 4 |
| | QC Field Ambient Air | E8010X8901 | * |
| Day 3 | GSP-784-5 | E7845X8901 | 3 |
| | GSP-784-5 | E784528901 | * |
| | GSP-784-4 | E7844X8901 | 4 |
| | GSP-784-4 | E784428901 | * |
| | GSP-784-3 | E7843X8901 | 7 |
| | GSP-784-2 | E7842X8901 | 8 |
| | QC Equipment Blank | E7840E8901 | * |

* Duplicate and Triplicates collected after port has been purged.

Table 4-4 (Cont.) Sample Number Assignment

| Sample Event | Gas Port to Sample | ID Number | Purge Time (Minutes) |
|---|---|---|---|
| Day 4 | GSP-WWW1-7 | EWW17X8901 | 0.5 |
| | GSP-WWW1-6 | EWW16X8901 | 1 |
| | GSP-WWW1-6 | EWW1628901 | * |
| | GSP-WWW1-6 | EWW1638901 | * |
| | GSP-WWW1-5 | EWW15X8901 | 2 |
| | GSP-WWW1-4 | EWW14X8901 | 2 |
| | GSP-WWW1-4 | EWW1428901 | * |
| | QC Standard | EWW10S8901 | * |
| Day 5 | GSP-WWW1-3 | EWW13X8901 | 2 |
| | GSP-WWW1-3 | EWW1328901 | * |
| | GSP-WWW1-2 | EWW12X8901 | 3 |
| | GSP-WWW1-1 | EWW11X8901 | 4 |
| | GSP-WWW1-1 | EWW1128901 | * |
| | QC Field Ambient Air | EWW10X8901 | * |
| Day 6 | GSP-771-6 | E7716X8901 | 3 |
| | GSP-771-5 | E7715X8901 | 4 |
| | GSP-771-5 | E771528901 | * |
| | GSP-771-4 | E7714X8901 | 4 |
| | GSP-771-3 | E7713X8901 | 5 |
| | GSP-771-2 | E7712X8901 | 6 |
| | QC Trip Blank | E7710T8901 | * |

* Duplicate and Triplicates collected after port has been purged.

# 5.0 SAMPLE COLLECTION PROCEDURES

Access tubes are permanently installed in each of the boreholes to be sampled. Samples will be collected from borehole gas ports identified in Table 2-1. Each gas port will be purged with three volumes of gas by attaching the sampling pump and running for the purge time specified in table 4-2. The upper ends of the tubes project above ground level approximately 1-2 feet and are enclosed and protected from the weather and tampering by surface casing with locking covers. The upper end of the tubes is attached to either a male, self-sealing Swagelock valve or barbed fittings with a cap or valve (See Section 2.1). Prior to beginning sampling, don all personal safety equipment and monitoring equipment (see Section 12). Take barometric and temperature readings and record in the field log book.

## 5.1 Standard Operating Procedures for Sample Collection

For specific procedures, refer to Geoscience Unit SOP #G-310 and to Figure 5.1 and Table 4.2 for additional information on the setup of the sampling train and the tube evacuation times.

## 5.2 Procedures for Collection of Duplicates and Blanks

It is anticipated that the 43 samples will be collected over a period of 2 to 3 weeks. The number of samples and the frequency of sampling is limited by laboratory throughput to a maximum of eight samples submitted every other day. Each one day sampling event will be coordinated with the Enivronmental Chemistry Laboratory and will include one QC sample and a minimum of one duplicate or triplicate collocated gas port sample. The ratio of QC samples to normal samples averages approximately 15%.

The field blank will consist of ambient air drawn into the syringe in the vicinity of the sampling area. The equipment blank will be drawn from the sampling train while the pump is pulling ambient air through the system. Duplicates (or triplicates) will be collected from a selected gas port immediately after collection of a normal sample. Standard samples will be prepared prior to the sampling event by another EG&G laboratory not responsible for the analyses. The trip blank will be collected in the laboratory from a gas-sampling bulb filled with an inert, pure gas such as nitrogen, and will be transported to and from the field sampling location. Blanks collected in the field will be transported to the analytical laboratory with the other samples.

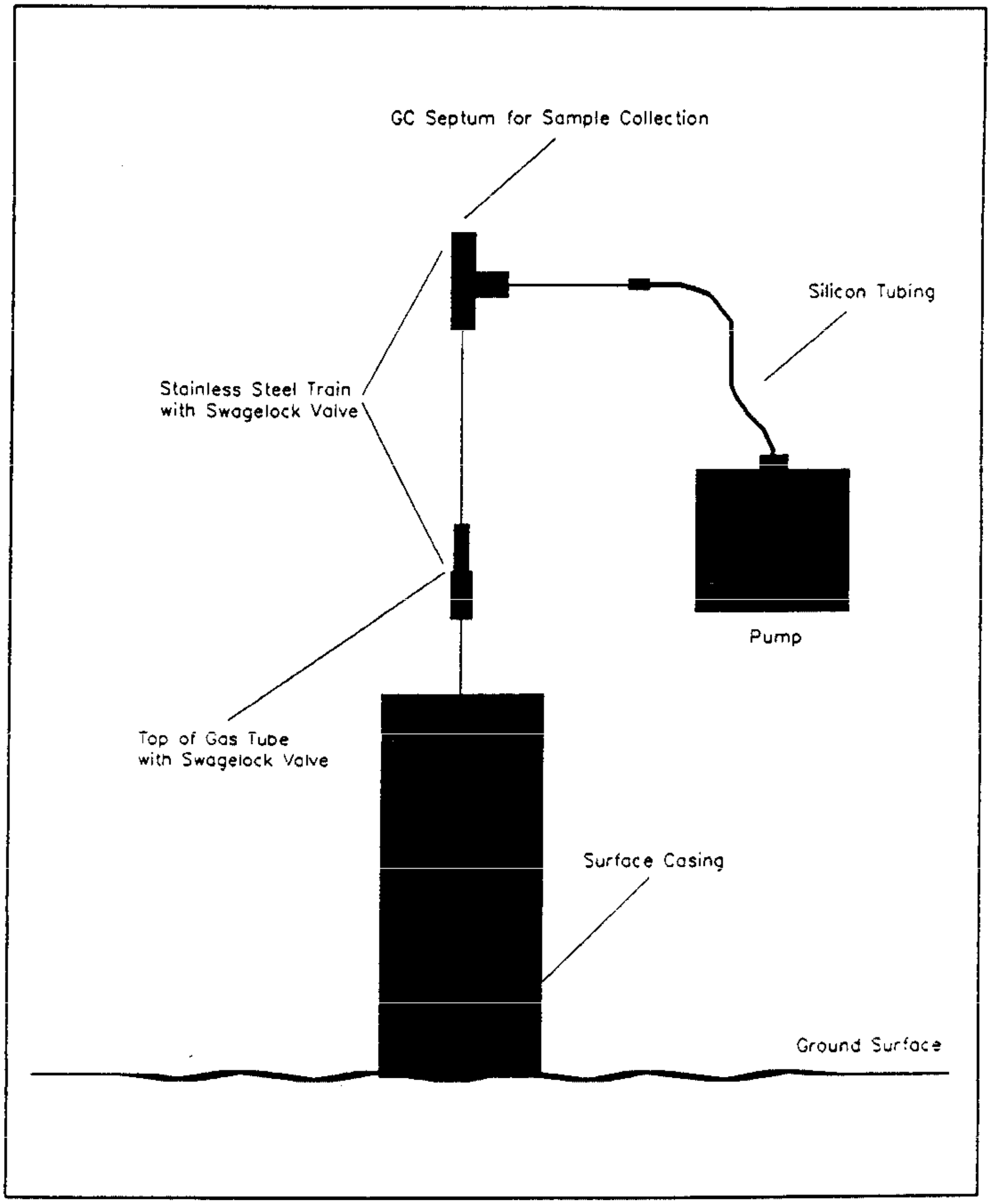
## 5.3 Equipment Decontamination

The components of the sampling train are decontaminated prior to each sampling day. All parts are washed with distilled water and MicroKleen, or other laboratory-grade, nonphosphate detergent, rinsed with distilled water, then rinsed with Optima-grade methanol. The stainless steel components are placed in an oven and baked overnight at 100°C. Other components (i.e., the silicon tubing) are air-dried and stored in a sealed plastic bag for transportation to the field. The metal parts are transported to the field in a decontaminated metal container.

A new GC septum is installed in the sampling train at the beginning of each day and/or when visual inspection indicates deterioration from use.

Between samples, the pump is run for approximately 5 minutes drawing ambient air through the sampling train. The train is not decontaminated between samples within 1 day's sampling event.

The syringes and needles, stored in the Environmental Chemistry laboratory, are decontaminated by rinsing with distilled water, Optima-grade methanol, air dried, and baked in a 100°C oven overnight. They are transported to the field wrapped in bubble wrap and placed in a cooler with blue ice. Their inlet valves should be closed and, to ensure that they have not been tampered with since their cleaning, they must be immediately placed in a storage container and a custody seal placed over the openings of that container.




NOTE: The stainless steel gas train may be replaced with silicone tubing (or equivalent) for gas ports which do not have swagelock fittings.

Figure 5-1. Diagram of sampling train.

# 6.0 SAMPLE CUSTODY PROCEDURES

Sample custody procedures include inventorying and documentation during sample collection, shipment, and laboratory processing. A sample is considered to be in one's possession if the sample is:

- in the physical possession or view of the responsible party or
- secured to prevent tampering, or
- placed in a restricted area by the responsible party.

The Principal Investigator is responsible for the custody of the samples collected by her/him until they have been properly and directly transferred to the laboratory. The transfer of samples from the field to the laboratory and through the testing process is documented using chain-of-custody procedures.

## 6.1 Chain-of-Custody Record

The chain-of-custody (COC) record will represent the official documentation for all transference of the sample custody from the time samples have been collected until they have been analyzed by the laboratory. Chain-of-custody forms will be used to document the integrity of all samples. To maintain a record of sample collection, transfer between personnel, and receipt by the laboratory, a chain-of-custody form will be filled out for each sample set. All samples will be accompanied by an approved COC record. When the possession of the samples is transferred, the individual relinquishing the samples will sign and write in the date and time of transfer on the COC document and the individual receiving the samples will do the same. This individual will inspect the form for completeness and accuracy. Any changes made to the form will be initialled by the person making the change. The COC form will contain the following information:

- sample number (for each sample in shipment);
- collection date (for each sample in shipment);
- sample description (matrix);
- analyses required for each sample; and
- signatures of custody, if transferred from one individual to another

### 6.1.1 Field Chain-of-Custody

The chain-of-custody in the field is first established by the unique identification of samples using the sample numbering system developed in section 4, by sample labels affixed to each sample, and by recording sample disposition data on the COC form. Sections 6.2 and 6.3 detail the procedures used to ensure a unique sample identifier for entry on the field COC form.

### 6.1.2 Laboratory Custody

Refer to Environmental Chemistry SOP #201 for Sample Receiving and #205 for Laboratory Chain-of-Custody.

## 6.2 Serialized Field Sample Log

The Field Sample Log will be used for each sampling event to track the collection and shipment of each sample. The log will identify the sampling location, field sample number, depth, type, time of sampling, chemical analysis requirements, containers collected, sample collector initials, shipping method, date shipped, temperature, barometric pressure, personnel in attendance, and sample shipper initials.

## 6.3 Sample Labels

A sample tag will be attached to all sample containers at the time of collection. The label will be completed with indelible ink and will contain the following minimum information:

- date and time collected;
- installation name;
- sample number;
- field instrument readings (radiological or hazard concentration)
- sampler's name and initials.

## 6.4 Transfer of Custody and Sample Shipment

Sampling syringes will be wrapped with plastic packing material and packed with reusable ice packs into sturdy, thermally-insulated coolers. The cooler lid will be sealed with a custody seal and the cooler carried directly to the laboratory on the same day of sampling.

# 7.0 EQUIPMENT

Measuring and test equipment shall be controlled by a calibration program in accordance with the BWP Quality Program Plan-149 Manual. Where applicable the guidance of EPA SW-846, third edition, shall be followed in determining analytical instrument calibration frequency and concentrations based on the methodology employed for sampling. Calibration of measuring and test equipment may be performed internally using standards traceable to the National Bureau of Standards, where applicable, or externally by the equipment manufacturer or approved calibration facility. If no nationally-recognized standard exists for the equipment to be calibrated, the basis for calibration shall be documented.

## 7.1 Sampling Equipment

Sampling device: MSR 482700 Flow Lite H personal sampling pump
silicon tubing
male Swagelock valve connected to a length of 3/16-inch stainless steel tube with a Swagelock t-joint
teflon coated septa

Sample container: 25 or 5 ml Hamilton Series 1000 Gastight Syringe with teflon Luer Lock miniature inlet valve
2-inch needles, standard 22* point, metal hub

Miscellaneous: Sample labels and/or tags
Chain-of-Custody forms and seals
Teriwipes
Field notebook
Cooler and blue ice
Field barometer
Field thermometer

## 7.2 Calibration Procedures

Documented and approved procedures shall be used to calibrate all measuring and test equipment. Whenever possible, widely-accepted procedures such as those published in EPA SW-846, third edition, or procedures provided by the equipment manufacturer shall be used.

As a minimum, calibration procedures shall include:

a. type of equipment
b. calibration method and sequential actions
c. calibration data recording form and format
d. a list of critical or replacement parts

Each piece of equipment shall be identified so that the pertinent calibration information can be retrieved. The equipment shall have an individual calibration log and be calibrated/standardized prior to use or as part of the operational use following the manufacturer's recommended calibration/standardization procedure(s).

Measuring and test equipment shall be calibrated at prescribed intervals and/or prior to use. Frequency shall be based on the type of equipment, inherent stability, manufacturer's recommendations, intended use, and experience.

Geosciences Unit SOP #G-311 details calibration procedures for the personal sampling pump.

### 7.2.1 Calibration Responsibilities

Responsibility for calibration of analytical equipment rests with the Environmental Chemistry Laboratory Manager.

Industrial hygiene and radiological monitoring equipment calibration responsibility rests with IH and H&S personnel respectively.

The PI/Field Team Leader is responsible for ensuring that equipment used by the sampling crew in the field is calibrated.

It is the responsibility of the personnel using the equipment to check the calibration status in the calibration log. This must be done prior to use to ensure that the equipment is operational.

### 7.2.2 Calibration Records

Records shall be prepared and maintained for each piece of calibrated field equipment to indicate that established calibration procedures have been followed.

Calibration records for the equipment controlled by the various laboratories, offices, and groups shall be maintained by the respective organization.

### 7.2.3 Calibration Failure

Equipment that fails calibration or becomes inoperable during use shall be removed from service and segregated to prevent inadvertent use, or shall be tagged to indicate it is out of calibration. Such equipment shall be repaired and/or recalibrated prior to further use.

Results of activities performed using equipment that requires adjustment during recalibration shall be evaluated by the Analytical QA Officer or the Laboratory Manager. The results of the evaluation shall be documented and retained in the Project Files.

## 7.3 PREVENTIVE MAINTENANCE

Laboratory equipment requiring routine maintenance will have an individual instrument file indicating the frequency of required maintenance, maintenance history, spare parts maintained by the laboratory, directions for maintenance, and any external service contracts.

The following preventive maintenance items will be accomplished before sampling begins:

a. Monitoring equipment calibration and operability will be checked.
b. All sample containers will be prepared in advance.
c. Spare monitoring equipment will also be provided to minimize downtime due to equipment failure.
d. Analytical laboratory preventive maintenance will be the responsibility of the Laboratory Manager. As a minimum, the laboratory will be required to have:

    1. Service contracts on all major instruments.
    2. Spare parts, as recommended by the instrument manufacturer.
    3. The items delineated in the Laboratories' written QA/QC plans.

# 8.0 ANALYTICAL PROCEDURES

The scope of this plan is to analyze the collected samples for the presence of volatile organic constituents according to USEPA SOW No. 10/86 (Contract Number WA-87J001, J002, J003) for low level volatiles in water. There are no EPA approved or recommended methods for soil gas analysis; consequently, this study represents an initial survey and evaluation of the practices described within this document. These practices will be undergoing a method performance evaluation during FY-1989 by the Environmental Chemistry organization.

The following Environmental Chemistry SOPS detail the analytical procedures to be used:

#402 Organic Standards Preparation

#408 Volatile Organic Analysis

#410 VOA BFB Tuning (CLP Protocol)

#412 VOA Continuing Calibration (CLP Protocol)

#414 VOA Sample Setup and Data Acquisition for Water and Soil Gas Samples

# 9.0 DATA REDUCTION, VALIDATION, AND REPORTING

Initial data reduction and data quality review will be performed by the EG&G Idaho Environmental Chemistry Laboratory. Review and signature by the laboratory QA coordinator is required. Pertinent SOPs from the Environmental Chemistry Unit are found in the Appendix:

- #909 Internal Data Reporting
- #912 Review and Approval
- #913 External Release of Data

Data will be reported in the form of a Report of Analysis (ROA), which includes method blank information, analytical results, Practical Quantitation Levels (PQLs) and Tentatively Identified Compounds (TIC). Raw data, initial and continuing calibration data, and initial GC/MS tune information will be supplied to the Geosciences Unit, but not reported in the ROA. Calibration data is reported on the 1/87 Rev. Form VI and VII. Tune information is reported on CLP Form V.

Initial assessment of data validation will be completed by the Laboratory QA Coordinator. The Analytical QA Officer will confirm the data assessment and the Data Integrity Review Committee will provide final data validation.

Analytical data produced for the requested analyses should be reported to Bonnie Chantrill, the Buried Waste Program Administrative Records and Document Control (ARDC) Coordinator. The ARDC Coordinator will forward a copy to E. M. Feldman (BWP), Kerry Ruebelmann (Geosciences), and others as appropriate. Analytical results should be reported or retained as indicated:

| Data Type | Report to BWP ARDC | Retain by Environmental Chemistry |
|---|---|---|
| Sample results | X | X |
| QC measurement results | X | X |
| Raw analytical data | X | X |

# 10.0 QUALITY CONTROL CHECKS AND FREQUENCY

Equipment blanks, field ambient air blanks, standard samples, and trip blanks will be used during the soil gas sampling to provide internal quality control checks. These checks will be performed once with each days sampling event. In addition, laboratory quality control and field measurement controls identified below shall be used.

## 10.1 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

It is the responsibility of the Laboratory QA Officer to ensure that the laboratory is exercising a proper QA/QC program. Data qualification shall be performed by EG&G Environmental Chemistry following the completion of the analyses.

It will be the responsibility of the Analytical QA Officer to provide a continuing record of the Laboratory performance. This will include control charts of all QA samples.

## 10.2 FIELD QUALITY ASSURANCE/QUALITY CONTROL

Any field measurements required will be made using existing equipment and Standard Operating Procedures for calibration. Verification information will be recorded in the field logbook and reviewed by the Field Quality Assurance Officer. Field activity quality control audits will be conducted to verify compliance with this Sampling and Analysis Plan. The audit will be scheduled to take place on one of the six sampling days. The Program Manager will be notified by letter of the scheduled audit date.

## 10.3 AUDIT PROCEDURES

Audits will include, as a minimum, the following areas:

a. Field operation records
b. Laboratory testing and records
c. Equipment calibration and records
d. Identification and control of samples
e. Numerical analyses
f. Computer program documentation and verification
g. Transmittal of information
h. Record control and retention

Audits for the RWMC soil gas sampling project will be performed by the Field QA Officer and the Analytical QA Officer. All audits shall be formally documented and records retained by the Project Manager and the Principal Investigator.

Checklists shall be prepared by the auditors and used to conduct the audits. During the audits and upon completion, the auditors will discuss the findings with the individuals audited and cite corrective actions to be initiated. Minor administrative findings which can be resolved to the satisfaction of the auditors during the audit need not be documented. Findings that are not resolved during the course of the audit and findings affecting the overall project quality, regardless of when they are resolved, shall be noted on the audit checklist.

### 10.3.1 Field Operations

The record of field operations shall be reviewed to verify that field-related activities were performed in accordance with the appropriate project Standard Operating Procedures. Items reviewed shall include:

a. The calibration records for field equipment,
b. Daily field activity logs,
c. Photographs,
d. Data logs, and
e. Check prints resulting from the field operations.

### 10.3.2 Laboratory Testing Audits

The Analytical QA Officer will ensure that the analytical laboratory is exercising a proper QA/QC program. Validation of all analytical results will be assessed annually by the Analytical QA Officer.

Environmental Restoration has not conducted an audit of the laboratory quality program. Although it is not a requirement for non-CLP Level III data, an audit conducted by the DOE Environmental Survey prior to an extensive soil gas sampling effort at the INEL will be referred to for audit performance.

### 10.3.3 Inspection and Audit Reports

Inspection and audit reports for any quality-associated audits performed are required to be retained in the Project Files. A summary of nonconformance/corrective action forms will be used to document the occurrence of significant problems and solutions and variances.

### 10.3.4 QA Inspection Report

A report shall be submitted to the Project Manager detailing QA inspections performed. This report will be prepared by the QA personnel and shall be maintained in the Project Files. The report shall contain the following:

a. Location of work
b. Work performed
c. Specific inspections performed and results,
d. Problems identified, and
e. Corrective actions or recommendations.

### 10.3.5 Audit Reports to Management

Following audit completion, the auditor(s) shall prepare and submit an audit report to the Program Manager. This report shall be published within ten (10) working days of the audit and will serve to formally notify the project of audit results.

The audit report shall contain, as appropriate:

a. Audit dates,
b. Identification of auditor(s),
c. Identification of activities audited,
d. Audit results,
e. Description of items requiring corrective action,
f. Due date for audit response, and
g. A statement requesting written response to the audit.

### 10.3.6 Corrective Actions

If corrective action is required, the Program Manager will respond to the audit within ten (10) working days after receiving the audit report. The response shall include corrective actions taken or proposed, and the completion dates for the corrective actions. If activities discovered during the audit process would significantly jeopardize the safety of personnel or quality of the data, the QA Officers and/or the Industrial Hygienist must stop the work until corrective action is taken. The QA Officers must approve all corrective actions.

Completions of the corrective action(s) shall be documented by the Program Manager. The auditor(s) shall follow up after the completion of the corrective action(s) to verify implementation. This followup shall be documented and when all corrective actions have been completed, an audit closure shall be issued by the auditor(s) to the Program Manager.

## 10.4 QA Reports to Management

Quality Assurance data associated with this project will be summarized quarterly. The project data QA summary will also be sent to the Analytical QA Officer and will become part of the project records.

The Principal Investigator will prepare a written report on the analytical data for the Project and Program Managers. The report will review the validity, quality, and completeness of the data and, if necessary, make recommendations for corrective action, further sampling, or additional analytical data.

All quality assurance procedures and results associated with this project will be available for review by the Program Manager. The final project report will state the planned Quality Objectives attained, those attained by adjustment of the plan with explanation of the adjustment, and any objective that had to be eliminated with explanation of the reason for elimination. This final report will become part of the permanent project file.

# 11.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

## 11.1 PRECISION AND ACCURACY

Field precision and accuracy will be assessed by field audits conducted to ensure the use of uniform sample collection, handling, and shipping procedures, and by the evaluation of field blanks. Overall precision will be estimated from analysis of collocated duplicates and triplicates. Analytical accuracy will be assessed by examining the analyses of QC standard samples run in parallel with the unknowns. Additional accuracy estimates may be obtained from standard samples submitted blind to the laboratory. Analytical precision will be evaluated by the analysis of replicate alliquots (sample size permitting). Precision and accuracy estimates will be performed by the Laboratory QA Coordinator and reported with the final results.

## 11.2 COMPLETENESS

Completeness will be determined by the Analytical QA Officer by reviewing the data received from the laboratory and comparing it to the requested results. A completeness less than 80% will be cause for the Analytical QA Officer to notify the Principal Investigator. The Principal Investigator, in turn, will request corrective action as described in Section 10.3.6.

# 12.0 SAFETY AND TRAINING

All field workers, including samplers and operators, for the VVED project will be trained in accordance with Occupational Safety and Health Administration (OSHA) regulations for workers at hazardous waste sites. All activities will be conducted in accordance with a Health and Safety (H&S) plan. All field workers will have reviewed the H&S plan before beginning work.

All instrument operators and field technicians will have documented training in the use of appropriate field instruments before beginning work for the VVED.

It is the responsibility of the VVED Manager, with assistance from the IH and H&S officers, to ensure that field personnel are adequately protected from the chemical and radiological hazards at the SDA. It is each field worker's responsibility to implement appropriate safety and health measures. A buddy system will be used at all times. When samples are collected, an IH or HP will be present to assess and monitor the hazards at the site.

## 12.1 PRECAUTIONS AND SAFETY FOR SAMPLERS

The Buried Waste Program Health and Safety Plan is the parent document governing precautions and safety measures required to safely conduct activities described in this SAP. Section 12.2 specifies additional guidelines to be followed during the gas sampling operation. All procedures are based on OSHA-recommended guidelines for work conducted at hazardous waste sites.

## 12.2 SAFETY PROCEDURES

Health and safety issues for this task are governed by the guidelines in the BWP Health and Safety Plan (EGG-WM-8504). Site-specific recommendations have been issued by the Industrial Hygienist at the RWMC. All requirements are in accordance with OSHA guidelines. The sampler/field team leader must complete a Safe Work Permit prior to each sampling event and the Industrial Hygienist, or a qualified designee, must conduct an initial survey of the site prior to sampling to determine if contaminants exist in the ambient air conditions. Due to the types of previously detected contaminants and their levels, the IH requires the following personal protective equipment and environmental monitoring devices to be used during each sampling event:

- Coveralls

- Safety glasses
- Half-face respirator with GMA cartridges
- HNu photoionization detector or a Photovac TIP II

The organic vapor monitoring badge is to be worn by the sampler from the initiation of sampling and until after the last sample has been taken. It should be turned in to the IH at the end of each sampling day and he will ensure that it is sent for analysis in a timely manner. The photoionization detector will be used to monitor the effluent coming from the exhaust port on the personal sampling pump. If the HNu indicates more than 5 ppm, sampling will be halted until the IH can evaluate the situation and make recommendations for safer operations. The sampler will wear the half-face respirator and appropriate cartridges during evacuation of the gas port and during collection of the sample. All efforts should be made to stand in an upwind position relative to the borehole during sampling.

# 13.0 DATA MANAGEMENT

All completed sampling logbooks, field logbooks, and calibration logbooks, related to the sampling effort, will be sent to the ARDC for inclusion in the project files.

After samples collected have been analyzed in the laboratory or after in-situ diagnostic instrumentation data have been collected by a local acquisition system, the data will be processed using routines which compact and transform them into more intelligible forms. These evaluations may require software on local work stations so that the data may be transformed, manipulated, and displayed in a variety of ways. Copies of all raw data and any subsequent analyses on the data will be sent to the ARDC for inclusion in the project file.

The data will undergo review by responsible engineers, who will evaluate the data with respect to subtask goals, assign uncertainties according to estimated methodologies, and submit the data, with supporting documentation, to a formal group of peers for qualification certification and to determine whether or not the data attained its pre-established data quality objectives. These evaluations may require software on local work stations so that engineers can transform, manipulate, and display data in a variety of ways.

# 14.0 REFERENCES

EGG-WM-8219, RCRA Facility Investigation Work Plan Vol. II, Summary of Field Analytical Services Provided to EG&G Idaho, Golder Associates, Contract No. C87-131432, December 1987.

EGG-WM-8381, Sampling and Analysis Plan for the Radioactive Waste Management Complex Subsurface Disposal Area RCRA Facility Investigation/Corrective Measures Study Task: Vapor Vacuum Extraction Demonstration, May 1989, EG&G Idaho, Inc.

EGG-WM-8504, Health and Safety Plan for OPerations Performed for the Buried Waste Program, Environmental Restoration Program, April 1989.

USEPA 540/G-87/003, Data Quality Objectives for Remedial Response Activities, March 1987

USEPA 600/4-83-004, Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, February 1983.

USEPA, Contract Laboratory Program SOW No. 10/86, Statement of Work for Organics Analysis Multi-Media Multi-Concentration, October, 1986.

USEPA SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Characteristics, Third Edition, March, 1987.

29 CFR 1910.120, Code of Federal Regulations, Part 29, Section 1910.120, Occupational Safety and Hazards, May 27, 1989.

# 15.0 APPENDIX

The appendix to Sampling and Analysis Plan for Background Soil Gas Sampling from Boreholes 8801D, 78-4, WWW-1, and 77-1 incorporates by reference the following EG&G Standard Operating Procedures:

BEG Geosciences

| | |
|---|---|
| SOP # G-310 | Collecting Soil Gas Samples Through Permanently Installed Ports |
| SOP # 3-311 | Personal Sampling Pumps - MSA #482700 Flow Lite |

CS Environmental Chemistry Laboratory

| | |
|---|---|
| SOP # 201 | Sample Receiving |
| SOP # 205 | Laboratory Chain-of-Custody |
| SOP # 402 | Organic Standards Preparation |
| SOP # 408 | Volatile Organic Analysis |
| SOP # 410 | VOA BFB Tuning (CLP Protocol) |
| SOP # 412 | VOA Continuing Calibration (CLP Protocol) |
| SOP # 414 | VOA Sample Setup and Data Acquisition for Water and Soil Gas Samples |
| SOP # 909 | Internal Data Reporting |
| SOP # 912 | Review and Approval |
| SOP # 913 | External Release of Data. |