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INFORMAL REPORT

SAMPLING AND ANALYSIS PLAN FOR BURIED WASTE PROGRAM SURFICIAL SOIL SAMPLING

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SAMPLING AND ANALYSIS PLAN
FOR BURIED WASTE PROGRAM
SURFICIAL SOIL SAMPLING

EG&G Idaho, Inc.

June 1989

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BURIED WASTE PROGRAM
SURFICIAL SOIL SAMPLING

SAMPLING AND ANALYSIS PLAN

June 1989

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LIST OF ACRONYMS

ARDC	Administrative Record and Document Control
BWP	Buried Waste Program
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
COC	Chain-of-Custody
DCQAP	Data Collection Quality Assurance Plan
DIRC	Data Integrity Review Committee
DOE	Department of Energy
DOP	Detailed Operating Procedure
DQO	Data Quality Objective
DRR	Document Revision Request
ERP	Environmental Restoration Program
ESQ	Environmental Safety and Quality
H&S	Health and Safety
HP	Health Physicists
IH	Industrial Hygienist
INEL	Idaho National Engineering Laboratory
OSHA	Occupational Safety and Health Adminisrtation
QAO	Quality Assurance Officer
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Program Plan
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RWMC	Radioactive Waste Management Complex
SAP	Sampling and Analysis Plan
SDA	Subsurface Disposal Area
SOP	Standard Operating Procedures
SOW	Statement of Work
USGS	United States Geological Survey
VOC	Volatile Organic Compounds

1. INTRODUCTION

This Sampling and Analysis Plan (SAP) is submitted to Region X of the U.S. Environmental Protection Agency (EPA) through the U.S. Department of Energy, Idaho Operations Office (DOE-ID) as part of the Resource Conservation and Recovery Act (RCRA) Facility Investigation Program (RFI). It describes anticipated activities to be conducted at the Radioactive Waste Management Complex (RWMC) of the Idaho National Engineering Laboratory (INEL). The objective of this SAP is to describe the sampling and analysis procedures that will be employed at the Subsurface Disposal Area (SDA) within the RWMC to collect surficial soils for hydrologic, mineralogic and geochemical properties testing.

Currently, there is no available data on saturated hydraulic conductivity for surficial soils from the SDA. Analysis of soil properties from this area is in support of the RFI, Task 4, to characterize the site and determine the hydrologic, mineralogic and geochemical properties of the soils. The determination of hydraulic properties of the sediments will provide hydrologic data required for calculation of flux (flow) rates within the sediments and for input into simulations of contaminant migration. The determination of mineralogical properties of the sediments supports evaluation of the potential sorption of contaminants, primarily radionuclides and metals. The geochemical data will support evaluation of sorption of organic solvents and vapors on organic carbon as well as the potential sorption of radionuclides and metals on other constituents of the soil.

1.1 SDA Background Information

The RWMC is located in the southwestern corner of the INEL, and was selected as a waste disposal area in 1952 by the Atomic Energy Commission (AEC) based on the near surface geohydrological studies by the U. S.

Geological Survey (USGS) and using AEC criteria (Figure 1-1). The RWMC encompasses 144 acres, and consists of two main disposal and storage areas:the Transuranic Storage Area (TSA) and the Subsurface Disposal Area (SDA). The buried waste is contained in the 88 acre SDA and were deposited with little or no soil between the waste and the bedrock. A majority of the waste was contained in drums and wooden-boxes. The Snake River Plain Aquifer is at a depth of about 600 ft from land surface at the SDA. This aquifer is the only source of water used at the INEL. Production wells at the INEL, including the production well for the RWMC, are regionally upgradient of the SDA.

Complete geologic and hydrologic conditions for the SDA can be found in the RCRA Facility Investigation Plan for the SDA/RWMC, Section 2, RFI Task 1, Volume I. Soils at the SDA range in thickness from 1 to over 23 ft reflecting differences in the surface of the underlying basalt bedrock and recontouring efforts of the RWMC personnel using cover material brought in from south of the SDA.

1.2 Description of Problem

As early as 1960, concern for migration of contaminants from the SDA to adjacent soil and bedrock and the Snake River Plain Aquifer prompted studies of the area (Hubbell et.al., 1985). Since 1971, at least 75 wells and shallow auger holes have been drilled in and adjacent to the RWMC by the United States Geologic Survey (USGS) and EG&G Idaho, Inc. to characterize the geology and hydrology at the SDA.

Recent studies indicate both radioactive and hazardous constituents have migrated from the SDA (Laney et al., 1988). Positive detections of radionuclides in shallow borings (less than 30 ft) are presumably associated with the migration of radionuclides from the buried waste within the surficial sedimentary cover of the SDA. Based on the analysis of VOC concentrations in soil gas at the RWMC, cabon tetrachloride, trichloroethylene, tetrachloroethylene, and 1,1,1-trichloroethane are migrating from a number of the SDA disposal pits. Measurable concentrations of volatile organic compounds (VOCs) occur in soil gas at distances from 2,000 to 3,400 ft from the SDA boundary (Laney et al., 1988).

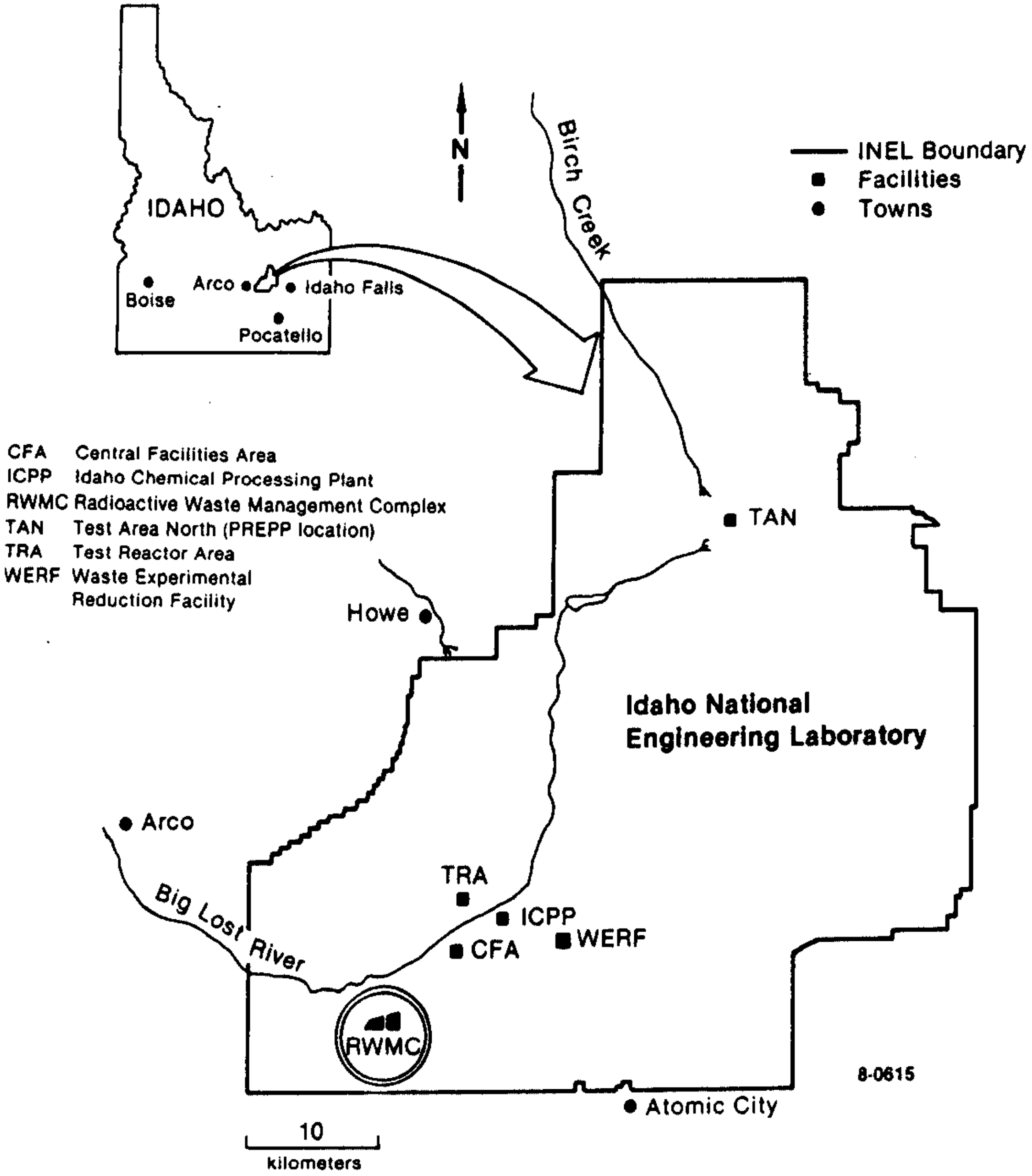


Figure 1-1. Map of INEL and Location of RWMC.

2.0 PROJECT DESCRIPTION

This SAP describes the drilling, sampling, and analysis of surficial soils at the SDA. The collection of site specific data, describing the hydrologic, mineralogic and geochemical properties of the soils overlying the first layer of basalt at the SDA, is necessary to better understand the hydrologic and contaminant transport processes in the vadose zone of the SDA.

Soils from within the SDA will be collected to determine hydraulic, mineralogical and geochemical properties. Ten boreholes will be drilled with a solid stem auger and soil samples collected approximately every 3 ft in depth for analysis. In addition, soil samples will be collected from six sampling sites located in the exposed 30 foot interbed in pit 17. The 30 foot interbed is the first sedimentary layer beneath the SDA. It is of interest because it has the potential to effect the unsaturated flow paths of water in the vadose zone. It is the only interbed that is exposed so it can be examined without drilling. Pit 17 is located in the eastern central portion of the SDA (Figure 2-1). The exposures of the 30 foot interbed are located on the east and west walls.

After sampling, seven of the boreholes will be instrumented with soil moisture and vapor monitoring equipment. The sampling and monitoring of these instrumented boreholes is not covered in this SAP.

2.1 Objectives of the Sampling Effort

The sampling and analysis objective is to characterize the hydrologic, mineralogic, and geochemical properies of surficial soils within the SDA. The sampling and analysis of surficial soils from the SDA will support the objectives of both the RWMC Site Characterization Program and the RFI task 4. The specific objectives of this sampling effort are as follows:

1. To collect samples from the SDA surficial soils and have hydrologic, mineralogic and geochemical properties determined.

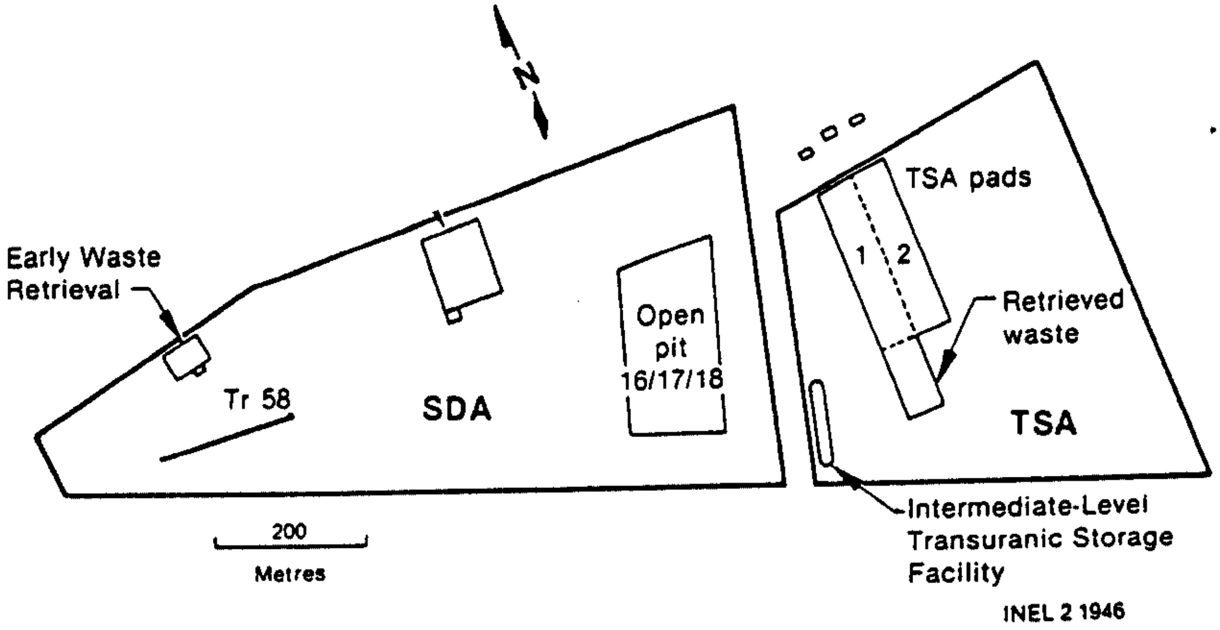


Figure 2-1. Map of the SDA

2. To collect soil samples from the exposed 30 foot interbed in pit 17 and have hydrologic, mineralogic and geochemical properties determined.
3. To install monitoring equipment in seven of the boreholes after sampling activities are completed.

The soil samples will be analyzed for the following hydrologic properties: air permeability, unsaturated hydraulic conductivity, saturated hydraulic conductivity, porosity, bulk density, particle density, moisture content, moisture retention and particle size distribution. The hydrologic properties of the soils sampled in the SDA will be used in a modeling effort to assess water and vapor movement through the subsurface of the SDA.

The soil samples will be analyzed for the following mineralogic properties: bulk mineral x-ray diffraction and clay mineral x-ray diffraction. The mineralogic data will support evaluation of potential sorption of contaminants, primarily radionuclides and metals.

Soil samples will be analyzed for the following geochemical properties: total carbon, total organic carbon, and cation exchange capacity. The geochemical data will support evaluation of sorption of organic solvents and vapors on organic carbon, as well as the potential sorption of radionuclides and metals on other constituents of the soil.

2.2 Data Quality Objectives

Data resulting from the activities described in this SAP will support Task 4 of the RFI and aid in the overall site characterization necessary to develop and evaluate alternative remedial measures for the SDA. Due to the lack of site specific information concerning the soil properties of the SDA surficial soils, this SAP has been set forth. The intended use of the data are to:

1. Support the SDA site characterization and Task 4 of the RFI.

2. Provide input data for the conceptual site model.

3. Refine understanding of hydrologic and geologic site characteristics.

4. Provide additional information on the migration pathways through the surficial soils.

Data types that will result from these activities include the following:

1. Analytical results from hydrologic, mineralogic and geochemical properties testing:
    - Hydraulic Conductivity(cm/s)
    - Moisture Retention(cm water versus moisture content(gm/cc))
    - Moisture Content(gm/cc)
    - Bulk Density(gm/cc)
    - Porosity(%)
    - Particle Size Distribution(% material retained versus sieve size)
    - Particle Density(gm/cc)
    - Air Permeability(Darcycm^3/s-cm^2)
    - Total Organic Carbon(gm/cc)
    - Total Carbon(gm/cc)
    - x-ray Diffraction(% of mineral constituent)
    - Cation Exchange Capacity(meq/L)

2. Depth and geologic descriptions of the sampled surficial soils:
    - Borehole Depth(ft)
    - Soil Type(clay, silt, sand, etc.)

All analyses will be performed by an outside subcontracted laboratory. The hydrologic properties testing will be performed by Daniel B. Stevens and Associates, New Mexico. The geochemical properties testing will be performed by the University of Utah Research Institute and the mineralogical analyses will be performed by a unidentified laboratory. The analyses to be performed and the associated precision, accuracy, and completeness goals are listed in Tables 2-1 and 2-2.

Table 2-1. Hydrologic Properties - Precision, Accuracy and Completeness Objectives

Measurement Parameter (Method)	Reference	Experimental Conditions	Precision	Accuracy % Biased	Completeness
Saturated Hydraulic Conductivity (Constant Head)	Part 1 MOSA p. 694, ASTM D2434	undisturbed sample	±50%	±50%	80%
(Falling Head)	MOSA p. 700	undisturbed sample	±50%	±40%	80%
Moisture Retention (Hanging Water Column)	Part 1 MOSA p. 635	undisturbed sample	±50%	±50%	80%
(Pressure Plate)	MOSA p. 648, ASTM D2325, D3152	undisturbed sample	±50%	±50%	80%
Moisture Content (Graviometric)	Part 1 MOSA p. 503, ASTM D2216	sealed sample	±2%	±2%	80%
(Volumetric)	MOSA p. 696	sealed sample	±2%	±2%	80%
Bulk Density	Part 1 MOSA p. 364, ASTM D4531	undisturbed sample	±2%	±2%	80%
Porosity	Part 1 MOSA p. 444	undisturbed sample	±5%	±5%	80%
Unsaturated Hydraulic Conductivity (Maulem)	Maulem 1976, Van Genuchten 1978	undisturbed sample	not quantifiable	not quantifiable	80%
(One Step Outflow)	Kool 1985, Van Genuchten 1976	undisturbed sample	not quantifiable	not quantifiable	80%

Table 2-1. Hydrologic Properties - Precision, Accuracy and Completeness Objectives (continued)

Measurement Parameter (Method)	Reference	Experimental Conditions	Precision	Accuracy % Biased	Completeness
Particle Size Distribution	Part 1				
(Mechanical Sieve)	MOSA p. 393	may be disturbed sample	±10%	±40%	80%
(Hydrometer)	MOSA p. 404	may be disturbed sample	±40%	±10%	80%
Particle Density (pycnometer)	Part 1 MOSA p. 378	may be disturbed sample	±2%	±2%	80%
Air Permeability	API-RP-40	undisturbed sample	±50%	±50%	80%

MOSA Methods of Soil Analysis, Part 1, Physical and Mineralogical Methods. A. Klute (Editor), 1986, American Society of Agronomy, Inc., Soil Science Society of America, Inc.

API American Petroleum Institute, 1970, API Recommended Practice for core analysis procedures, API-RP-40, Sect. 3.4, Gas Permeability Determination, page 18.

Precision represents the relative standard deviation reported with one sigma.

Table 2-2. Mineralogical and Geochemical Properties - Precision, Accuracy and Completeness Objectives

Measurement Parameter (Method)	Reference	Experimental Conditions	Precision	Accuracy % Biased	Completeness
Total Organic Carbon	MOSA Part 2 p. 539 p. 581	may be disturbed; has not been sieved	±10%	±10%	90%
Total Carbon	MOSA Part 2 p. 539	may be disturbed; has not been sieved	±10%	±10%	90%
Mineralogic (x-ray diffraction)	MOSA Part 1 p. 331	<35 mesh	$2\theta = \pm 0.05$ on split samples	±5% rel. dev. on Qtz, Std. (100% intensity peak)	90%
Cation Exchange Capacity	USDA Handbook #60 1954 p. 101 Part 2	may be disturbed has not been sieved	±10%	±10%	90%

MOSA Methods of Soil Analysis, Part 1, Physical and Mineralogical Methods. A. Klute (Editor), 1986, American Society of Agronomy, Inc., Soil Science Society of America, Inc.

USDA Diagnosis and Improvement of Saline and Alkali Soils, L. A. Richards, Editor, 1954, USDA Handbook No. 60.

Precision represents the relative standard deviation reported with one sigma.

The quality of data is expressed in terms of precision, accuracy, representativeness, comparability and completeness. Precision is the agreement among individual measurements of the same property performed under similar conditions. The precision of the sampling will be assessed based on the analytical results of duplicate and split samples and is expressed as the relative standard deviation. A minimum of one sample split will be submitted for every ten samples collected for geochemical and mineralogical properties testing. The hydrological analyses are not amenable to taking duplicate or split samples. The accuracy of field sampling is not quantifiable to soil samples because a true average is not available. Representativeness expresses the extent by which data define an environmental condition. The samples are representative of discrete stratigraphic layers within the cover material. Representativeness is met through proper selection of sampling sites and collecting a sufficient number of samples, this is further addressed in section 4.

The comparability of the samples is defined by the confidence with which one data set can be compared to another. The consistent use of sampling practices and analytical methods and by including duplicate and split samples will result in data that can be compared.

Completeness is expressed as the percentage of valid data obtained from a measurement system. 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 and provide enough quality sample material to complete those analyses. The completeness goal for the sampling effort is 80%.

2.3 Analysis of Existing Data

Previous studies which have collected samples for hydraulic properties of soils within the SDA include Borghese 1988 and Barraclough 1976. Borghese presents hydraulic properties for 14 samples of disturbed soils taken from the cover material within the southern portion of the SDA. The results of this study are inconclusive with regards to areal variations or trends of hydraulic characteristics for the disturbed soils sampled. Vertical variations of hydraulic characteristics were found to be minimal.

Barraclough presents hydraulic properties for 7 soil samples collected with a split spoon sampler from the SDA at depths ranging from 1 to 14 ft. The hydraulic properties are lower than undisturbed soil samples due to compaction of the sample by the sampling methodology used. The results of this study are not representative of the field soil conditions due to the high compaction of the soils during sampling.

There is information available on the 30 foot interbed pertaining to mineralogy from core collected from boreholes drilled in the SDA, but no information on hydraulic properties.

Modeling of the hydrologic and contaminant transport processes within the vadose zone of the SDA requires more site specific data regarding the hydraulic properties of soils, both "disturbed" and "undisturbed", within the SDA. This SAP has been written to acheive this characterization of the hydrologic properties of soils within the SDA.

3. PROJECT ORGANIZATION AND RESPONSIBILITY

3.1 Ownership

The Idaho National Engineering Laboratory (INEL) is an 886 square mile area managed by the Department of Energy--Idaho Operations Office (DOE-ID). EG&G Idaho, Inc. is the site contractor responsible for operations of the RWMC facility. DOE-ID has primary responsibility and authority for the Resource Conservation and Recovery Act/Comprehensive Environmental Response Compensation and Liability Act (RCRA/CERCLA) EPA regulatory compliance activities at the RWMC.

3.2 Project Personnel

The organization and responsibility for surficial soil sampling is shown in Figure 3-1. The responsibilities of individual positions for this project are described below.

3.2.1 BWP Site Characterization Unit Manager

The BWP Site Characterization cost account manager is responsible for ensuring that all activities are conducted following approved procedures and ultimately responsible for the success of the surficial soil sampling as part of the Buried Waste Programs. This includes all administrative functions, site characterization/investigative activities at the RWMC. This manager also provides coordination and interface with the DOE-ID program personnel.

3.2.2 Surficial Soil Sampling Work Package Manager

The surficial soil sampling Work Package Manager (WPM) is responsible for the safe and successful completion of this effort. Should a potentially hazardous health and safety issue arise, the WPM will stop operations until consultations with the Industrial Hygienist (IH), Health and Safety Officer (HSO), and RWMC Operations Manager have resulted in a safe solution to the problem.

3.2.3 RWMC Operations Manager

The RWMC Operations Manager has responsibility for the safe completion of drilling and sampling activities. He will be kept informed on all drilling activities and will also serve as advisor to the drilling/sampling crew with regard to RWMC operations. This will facilitate interaction and communication between drilling and sampling personnel and RWMC operations so that neither activity is adversely impacted by the other.

3.2.4 Project Geologist

The Project Geologist (PG) has technical responsibility for the successful drilling and sampling of the boreholes. Routine responsibilities of the project geologist include: (a) preparing a summary drilling and sample collection report, (b) maintaining the sample log, including describing soil characteristics as samples are collected, (c) chain-of-custody control and shipment of the soil samples to the analytical laboratory (d) supervising borehole backfilling, (e) collecting the drillers daily drilling summary, and (f) monitoring site completion.

3.2.5 Driller

The Driller is responsible for site operation and maintenance of the drilling equipment, collection of samples as required by the project geologist, and supervision of the drilling crew. The driller has responsibility for conducting drilling and sampling activities in a manner consistent with applicable industrial safety standards. The driller will be responsible for optimizing sample recovery.

3.2.6 Health and Safety Officer

The Health and Safety Officer (HSO) will be responsible for ensuring compliance with and execution of the BWP Health and Safety Plan. The HSO will be supported by the Industrial Hygienist and Health Physics Technician.

3.2.7 Industrial Hygienist

The Industrial Hygienist (IH) will be responsible for monitoring the exposure levels to hazardous contaminants throughout the sampling activities. The IH is responsible for operating, daily cleaning, and calibrating all monitoring equipment (except radiological equipment), as well as maintaining a daily logbook of monitoring activities. The IH will be at the site during all operations, and will retain responsibility to advise the WPM and HSO on any monitoring or personal protective equipment changes and on site evacuation and re-entry. He will initially enter each drill location ahead of any personnel or equipment to assess the presence of initial hazards and advise to proper monitoring equipment.

The IH will make provisions with the analytical laboratory for a 24-48 hour turnaround for analysis of the vapor monitor badges in the event of an accidental acute exposure. The IH will inform the WPM and HSO of any suspected acute exposure to hazardous chemical vapors, liquids, or solids.

3.2.8 Health Physics Technician

The Health Physics (HP) Technician will be the primary source of information and guidance for the monitoring of radiological hazards. The HP is responsible for issuing green tags for radiologically clean samples. The HP Technician shall be present during all drilling and sampling of the surficial soil. The HP Technician will perform instrument surveys and smears of equipment during and following sampling activities. The HP Technician is responsible for calibration of all radiological instruments, control of the calibration logbook (HP Field Log), maintenance and proper operation of monitoring equipment.

3.2.9 Contracted Laboratory Manager

The Laboratory Manager has overall responsibility for laboratory technical quality, cost control, laboratory personnel management, and adherence to schedules. He is responsible for ensuring all analytical procedures are performed properly, custodial information is complete, all specified Quality Control procedures are implemented and recorded in accordance with the specified analytical methods and the laboratory Quality Assurance Plan. The Laboratory Manager will serve as the primary contact for coordinating field and laboratory activities.

3.2.10 ARDC Manager

The surficial soil sampling ARDC Manager shall collect all data, logbooks, etc. and transmit it to the BWP Document Control Coordinator for retention. In addition, he shall be responsible for maintenance and control of all reports generated concerning the soil sampling using BWP Document Control.

3.2.11 Field QA Officer

The field QA officer is responsible for overseeing the sampling process and assuring the sampling plan is followed. He will monitor activities of the sampling team, verifying that the applicable sampling procedures have been followed, and certifying that all procedural and documentation requirements have been met. The field QA officer will remain outside of the exclusion area in a position that will allow for observation of the general activities of the field team. This person may be the RWMC/SWEPP Quality Engineer or any quality professional who has received forty-hour OSHA Hazardous Materials training and experience with previous sampling projects.

3.2.12 BWP QA Officer

The BWP QA Officer's duties include: obtaining the necessary technical expertise to review analytical data, performing field, system, and laboratory audits, assisting in the development of QA/QC procedures for the program, developing audit checklists, as well as assisting the BWP Site Characterization Manager with monthly and annual report development.

3.2.13 Data Analyst

The data analyst is responsible for review and evaluation of the analytical data as received from the contracted laboratory. The data analyst will prepare a written report on the data results and forward the report to the BWP Site Characterization Manager.

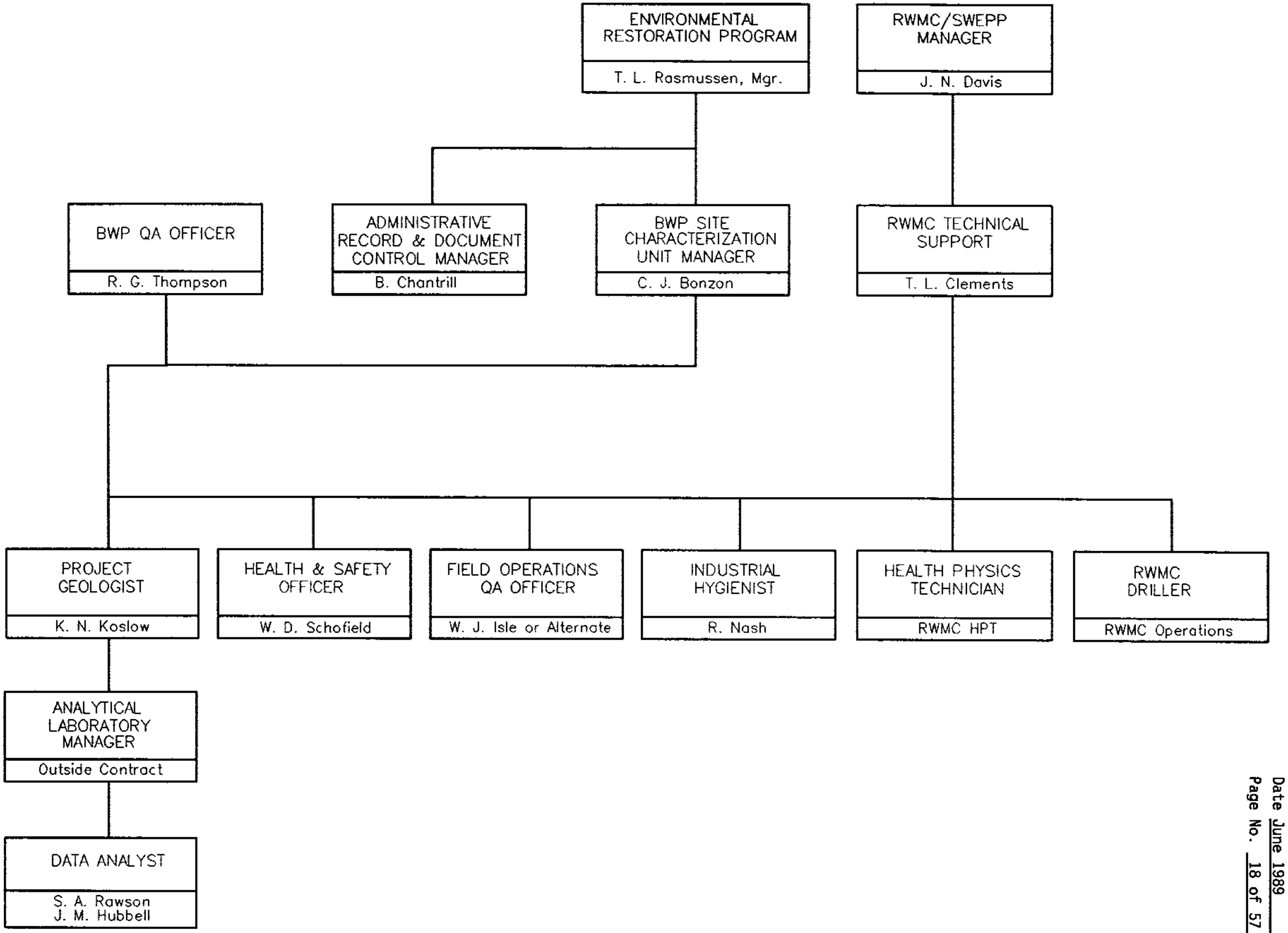


Figure 3-1. Project Organization

4. SAMPLING AND ANALYSIS STRATEGY

Soil samples from the SDA will be collected from ten boreholes and the exposed 30 ft interbed in Pit 17 to determine the hydrologic, mineralogic and geochemical properties of the soils. A complete tabulation of the sample analysis, number of samples and sample location is provided in Table 4-1. A sampling start date of July 17 is proposed pending review and approval of this plan. Based on a Monday through Thursday work week and contingency for weather or other unavoidable delays all sampling will be completed by approximately August 9. The turnaround time for sample analysis and data reduction/evaluation is eight weeks.

Ten auger holes will be drilled within the SDA to collect samples approximately every three foot depth of the borehole and/or in changes of lithology to obtain samples of different soil types at the RWMC. The locations of these sites are presented in Figure 4-1. The hole locations were chosen to collect samples based on the following objectives:

a. Provide data on sites near existing or planned monitoring locations to calculate moisture flux in the sediments.
b. Provide additional information for sites previously sampled and instrumented.
c. Obtain samples from locations containing the major textural classifications of sediments (sand, silt and clay)
d. Provide information on areas not previously drilled or sampled
e. Locations are spatially distributed throughout the SDA
f. To determine the depth to basalt
g. Provide access to sediments where instruments could be emplaced to obtain monitoring data
h. Sample where floods have occurred (NE portion of SDA)

The number and types of samples required were determined from an evaluation of data needs for a computer model following a scoping analysis. The number of samples collected will give an initial indication of the hydrologic and geologic properties of soils within the SDA.

Table 4-1. Number of samples collected and analysis.

Sample Analysis	Number of Samples		Total Number of Samples
	Ten Boreholes	Pit 17	
Hydrologic			
Air Permeability	17	6	23
Saturated Hydraulic Conductivity	61	6	67
Unsaturated Hydraulic Conductivity	33	6	39
Particle Size Distribution	33	6	39
Porosity	61	6	67
Bulk Density	61	6	67
Particle Density	61	6	67
Moisture Content	61	6	67
Moisture Retention	61	6	67
	61	6	67
Mineralogic			
x-ray Diffraction	16	4	20
Geochemical			
Total Carbon	16	4	20
Total Organic Carbon	16	4	20
Cation Exchange Capacity	16	4	20

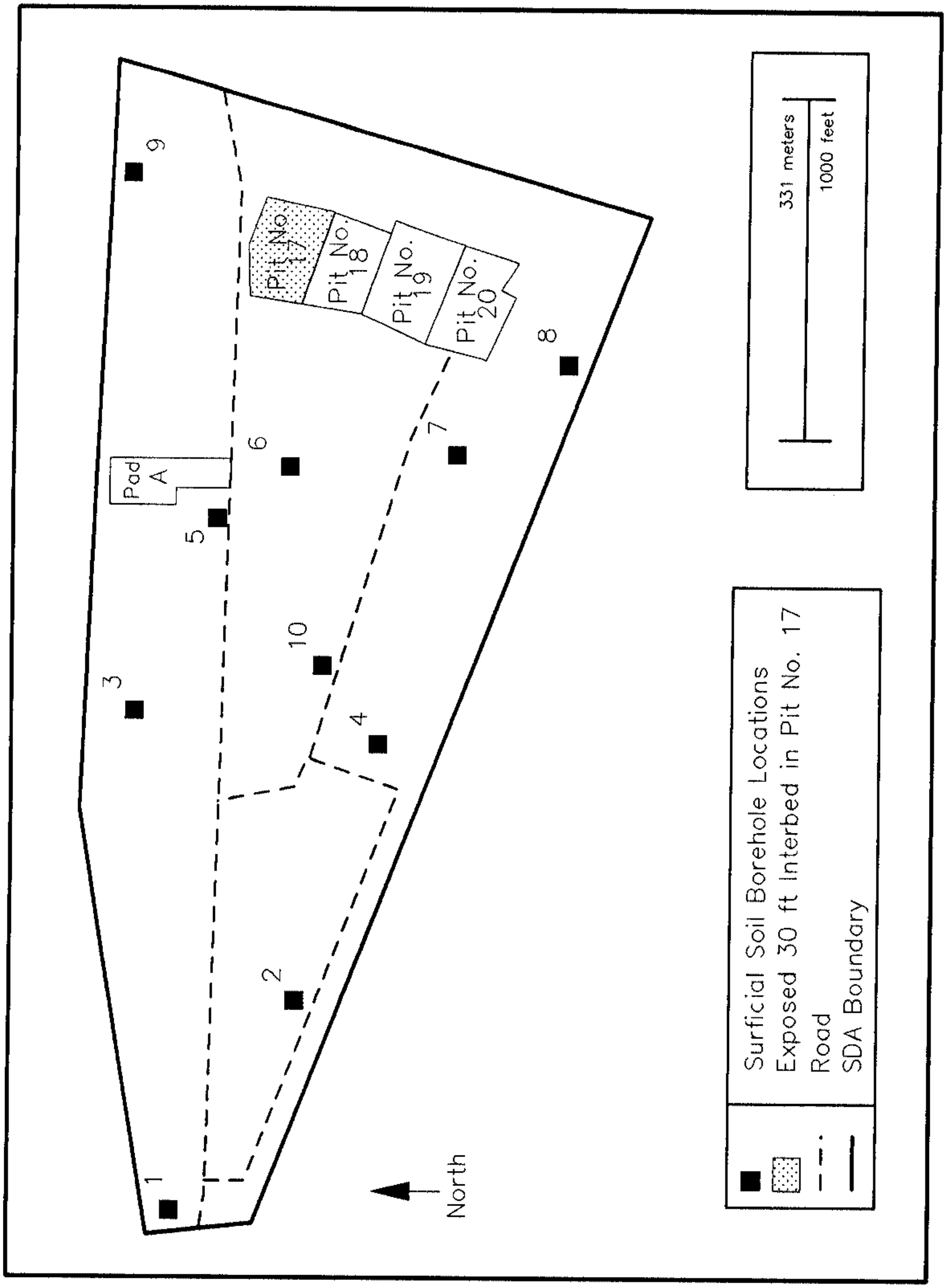


Figure 4-1. Location of sampling sites in the SDA.

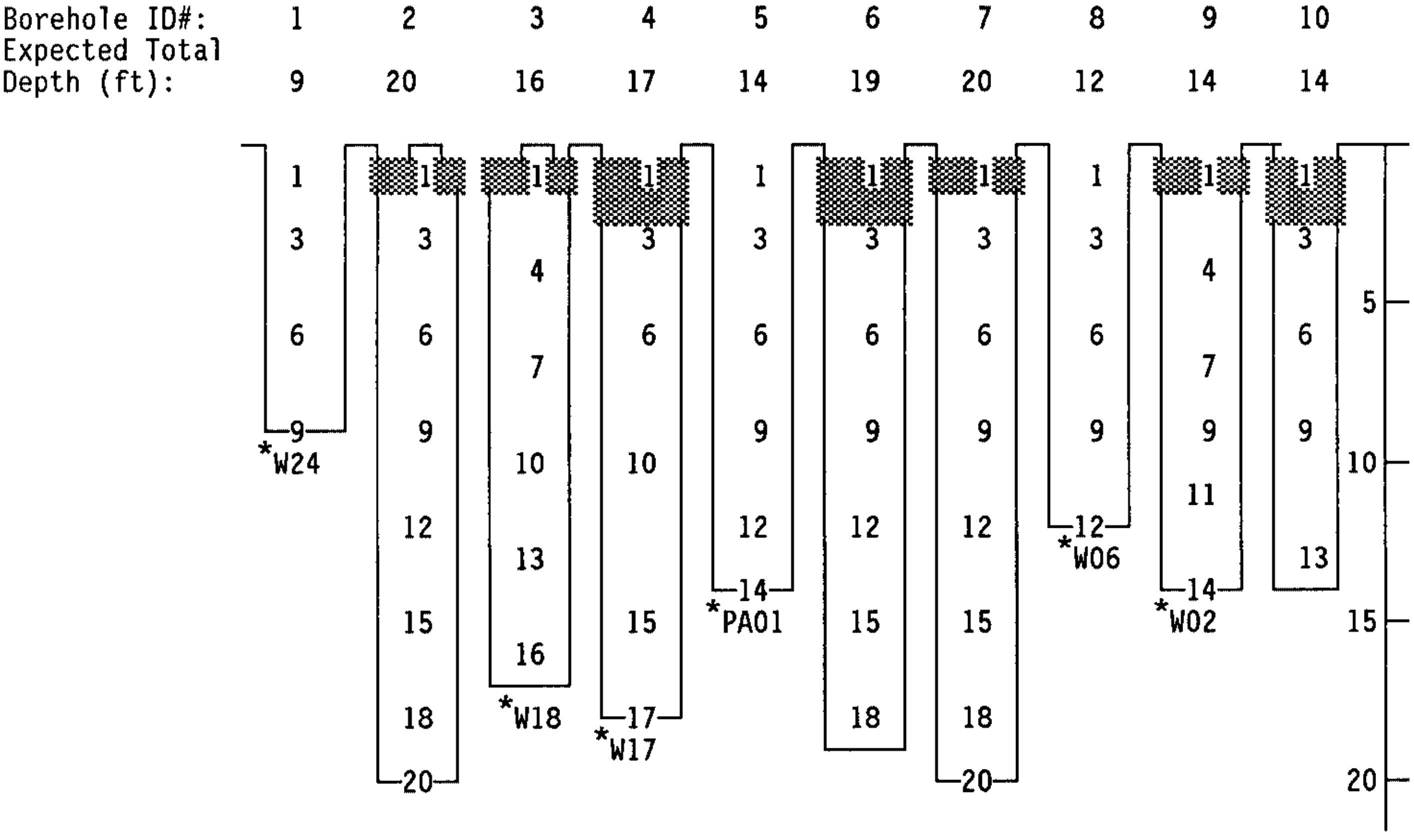
Drilling within the SDA is limited to areas between soil vaults, pits and trenches, off of the major roadways, and away from power and utility lines.

In addition, six sampling sites will be selected from the exposed 30 foot interbed in Pit 17 and analyzed for the same hydrologic, mineralogic, and geochemical properties.

The proposed sampling locations within the ten boreholes are presented in Figure 4-2. The depths specified in boreholes 1, 3, 4, 5, 8, and 9 correspond to instrument depths from a nearby well. Approximately sixty-one samples will be collected from the ten boreholes with seven samples from the "disturbed" cover material and the remaining samples from the "undisturbed" sediments. All samples will be analyzed for saturated hydraulic conductivity, moisture content, moisture retention, porosity, particle and bulk density.

Thirty-three of the sixty-one soil samples obtained for saturated hydraulic conductivity will also be analyzed to determine the unsaturated hydraulic conductivity curve. Two different methods, the Maulem and One Step Method, will be used for the analysis of the unsaturated hydraulic conductivity. The borehole locations and sampling depths were samples will be collected for analysis of the unsaturated hydraulic conductivity using the Maulem and One Step methods is shown in Figures 4-3 and 4-4, respectively. The four samples collected from borehole #9 will be analyzed for the unsaturated hydraulic conductivity using both methods to provide a comparison of the two methods. These depths and locations were chosen to provide hydrologic properties data for calculation of moisture flow (flux) in conjunction with existing instrumented boreholes from similar locations. All of the samples collected for unsaturated hydraulic conductivity will be tested for determination of particle size distribution.

Seventeen of the sixty-one samples will also be analyzed for air permeability from the "undisturbed" and "disturbed" soils as shown in Figure 4-5. Seven samples will be taken from the cover material and ten



Key:

▨ Cover material (disturbed sediment)

1 Sampling location, specified by bottom depth

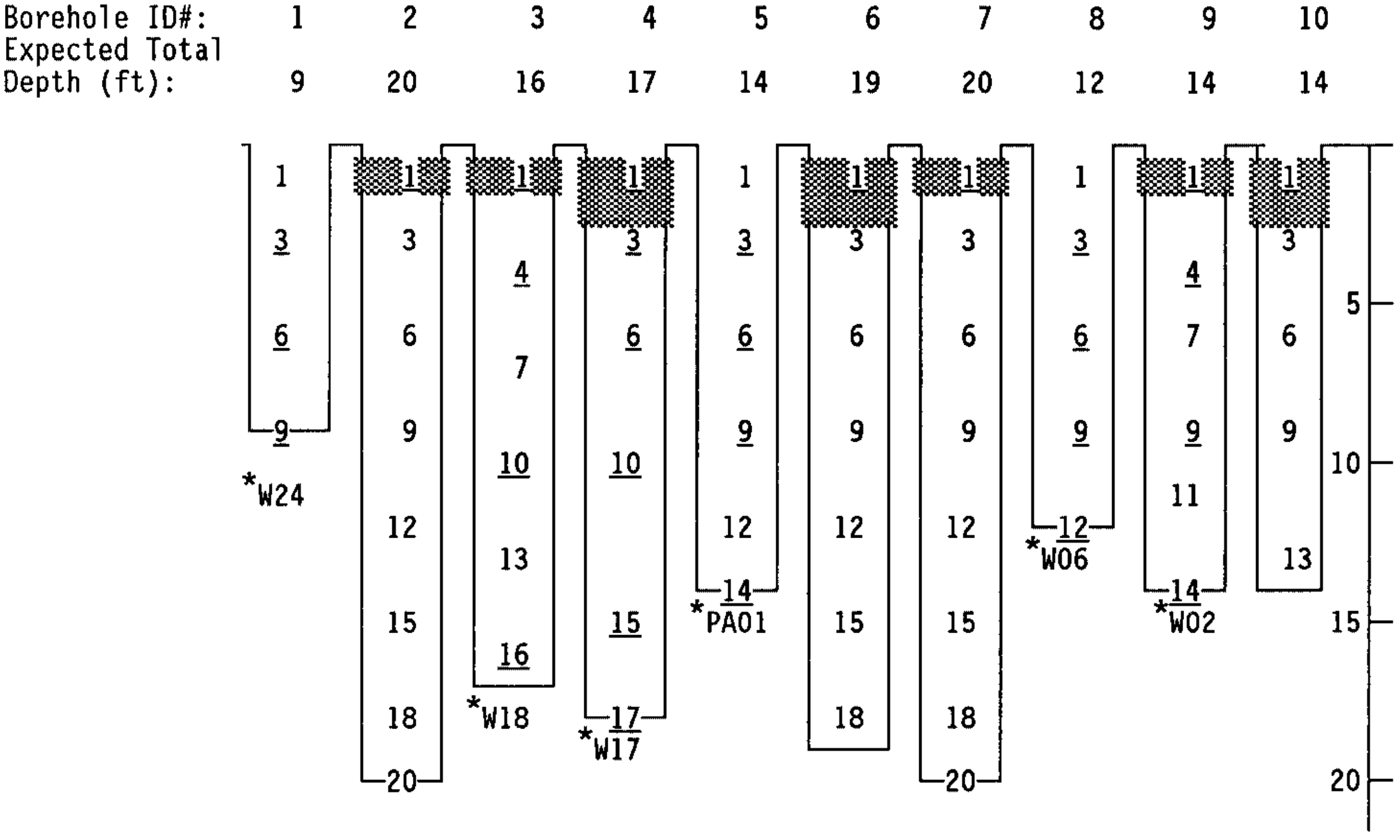
* Existing borehole nearby.

Note: All depths are approximate, refer to geologists log for actual depth collected during sampling.

The depth specified is the bottom depth of a 1 foot sample (i.e. 18 corresponds to 17 to 18 feet depth).

All sampling sites will be sampled for saturated hydraulic conductivity, moisture content, porosity, bulk density, and particle density.

Figure 4-2. Proposed Sampling Locations within the Ten Boreholes.



Key:

1 Unsaturated hydraulic conductivity sampling location

1 Generic sampling depths (bottom depth is specified)

▨ Cover material (disturbed sediment)

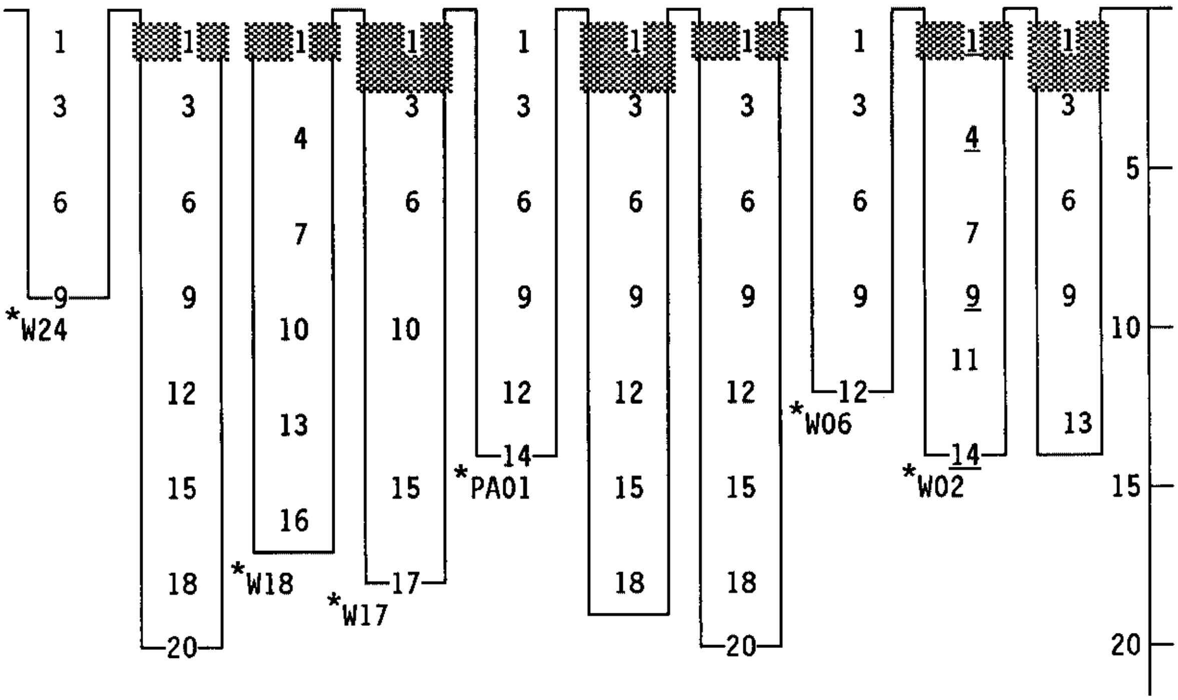
* Existing borehole nearby

Note: All depths are approximate, refer to geologists log for actual depth collected during sampling.

The depth specified is the bottom depth of a 1 foot sample
(i.e. 18 corresponds to 17 to 18 feet depth).

Figure 4-3. Sampling Locations for Unsaturated Hydraulic Conductivity Using Maulem Method

Borehole ID#:	1	2	3	4	5	6	7	8	9	10
Expected Total Depth (ft):	9	20	16	17	14	19	20	12	14	14



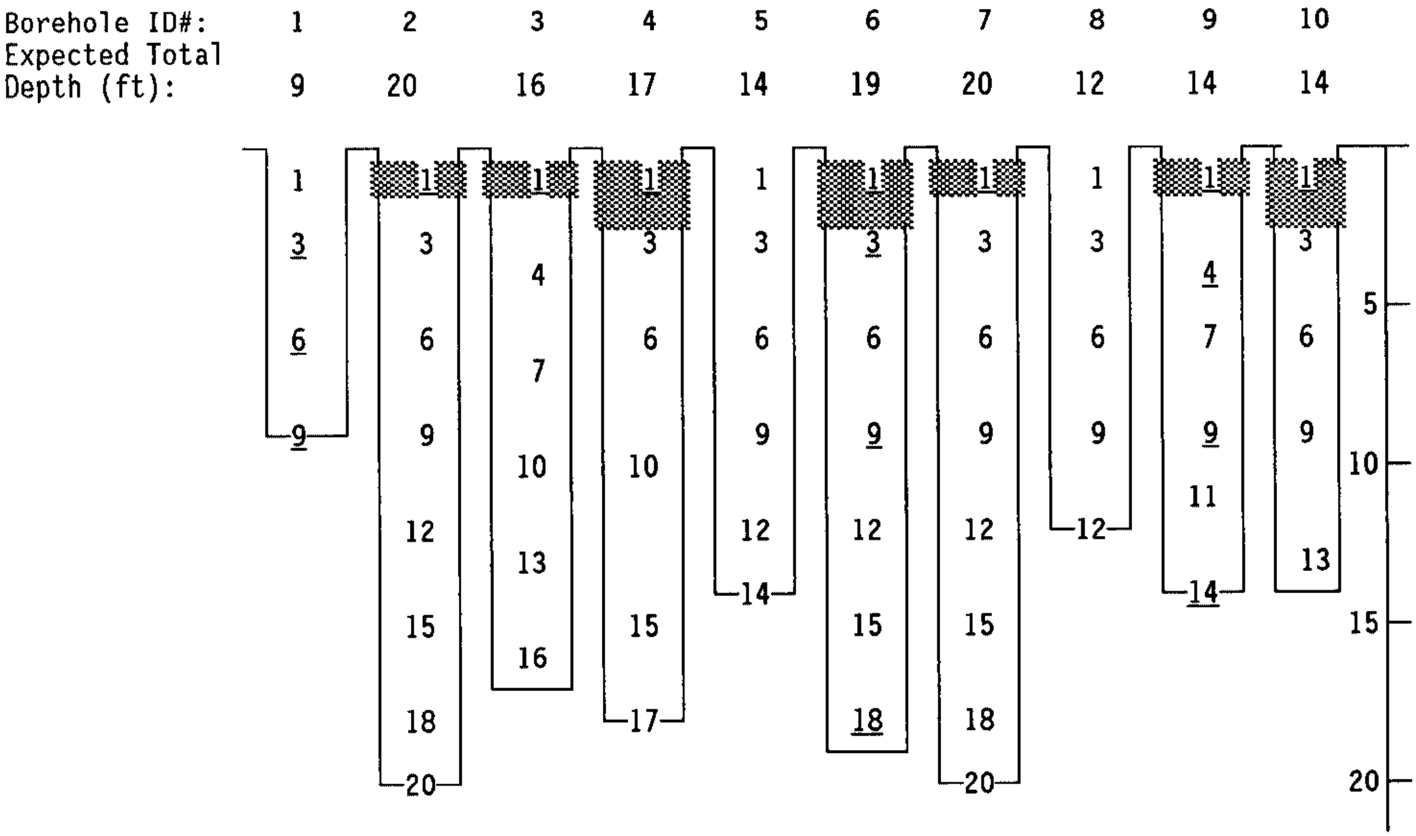
Key:

<u>1</u>	Sampling locations for One Step Method Analysis
▨	Cover material (disturbed sediment, depth estimated)
1	Generic sampling locations, specified by depth
*	Existing borehole nearby

Note: All depths are approximate, refer to geologists log for actual depth collected during sampling.

The depth specified is the bottom depth of a 1 foot sample (i.e. 18 corresponds to 17 to 18 feet depth).

Figure 4-4. Sampling Locations for Unsaturated Hydraulic Conductivity Using One Step Method



Key:

1 Air Permeability sampling location

▨ Cover material (disturbed sediment)

2 Generic sampling depths

Note: All depths are approximate, refer to geologists log for actual depth collected during sampling.

The depth specified is the bottom depth of a 1 foot sample (i.e. 18 corresponds to 17 to 18 feet depth).

Sediment textures will be checked prior to shipping samples to insure that there are examples of each of the primary textures (sand, silt, clay and clayey silt) of sediments found at the SDA.

Figure 4-5. Sampling Locations for Air Permeability samples from the "undisturbed" surficial soils. The tenth sample location has not been specified but will be selected based on the textural characteristics to insure the different textures of sand, silt and clay are represented. The sampling locations were chosen to obtain samples from various depths from three boreholes. Borehole #6 was chosen to provide air permeability information for the soils adjacent to well 8801D. The three sites will provide the basis for an East-West cross-section of air permeability across the SDA.

Approximately sixteen, including a split sample, of the sixty-one samples will be analyzed for the following mineralogic and geochemical properties: bulk mineral and clay mineral x-ray diffraction, total organic carbon, total carbon, and cation exchange capacity.

Six of the sixteen samples will be taken from borehole #6 at the following depths: 3, 6, 9, 12, 15, and 18 feet. This borehole was chosen because it will be located very close to the deep boreholes 8801D and 8901D, which have been or will be sampled for radionuclides at depth. Deep borehole 8801D was also instrumented with gas ports for sampling organic vapors. It is planned to instrument shallow borehole #6 with gas sampling ports. It will be useful to know the geochemical parameters to support the gas sampling.

Five of the sixteen samples will be taken from borehole #5 at the following depths: 3, 6, 9, 12, and 14 feet. This borehole was chosen because it is located in a very wet area of the SDA, adjacent to an existing shallow borehole that contains a pressure vacuum suction lysimeter. The mineralogical data collected at this location will support geochemical modeling of the waters from the suction lysimeter in PA01. Radionuclides were detected in the water collected from the suction lysimeter once, so it is important to determine the possibility of radionuclide sorption on sediments in this area.

Four of the sixteen samples will be taken from borehole #9 at the following depths: 4, 7, 11, and 14 feet. This borehole was chosen because it is located in an area that may be saturated during part of the year, and is adjacent to an existing shallow borehole that contains a pressure vacuum suction lysimeter. The mineralogical data collected at this location will support geochemical modeling of the waters from the data collected from the lysimeter in W02. Cation exchange capacity information will be determined to evaluate the potential of radionuclide sorption on the sediments.

One of the fifteen samples described above will be randomly chosen for a QC split sample, for a total of sixteen samples.

In addition, six samples will be collected from the exposed 30 foot interbed in Pit 17 to obtain undisturbed grab samples for determination of the same hydrologic properties described above. The unsaturated hydraulic conductivity will be annalyzed using the Maulem method. The samples will consist of grab samples selected from the exposed face to represent the various textures of the soils. An initial examination of the exposure indicates the soils have four distinct colorations, in part due to heating from the overlying basalt flow. Each of these layers will be sampled, if there is sufficient sample material to be collected. Four of these six samples will be analyzed for the same mineralogical and geochemical properties described above, including a QC split sample.

After sampling is complete, instrumentation will be installed in seven of these boreholes to help clarify the moisture and vapor movement in the soils(sampling of these instrumented boreholes does not fall under this plan). Gas sampling ports will be installed at four depths at site 6 which is located next to well 8801D, a well with gas sampling ports installed from 32 to 230 feet below land surface. A combination of heat dissipation sensors, gypsum blocks and tensiometers will be installed in boreholes 2, 7, and 10 to provide additional information on moisture distribution and movement in the soils.

Boreholes 5, 8, and 9 will have pipe, screened in the bottom, placed in the boreholes to test for the presence of perched water on top of the basalt. These three sites have indicated saturated conditions during portions of the year. These sites would be checked for the presence of water during the routine monthly monitoring. If water did accumulate in these boreholes, samples would be withdrawn and analyzed in accordance with

5.0 SAMPLING PROCEDURES

Soil samples will be collected from the surficial soils overlying the first layer of basalt in the SDA and from the 30 foot interbed exposed in Pit 17. Detailed sampling procedures are described below.

5.1 Sample Collection

Soil samples will be collected from the SDA to determine the hydrologic, mineralogic and geochemical properties of the soils within the SDA. Sampling consists of drilling 10 boreholes with a solid stem auger and collecting soil samples from a 3-in. OD shelby tube, hydraulically driven into the soil at the specified depth intervals. The borehole locations will be recorded, marked on the ground, and surveyed and/or plotted on an appropriately scaled map. For each sample the sample's site and depth will be recorded in the field log book.

The driller will operate the drill rig and auger to a depth above the interval to be sampled. The auger is then taken off the drill rig and the shelby tube adapter and tube is then placed on the drill. The shelby tube is hydraulically driven into the soil at the specified depth interval. The sample is then collected in the 30-in. long and 3-in. diameter shelby tube. The shelby tube containing the sample is withdrawn from the borehole. The bottom of the shelby tube is immediately capped to prevent loss of sample material. All samples will be measured for direct radiation and organic vapors and results will be logged in the field logbook. The direct measurements will be used for the purpose of health protection. The instruments will be calibrated prior to field use and will be used by a trained Health Physics Technician (HP) and Industrial Hygienist (IH) to insure the safety of field personnel (Referr to Sec. 7.0 and 12.0).

The shelby tube containing the sample is removed from the auger and taken to the work station for sample preparation. The shelby tube will be cut with a cutting tool to the appropriate length, depending on analyses (see Table 5-1). Both ends of the tube will be capped, taped, and the tube

Table 5-1. Sample Collection Requirements

Sample Analysis	Volume of Sample	Sample Container
Hydrologic		
Air Permeability	3" diameter core/ 4" length	Shelby Tube
Saturated Hydraulic Conductivity	3" diameter core/ 5" length	Shelby Tube
Unsaturated Hydraulic Conductivity	3" diameter core/ 5" length	Shelby Tube
Porosity	3" diameter core/ 5" length	Shelby Tube
Bulk Density	3" diameter core/ 5" length	Shelby Tube
Particle Density	3" diameter core/ 5" length	Shelby Tube
Moisture Content	3" diameter core/ 5" length	Shelby Tube
Moisture Retention	3" diameter core/ 5" length	Shelby Tube
Particle Size Distribution	3" diameter core/ 5" length	Shelby Tube
Mineralogic		
x-ray Diffraction	10 grams < 35 mesh	60-ml wide-mouth polyethylene bottle
Geochemical		
Total Carbon	5 grams	60-ml wide-mouth polyethylene bottle (1 bottle for all 3)
Total Organic Carbon	5 grams	
Cation Exchange Capacity	10 grams	

Note: The hydrologic analyses of porosity, bulk density, particle density, moisture content, saturated hydraulic conductivity, unsaturated hydraulic conductivity, and particle size distribution will be performed on the same shelby tube sample.

appropriately labeled (Referr to Sec. 6.0). The sample and tube are ready to be shipped to the contracted laboratory for hydrologic properties testing.

The remaining sample will be removed from the shelby tube and placed in two 60 ml polyethylene bottles for mineralogic and geochemical properties testing. The bottles will be capped, sealed, and appropriately labeled. The samples are ready to be shipped to the contracted laboratory for analysis. This process will be repeated for the remaining sampling sites.

Six samples will be collected from the exposed 30 ft interbed in pit 17. The outcrop of the 30 ft interbed will be examined by the project geologist and the sampling locations chosen. The samples will be chosen to collect representative samples of the various soil textures. Photographs will be taken of the outcrop to indicate the orientation of the undisturbed interbed and field sampling sites. The sampling location will be cleaned and leveled prior to sampling. Cleaning will involve removing any foreign debris along with a thin layer of sediment from the sampling site with a clean tool to expose a "clean" sampling surface. A model 200-A soil core sampler will be driven into the interbed with a hammer to the outside ring of the sampling tool. The sampler is removed from the interbed and the barrel of the sampler is unscrewed from the cap so that the sample retaining cylinder can be pushed out with the core extractor. The sediment in the retaining cylinder is examined to insure a full sample, if the sample tube is not full the sample will be removed and the site resampled. All samples will be measured for direct radiation and organic vapors. The results will be logged in the field logbook. The sample tube will be capped, taped, and appropriately labeled. The sample tube is ready to be shipped to the contracted laboratory for hydrologic properties testing.

Three of the six sampling sites will be chosen to provide additional sample material for mineralogical and geochemical properties testing. Additional sample material will be collected with a clean scoopula or equivalent sampling device. The sample material will be placed in two 60 ml polyethylene bottles for mineralogical and geochemical properties testing.

The bottles will be capped, sealed, and appropriately labeled. The samples do not require any preservative and are now ready for shipment to the contracted analytical laboratory. This process will be repeated for the remaining sampling sites. Photographs of the sampling sites will be taken following sampling to document their location and orientation.

5.2 Decontaminaton Procedures

This procedure describes the method to clean and decontaminate sampling equipment before and after use to reduce potential radiation exposure to personnel from contaminated sampling equipment. The equipment (shelby tubes, spoons, polyethylene bottles) to be used in the field will be cleaned in the laboratory before use as follows:

a. Wash the equipment in tap water using a nonphosphate glassware detergent.

b. Rinse the equipment with tap water.

c. Air dry the equipment on clean blotter paper.

d. Place the equipment in a clean plastic bag and seal the bag.

e. Transport the clean, bagged equipment to the sampling site.

Used field equipment will be returned to the laboratory for cleaning using the same procedures outlined above.

6. SAMPLE CONTROL AND DOCUMENT MANAGEMENT

A documented chain-of-custody program shall be used to identify and trace all samples, from the point of collection to final analysis.

6.1 Documentation

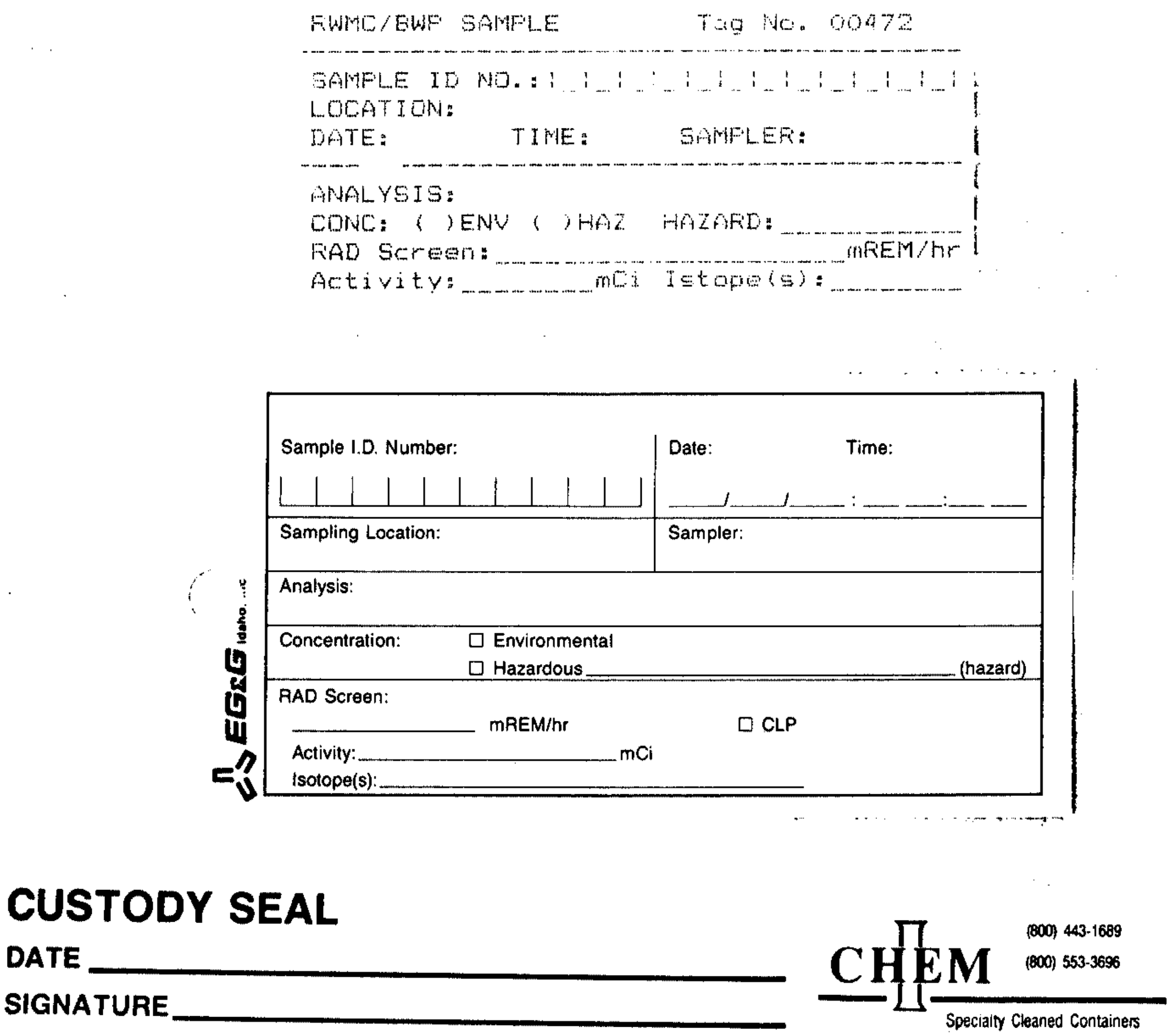
Documentation of drilling and sampling activities will include the use of sample labels, sample tags, chain-of-custody, custody seals, field logbooks and sample tracking. This documentation is necessary to ensure that all of the appropriate data is collected and to further aid in the interpretion and validation of the data. Field documentation is described in detail below.

6.1.1 Sample Labels

A label will be attached to all sample containers at the time of collection. Sample labels will contain the following information: borehole identification number, sample identification number, date and time of sample collection, sample depth, location of top of core, analysis to be performed, organic vapor reading and radiation reading if above background (Figure 6-1).

6.1.2 Sample Tags

A sample tag will be attached to the sample container to maintain sample identity and identify hazards associated with the sample that may require special handling procedures. The suspected hazards associated with the sample will be conveyed to laboratory personnel receiving the samples. The sample tag will include the sample identification number, sampling location, sample collector, date and time of collection, analysis requested, concentration, and radiation and organic vapor screen results (Figure 6-1).



RWMC/BWP SAMPLE Tag No. 00472

SAMPLE ID NO.: |_|_|_|_|_|_|_|_|_|_|

LOCATION:

DATE: TIME: SAMPLER:

ANALYSIS:

CONC: ( )ENV ( )HAZ HAZARD: ____________

RAD Screen: ______________________ mREM/hr

Activity: ________ mCi Istope(s): ________

Sample I.D. Number: |_|_|_|_|_|_|_|_|_|_|

Date: ____/____/____ Time: ____ ____ : ____ ____

Sampling Location:

Sampler:

Analysis:

Concentration: ☐ Environmental

☐ Hazardous ______________________ (hazard)

RAD Screen:

____________ mREM/hr ☐ CLP

Activity: ______________ mCi

Isotope(s): ______________________

CUSTODY SEAL

DATE ______________________

SIGNATURE ______________________

I-CHEM (800) 443-1689 (800) 553-3696

Specialty Cleaned Containers

Figure 6-1. Example Sample Label, Tag, and Seal.

6.1.3 Custody Seals

The field staff will be responsible for the proper recovery and storage (locked to preclude unauthorized access) of the samples until the samples are delivered to the laboratory. Custody seals or evidence tape will be used to detect unauthorized tampering of samples following sample collection until analysis. The seal or tape will be attached in such a way that the seal or tape must be broken to open the sample container. The seal or tape will contain the following information: signature of the person collecting the sample, date and time (Figure 6-1).

6.1.4 Sample Identification Number

A unique sample identification number will be assigned to each sample. The sample identification number must be: (1) unique to distinguish the sample from other similar evidence; (2) traceable throughout the sampling and analysis process; (3) not longer than 12 digits; and (4) consist of numeric characters 0 through 9 and upper case alphabetic characters A through Z.

To meet these requirements and those of the DCQAP document, the sample identification number will have the following sequence of alphanumeric characters:

Characters	Define	Code
1	Surficial Soil Sampling	S
2,3	Borehole or sample site identification number	01-20
4,5	Sample depth	01-20
6,7	Calendar year	89
8,9	Sample number	01-99
10	Properties Testing	H-Hydrologic M-Mineralogic G-Geochemical
11,12	Sample analysis	01-10

6.1.5 Field Logbook

A bound field logbook with consecutively-numbered pages will be maintained by the Project Geologist. Field logbooks will be used to record information pertaining to the sampling activities. All logbook entries will be made in permanent black ink, dated, and signed by the individual making the entry. If an error is made on any documents, corrections will be made by drawing a single line through the error and the correct information entered. All corrections will be initialed and dated by the individual making the correction. Logbook pages shall not be removed from the logbook for any reason. The logbooks to be used during this sampling activity, the individual responsible for the logbook, and the information contained in the logbook is listed in Table 6-1.

6.1.6 Chain-of-Custody

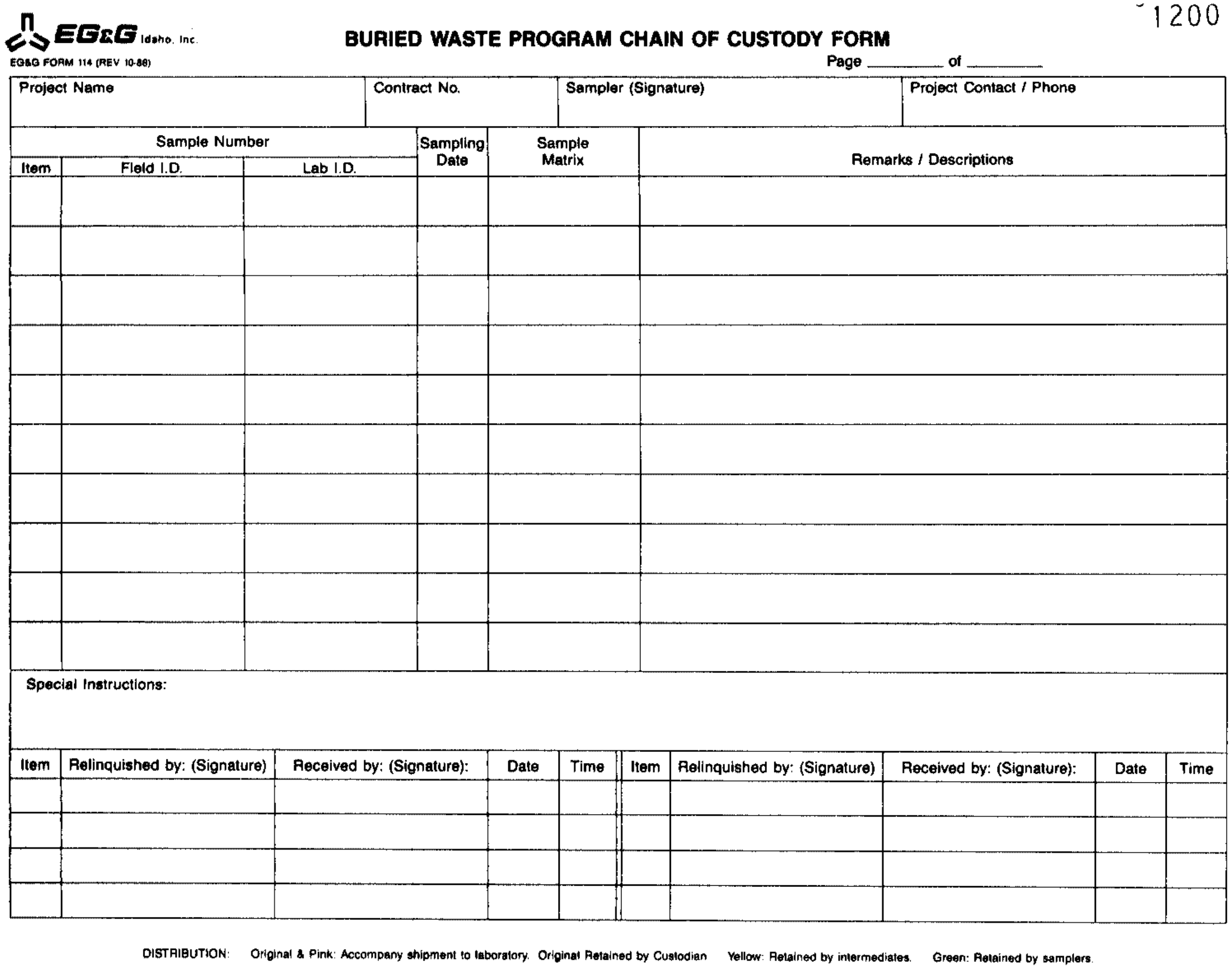
The Chain-of-Custody (COC) form establishes the documentation necessary to trace the sample possession from the time of collection to analysis. Each change of possession will be documented, thus establishing a chain for tracking the handling of samples. This form will be initiated by the field staff and a copy of the form will be held in the field file. The COC form will accompany the samples to the laboratory, where it will be signed and dated by the Laboratory Manager or Laboratory Custodian accepting delivery of the samples. The COC record will be returned to the ARDC for filing in the project files. It may be combined with the Sample Analysis Request Sheet.

The chain-of-custody form shall contain the following minimum information: sample identification number, signature of collector, date and time of collection, sample type, signatures of all persons involved in the chain-of-custody, and inclusive dates of sample possession (Figure 6-2).

Table 6-1. Logbooks Required for Surficial Soil Sampling Activities.

Logbook Title	Responsible Individual	Information Required
Sample Logbook	Project Geologist	Sample number, type, location preservative, weather conditions, field observation field measurements
Field Team Leader Daily Logbook activities.	Project Geologist	Names of sampling team and discussion of field
Sample Shipping Logbook	Project Geologist	Sample number, date collected storage area, date shipped, COC number.
HP Field Logbook	Health Physicist	Field radionuclide instrument calibration.
Monitoring Activities Log	Industrial Hygienist	Organic vapor instrument calibration.

1200



EG&G Idaho, Inc.
EG&G FORM 114 (REV 10-88)

BURIED WASTE PROGRAM CHAIN OF CUSTODY FORM

Page ________ of ________

Project Name	Contract No.	Sampler (Signature)	Project Contact / Phone

Sample Number			Sampling Date	Sample Matrix	Remarks / Descriptions
Item	Field I.D.	Lab I.D.			

Special Instructions:

Item	Relinquished by: (Signature)	Received by: (Signature):	Date	Time	Item	Relinquished by: (Signature)	Received by: (Signature):	Date	Time

DISTRIBUTION: Original & Pink: Accompany shipment to laboratory. Original Retained by Custodian Yellow: Retained by intermediates. Green: Retained by samplers.

Figure 6-2. Example Chain-of-Custody Form.

6.1.7 Green Tag or Radioactive Shipment

All samples and field equipment will be surveyed by the HP Technician for fixed and smearable radiological contamination. If the samples are determined to be nonradioactive, beta-gamma activity is less than 100 cpm above background and the HP determines no alpha activity, a green tag will be issued and the sample and equipment may leave the site. If the samples are above this limit, the sample material will be returned to the borehole or properly disposed on site. No radioactive samples will be sent to the contracted laboratory.

6.1.8 Sample Tracking

A BWP sample tracking system has been established within the ERP program, consisting of a computer program that stores information on the location of a sample. Field COC will be initiated by completing BWP Form 114, upon collection of the sample in the field. Field personnel responsible for shipping/transporting samples will send copies of the COC forms to the ARDC manager who is responsible for the sample tracking system.

The laboratory responsible for analyses will have a QA/QC program that as a minimum, will accomplish the following. Upon sample(s) receipt by the laboratory, the Laboratory Custodian will inspect the sample(s) and sample condition, reconcile the information on the sample label against that of the COC form, assign a laboratory number, log in the sample(s) in the Laboratory Logbook. Any discrepancies between the information on the sample label and the information on the COC form will be resolved before the sample is assigned for analysis. Results of the inspection will be noted on the COC form and on the Laboratory Sample Logbook. The ARDC manager will communicate with the analytical laboratory as to the status of the samples.

6.2 Sample Handling

To prevent disturbance of the sample and ensure that the analytical data are truly representative of the sample media collected, the samples must receive proper handling.

6.2.1 Sample Containers

The samples for hydrologic properties testing will be sent in the shelby tube that they are collected in, cut to the appropriate length (Referr to Table 3). The samples for mineralogic and geochemical properties testing will be placed in two precleaned 60-ml wide-mouth polyethylene bottles.

6.2.2 Sample Preservatives

Soil samples for the outlined analyses require no preservatives.

6.2.3 Field Radiation Screening

All samples will be measured for fixed and smearable radiological contamination by a trained and certified HP technician. The results will be logged in the Sample Log Book. These radiation measurements will be used for the purpose of field personnel radiation protection during sampling and to prevent any radiologically contaminated samples from leaving the site.

6.2.4 Field Screening for Hazardous Substances

Employee exposure to hazardous substances will be monitored during the sampling activities, using a combination of techniques addressed in the BWP Health and Safety Plan. Organic vapor measurements will be taken periodically from the spin-off soil and the hole being drilled. Measurements will also be taken from the shelby tube as it is brought up out of the hole. A photoionization detector (HNu) or similar instrument will be used to take these measurements. The results will be logged in the Sample Log Book.

6.2.5 Transportation of Samples

After sample collection and packaging in the field, the samples must reach the laboratory intact. Samples will be packaged according to the Department of Transportation (DOT) shipping requirements. There are two basic categories for samples under the DOT regulations--environmental samples and hazardous substance samples. The nature of the samples collected for this project are considered environmental samples.

The following applies to samples that have been collected and are ready for packaging prior to shipment to the analytical laboratory to ensure proper handling.

1. Sign (field sample custodian or person doing the packaging) the chain-of-custody form upon receiving the sample from sampler.

2. Attach a sample seal and sample tag properly labeled to each container.

3. Place sample in an upright position, properly labeled and sealed, in the shipping container. Make sure the sample is tightly packed using styrene or other suitable packing material.

4. Place completed chain-of-custody and sample analysis request form in the shipping container.

5. Label the shipping container with the following information:
    a. "Laboratory Samples" label
    b. "This End Up" label on lid
    c. "This End Up" arrows on all four sides
    d. Address label with name, address, and phone number of receiving lab and the sender.

6. Secure the container and place a signed custody seal across the top and side.
   NOTE: This parcel is now suitable to be shipped by commercial air cargo transporter, rail, or truck.

7. Transport to shipping personnel Terri Cotterell at Central Facilities Area (CFA) Bldg. 601 for shipment via Federal Express to the contract analytical laboratory. EG&G form 176 "Request for Shipment of Materials" must be filled out and accompany the shipment.

6.2.6 Special Handling

Samples sent for hydrologic properties must remain in an upright position, packed tightly with suitable packing material, such as styrene or vermiculite.

7. EQUIPMENT

Safety and radiological monitoring equipment will be maintained and calibrated by the HP and IH. Calibration logbooks (HP Field Log and Monitoring Activities Log) are maintained for each instrument. The following is a list of radiological and field equipment that will be used in this sampling effort.

- Hand-held alpha and beta-gamma detectors
- Dose Rate Meter (beta-gamma)
- HNu
- Direct Reading Dosimeter
- TLD Dosimeter

Measuring and test equipment used in the field shall be controlled by a calibration program in accordance with QAP-149. Calibration of measuring and test equipment may be performed internally using standards traceable to the NIST, where applicable or externally by the equipment manufacturer or approved calibration facility.

7.1 Maintenance and Operation

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

a. Monitoring equipment calibration status and operability will be checked.
b. Spare monitoring equipment will also be provided to minimize downtime due to equipment malfunction to the greatest extent possible.

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. Preventive maintenance will be the responsibility of the subcontracted Laboratory Manager. As a minimum, the laboratory will be required to have:

1. Spare parts, as recommended by the instrument manufacturer,

2. The above items delineated in the Laboratories' written QA/QC plans.

7.2 Calibration

Responsibility for calibration and maintenance of radiological monitoring equipment lies with the HP Technician. The IH will be responsible for industrial hygiene equipment calibration and monitoring. Calibration and maintenance of any laboratory equipment is the responsibility of the Laboratory Manager.

It is the responsibility of the personnel using the equipment to check the calibration status in the log, or record prior to use and to ensure that the equipment is operational. All personnel handling, transporting or storing measuring equipment will do so in a manner which will minimize the risk of adversely affecting the calibration.

As a minimum, calibration procedures shall include:

a. Type of equipment to be calibrated
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).

8. ANALYTICAL PROCEDURES

The scope of this plan is to analyze the collected samples for hydrologic, mineralogic and geochemical properties. The soil samples will be analyzed for the following hydrologic properties: porosity, bulk density, particle density, moisture content, moisture retention, particle size distribution, saturated hydraulic conductivity, unsaturated hydraulic conductivity, and air permeability. The unsaturated hydraulic conductivity will be calculated utilizing the Maulem and One Step methods. The samples for hydrologic properties testing will be analyzed following the referenced methods outlined in Table 2-1, which also includes data precision, accuracy and completeness objectives.

Soil samples will be analyzed for the following mineralogic properties: bulk mineral x-ray diffraction and clay mineral x-ray diffraction. Selected soil samples will be analyzed for the following geochemical properties: total carbon, total organic carbon, and cation exchange capacity. The samples for mineralogical and geochemical properties testing will be analyzed following the referenced methods outlined in Table 2-2, which also includes data precision, accuracy and completeness objectives.

The analyses will be performed by an outside subcontracted laboratory. The air permeability analyses will be performed by Petroleum Testing Services, Inc., the x-ray diffraction analyses will be performed by an unidentified laboratory, cation exchange capacity, total carbon, and total organic carbon analyses will be performed by University of Utah Research and hydrologic properties testing will be performed by D. B. Stevens and Associates. Specific requirements to deliverables and method of analyses will be specified in a Statement of Work (SOW) to each of the contracted laboratories. The laboratory performing the analyses will submit the following:

1. Narrative report, describing analytical problems encountered and internal QC processes applied.
2. Copies of sample tracking reports.
3. Sample data, including tabulated results.
4. Quality control summary and instrument performance information.

9. DATA MANAGEMENT

Data management for this task includes data reporting, data reduction, and data validation. The data management procedures that will be employed for this project are described in the following sections.

9.1 Data Reporting

Results of all analyses will be reported to EG&G Idaho Buried Waste Programs via the ERP Site Characterizationt Cost Account Manager. External analytical results will be directly submitted to Geosciences who will review the data and forward to ARDC Project Files.

The data received from the laboratory will be tabulated to indicate the hydraulic conductivities in each borehole with geometric means calculated for each hole. These hydraulic conductivities will be looked at aerially by individual depths and a comparison made to see if there are trends in either depth or spatially throughout the SDA. This will be performed for both the undisturbed and disturbed soils. The results for unsaturated hydraulic conductivity using the One Step and Maulem methods will be compared to determine the variation in calculated unsaturated hydraulic conductivities using the two different methodologies.

9.2 Data Reduction

Data reduction methods will be limited to placing the data in an EG&G standardized format for future incorporation into the Buried Waste Information System data base.

9.3 Data Verification and Validation

The integrity of the samples will be ensured through use of daily log books, labels, and the chain-of-custody reports for all transported samples which will include the date and time for analysis of each sample. The Field QA Officer shall assist the BWP in assuring sample integrity by reviewing the sampling process as it is accomplished to verify that sampling procedures are followed.

10. QUALITY ASSURANCE

All sampling and analysis activities described in this SAP will be conducted in accordance with the QA/QC practices described in the BWP Data Collection Quality Assurance Plan (DCQAP) (EG&G, 1988b).

10.1 Field QA/QC

Two split samples will be collected with the routine samples tagged for geochemical and mineralogical properties testing. One split sample will be collected from the samples collected from the exposed pit 17 and one split sample will be collected from the boreholes sampled for geochemical and mineralogical properties testing.

No field, equipment, or trip blanks are required for this sampling effort.

10.2 Laboratory QA/QC

A contracted laboratory will conduct the analyses listed in Table 1 and 2, adhering to QA standards specified in the SOW. The laboratory QA/QC procedures will be those submitted by the chosen subcontractor. The QA/QC program should provide for calibration of instruments, instrument maintenance and chain-of-custody for samples. Data qualification will be performed by EG&G Geosciences following receipt of the analytical data.

10.3 Audits

An audit is a systematic check to determine if project personnel are adhering to the steps, methods, and protocols outlined and referenced in this SAP. The BWP DCQAP discusses audits to be performed during the activities covered by this SAP. Audits for the Surficial Soil Sampling will be performed by the BWP QA Officer and/or the Environmental, Safety, and Quality (ESQ) Department. The BWP QA Officer will submit a schedule for audits to be conducted during this sampling effort. All audits shall be formally documented and records retained by the BWP Document Coordinator and ESQ.

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 Corrective Action

The Program Geologist shall evaluate the laboratory results to determine the adequacy of the data. If the data is suspect, the Program Geologist shall formally request that the laboratory reanalyze the sample(s), if possible, and determine the inadequacy of the data. This request will be sent to the laboratory manager.

The laboratory manager shall assess the laboratory QA process to determine why the poor quality data was allowed to leave the laboratory. In addition, the laboratory manager shall document the corrective actions taken to prevent reoccurrence.

If corrective action is required, the BWP Site Characterization Cost Account Manager shall respond to the audit findings 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 Officer or Safety representative shall stop the work until corrective action is taken. The QA Officer must approve all corrective actions.

10.4 Reports to Management

A report on the performance of the quality assurance program will be prepared by the BWP QAO and presented to the BWP Program Manager. When appropriate, analytical laboratory QA/QC reports will be included. At the completion of the task and after data verification and validation, all QC data will be sent to the Administrative Record and Document Control Officer to become part of the program files.

A report to the Program Manager on the performance of measurement systems and data quality will be provided by the BWP Site Characterization Unit Manager. This report will include:

a. Data quality assessment,
b. Results of internal performance inspections, with corrective actions, recommendations, and status.

The Data Analyst will prepare a written report on the analytical data for the BWP Site Characterization Unit Manager. 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.

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

Procedures that will be used to assess the precision, accuracy, and completeness of the data collected from sampling the surficial soils in the SDA are different for field data and laboratory data. Field and laboratory procedures are described in the following sections.

11.1 Field Work

11.1.1 Precision

Field precision will be assessed by field audits conducted to ensure the use of uniform sample collecting, handling, and shipping procedures. Field sampling precision will be assessed by analytical results of duplicate samples for the analyses where duplicate samples are appropriate.

11.1.2 Accuracy

Field accuracy is not applicable to field sampling for soils, because the "true" average is not quantifiable.

11.1.3 Completeness

Completeness of the field data will be assessed by calculating the ratio of samples analyzed to the total number of samples collected, stated as a percentage. The completeness goal for field data is a ratio of 90 percent.

11.2 Laboratory Data

The analytical laboratories will perform analyses according to the SOW and referenced procedures to insure the analytical precision, accuracy and completeness is as requested.

11.2.1 Measures of Precision

Measures of precision include the standard deviation, relative percent difference, the range, and the confidence limit. Precision of laboratory data will be measured by the analysis of duplicates. The data will be within the prescribed control limits for precision as stated in Tables 2-1 and 2-2.

11.2.2 Accuracy

The accuracy for the laboratory data will be assessed by examining that the laboratory equipment used in the tests have been calibrated to National Institute of Standards and Technology (NIST) or other acceptable industry standards. The data will be within the accuracy limits as stated in Tables 2-1 and 2-2.

11.2.3 Completeness

Completeness of the laboratory data will be measured by the ratio of samples with results that are of acceptable accuracy and precision to the total number of samples received by the laboratory, stated as a percentage. The completeness goal for laboratory data is as stated in Tables 2-1 and 2-2.

12.0 SAFETY AND TRAINING

The project Health and Safety Plan will assure the safety of those working on site and familiarize personnel with the hazards associated with this project. All activities will be conducted in accordance with pertinent DOE orders, RWMC operations Branch Project Directives (PD), EG&G Safety Manual Procedures, Environmental Protection Agency (EPA) sampling and analysis protocols, Department of Transportation (DOT) and EPA shipping regulations, and Occupational Safety and Health Act (OSHA) safety regulations.

12.1 Equipment

Personal protective equipment is based on the recommendations contained in the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (NIOSH, 10/85). Personal protective equipment will be required during the course of the project and selection will be based primarily on hazard assessment data and work task requirements. Prior to entry, each work location will be monitored for potentially hazardous contaminants using an HNU photoionization detector, a combustible gas indicator, and a radiological scan by an HP.

The recommended level of Personal Protective Equipment (PPE) is Level D. This requirement may be changed with concurrence from the Industrial Hygienist, the Health Physicist, the Work Package Manager and the Project Geologist.

Level D Personnel Protective Equipment

Level D clothing as described below must be worn, as a minimum, by all personnel working within the Exclusion Zone.

- Coveralls
- Safety shoes with steel toe and shank
- Hard hat
- Gloves
- Hearing protection (as required by IH)
- Eye protection where needed

12.2 Personnel

All personnel will have received 40 hours of training in accordance with the OSHA Interim Final Standard 20 CFR Part 1910 Docket #S-760, December 19, 1986, augmented by fit-testing of respiratory protectors prior to commencing work on the project site. In addition, all personnel will be required to understand the hazards associated with site operations and will be subject to any site specific training program. All field workers will have reviewed and signed the H&S Plan before beginning work operations.

It is the responsibility of the IH to ensure that field personnel are adequately protected from the hazards at the SDA. It is each field workers responsibility to implement appropriate health and safety measures.

13. DATA MANAGEMENT

All information, logbooks, analyses, project files, and field records will be submitted to the ERP ARDC Manager upon completion of the project. These records will be maintained under lock and key by this individual and provided to interested EG&G Idaho and DOE-ID personnel via a records checkout process.

This record checkout process will consist of requiring the ERP ARDC Manager or designated alternate to fill out a card identifying the records removed, the date removed, and the person receiving the record. Upon return of the record, it will be placed back under lock and key and the checkout card removed.

It is the responsibility of the ERP ARDC Manager to ensure all records are maintained under lock and key. When issuing all or parts of these records, this individual shall direct the person receiving the records to maintain these records under lock and key while in their possession.

14. LOGISTICS

Field logistics involves the procurement, maintenance, and transport of personnel, materials, and facilities for field sampling. Overall coordination of field logistics will be the responsibility of the sampling work package manager. He will communicate and coordinate between the field drilling and sampling teams and the analytical laboratory. Daily meetings at the start or end of the day will help ensure communication and coordination among the field drilling and sampling teams. All field sampling and drilling equipment will be provided by EG&G Idaho, Inc.

15. REFERENCES

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