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Date Received: 7/19/93

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Responsible Manager (Printed/Signature) Date: R. A. Carlson R.A. Carlson 7/16/93

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CONTENTS

1.0 INTRODUCTION

This report presents results of an assessment of the available information concerning U.S. Environmental Protection Agency (EPA) quality assurance/quality control (QA/QC) requirements and guidance applicable to sampling, handling, and analyzing physical parameter samples at Comprehensive Environmental Restoration, Compensation, and Liability Act (CERCLA) investigation sites. Included in this report are the levels of QA/QC accepted by EPA Region 10 project managers at another Federal facility CERCLA investigation.

1.1 BACKGROUND

Geotechnical testing laboratories measure the following physical properties of soil and sediment samples collected during CERCLA remedial investigations (RI) at the Hanford Site:

- moisture content
- grain size by sieve
- grain size by hydrometer
- specific gravity
- bulk density/porosity
- saturated hydraulic conductivity
- moisture retention
- unsaturated hydraulic conductivity
- permeability of rocks by flowing air.

Geotechnical testing laboratories also measure the following chemical parameters of soil and sediment samples collected during Hanford Site CERCLA RI:

- calcium carbonate
- saturated column leach testing.

Physical parameter data are used for (1) characterization of vadose and saturated zone geology and hydrogeology, (2) selection of monitoring well screen sizes, (3) to support modeling and analysis of the vadose and saturated zones, and (4) for engineering design.

1.2 OBJECTIVES

The objectives of this report are to determine the QA/QC levels accepted in the EPA Region 10 for the sampling, handling, and analysis of soil samples for physical parameters during CERCLA RI.

2.0 REGULATORY GUIDANCE

2.1 EPA REGION 10 GUIDANCE

Regulatory guidance from EPA Region 10 staff was solicited by calling EPA QA personnel in Seattle, Washington. EPA Region 10 QA staff responded that beyond use of standard methods such as those published by the American Society for Testing and Materials (ASTM), there were no Region 10-specific QA requirements applicable to sampling or analysis of soil for measurement of physical properties.

To assess Region 10 practice regarding acceptable QA/QC for physical parameter measurements, work plans from a non-Hanford CERCLA site RI were examined. Specifically, two work plans from the Fairchild Air Force Base (AFB) Remedial Investigation/Feasibility Study (RI/FS) were examined. Excerpts from the work plans applicable to QA for soil sampling and physical parameter analyses are included in Appendix A.

The Fairchild AFB RI/FS work plans (SAIC 1990, Halliburton NUS 1991a and 1991b) specify the following physical parameters for analysis:

- grain size - by ASTM D 4222 (Halliburton NUS 1991a)
- bulk density - following Chapter 9 of Methods of Soils Analysis, American Association of Agronomy (Halliburton NUS 1991a)
- permeability - by EPA (1986) Method SW 9100 (Halliburton NUS 1991a)
- density - no method given (Halliburton NUS 1991b)
- Atterberg limits - by ASTM D 4318 (Halliburton NUS 1991a)
- percent moisture - by ASTM D 2216 (SAIC 1990, Halliburton NUS 1991a).

The work plans do not specify sample preservation or holding time requirements for physical parameter samples (SAIC 1990, Halliburton NUS 1991a and 1991b). At Fairchild AFB, "field duplicates" will be collected from soil borings at a 25% frequency for analysis of bulk density and grain size (Halliburton NUS 1991b). Field duplicates will not be collected from a thin-walled tube or from test pit samples (Halliburton NUS 1991b). The Halliburton NUS Quality Assurance Project Plan (1991a) states that duplicate samples should be analyzed on a 10% frequency when ASTM D 2216 percent moisture analyses are performed. Acceptance criteria for the data are stated as "precision within current control limits" (Table 1.10-1, Halliburton NUS 1991a). These are the only references to QC sample frequency and acceptance criteria identified for physical parameter data.

2.2 PUBLISHED EPA GUIDANCE

Published EPA guidance for QA/QC relating to determination of physical parameter of soil samples includes:

- Compendium of Superfund Field Operations Methods (EPA 1987a)
- Data Quality Objectives for Remedial Response Activities, Development Process (EPA 1987b) and Data Quality Objectives for Remedial Response Activities, Example Scenario (EPA 1987c)
- Test Methods for Evaluating Solid Waste, USEPA SW-846, 3rd Edition, November 1986, Method 9100 (EPA 1986)
- Soil Sampling Quality Assurance User's Guide (EPA 1984).

2.2.1 Compendium of Superfund Field Operations Manual

Chapter 9 of the Compendium of Superfund Field Operations Methods (EPA 1987a) contains specific guidance on the following topics that are applicable to physical parameter testing of Hanford Site soil samples:

- test parameters versus test methods
- procedures (which includes EPA assessments of ASTM test methods)
- laboratory QA/QC.

Test methods are referenced by Exhibit 9-1 in the compendium for soil and rock physical properties. The exhibit lists 31 test parameters and corresponding test methods; all except two are from ASTM (1992) Volume 04.08, Standards Relating to Dimension Stone; Soil and Rock; Geosynthetics. Two test parameters and methods, Sand Equivalent by ASTM D 2419-74 and Apparent Specific Gravity by ASTM C 127-83, are from ASTM (1991) Volume 04.02, Concrete and Mineral Aggregates.

Methods or practices specified in the ASTM methods should be applied to the transportation, storage, and preparation of samples to maintain the physical state and sample integrity. For example, the preservation of the moisture content of a sample during sampling and handling is critical if moisture content is a parameter to be measured in the laboratory. If sequential tests will be performed on a sample, the tests should be arranged to minimize the possibility that initial testing could irreversibly alter the sample and prevent sample reuse for further testing (EPA 1987a).

Section 9.6.3 of EPA (1987a) includes specific assessments of limitations and precautions applicable to physical parameter tests used at the Hanford Site. These are as follows:

- Moisture Content by ASTM D 2216-80 (ASTM 1992) - Minimize changes in moisture content during sampling, shipping, and handling by sealing the sample or Shelby tube in wax, foil, plastic, or a combination thereof.

- Grain Size (sieve and hydrometer) by ASTM D 422-63 (ASTM 1992) - Grain size determined by the hydrometer method is less reliable for fine-grained than for coarse-grained soil samples. Also, hydrometer analyses may be more sensitive to interferences from hazardous materials in the sample than are sieve analyses.

- Specific Gravity by ASTM D 854-84 (ASTM 1992) - Soil samples containing soluble salts should be slurried in kerosene. This may greatly alter the specific gravity calculated and pose safety hazards. The test is susceptible to errors in measurements of temperatures and weights.

- Specific Gravity (bulk density/porosity of rock) by ASTM C 127-83 (ASTM 1991) - The specific gravity determined from the sample may overestimate the bulk density of the deposit because joints, cavities, and other discontinuities reduce the overall density of natural deposits.

- Capillary Moisture Relationships (moisture retention) by ASTM D 2325-68 (1981) and ASTM D 3152-72 (1977) (ASTM 1992) - The test results are only directly applicable to the capillary moisture relationship of the soil sample tested. Extrapolation of the laboratory data to field or in situ conditions requires engineering judgement.

- Permeability (saturated hydraulic conductivity) by ASTM D 2434-68 (1974) (ASTM 1992) - Laboratory samples are extremely small when compared to natural in situ conditions. Also, samples are disturbed, methods of testing are not universally standardized, and extrapolations of laboratory data to field conditions may be approximate at best. Determinations of the coefficient of permeability are generally considered accurate within an order of magnitude. Estimates of the quantities and rates of flow are only considered accurate within an order of magnitude. Results of a permeability test are best used with proper engineering judgement.

The EPA (1987a) recommends the following laboratory practices: use of standard data sheets; proper record keeping; and use of a sample log. Standard WHC QA

requirements for data sheets, e.g., use of printed forms, and for record keeping are adequate to meet EPA (1987a) recommendations. The sample log should encompass the following activities and data:

- log in samples in a bound record book
- assign a sequential identification number to each sample
- record the sample receipt date
- record the date and location of sample storage
- record the date tested
- record the date of sample disposal.

Chain of custody should be maintained on all samples throughout the process (Section 9.6.6.1, page 9-42, EPA 1987a). Section 9.6.6.1 of EPA (1987a) also recommends that all laboratory record sheets include the identification number, the project name, and project number.

2.2.2 Data Quality Objectives

Key steps in the process of developing data quality objectives (DQO) are identification of the end use of data; identifying the quality of data required; and the amount of data needed. Ideally, the formal DQO development process should be applied to physical parameter testing (EPA 1987b and 1987c). The DQO documents (EPA 1987b and 1987c) provide the following guidance for physical property data:

- Data from physical property analysis of soils are often required for engineering design (EPA 1987b).
- Physical parameter tests are usually Level V or "other" category analytical support (page 4-10, and Table 4-4, EPA 1987b).

The DQO documents (EPA 1987b and 1987c) provide little other guidance regarding the development of DQO for soil physical properties data.

2.2.3 Test Methods For Evaluating Solid Waste

EPA Method 9100 (EPA 1986), Saturated Hydraulic Conductivity, Saturated Leachate Conductivity, and Intrinsic Permeability is directly applicable to measurement of saturated hydraulic conductivity and is referenced in work plan documents for the Fairchild AFB RI/FS (Halliburton NUS 1991a). Section 2.10 of Method 9100, pages 9100-26 and 9100-27 includes sources of error for the laboratory measurement of hydraulic conductivity (EPA 1986). These include:

- Sidewall leakage in fixed-wall permeameters may produce higher than actual values for hydraulic conductivity.

- Shrinkage of the sample in flexible-wall permeameters may result from leachate and sample interaction. The hydraulic conductivity values will then be misleadingly low.
- Errors in sample preparation can cause the measured hydraulic conductivity values to be either too low or too high.

A detailed explanation of the sources hydraulic conductivity measurement errors and methods to minimize them is provided by Olsen and Daniel (1981).

2.2.4 Soil Sampling Quality Assurance User's Guide

Despite the title Soil Sampling Quality Assurance User's Guide (EPA 1984), this document provides little information that is directly applicable to the QA of physical parameter data generated by the analysis of soil samples at the Hanford Site. The document is predominantly concerned with sampling of soils for analysis of chemical constituents.

Sampling of soils for analysis of physical properties is addressed by EPA (1984) only briefly. Static soil properties (physical properties), such as percent clay, bulk density, etc., can have coefficients of variation $< \pm 20\%$ (page 26, EPA 1984). This coefficient of variation can be used to determine the number of samples that should be analyzed to produce data of a desired precision and confidence (Table A-1, Appendix A, EPA 1984).

3.0 STANDARD METHODS

The ASTM has developed standards, e.g., standard practice(s) and test methods, for determination of many physical properties of sediment and soil. These are in the Annual Book of ASTM Standards, Volume 04.08, "Standards Relating to Dimension Stone; Soil and Rock; Geosynthetics" (ASTM 1992), and in the Annual Book of ASTM Standards, Volume 04.02, "Concrete and Mineral Aggregates" (ASTM 1991). ASTM test methods and practices that are used and applicable to Hanford Site CERCLA investigations are listed in Tables 3-1 and 3-2. These were reviewed to determine if ASTM has established specific precision and bias values. The ASTM has published precision values for Standards D 854-91 and D 2216 (Volume 04.08) and Standards C 117-90, C 127-88, C 128-88, and C 136-84 (Volume 04.02). The ASTM has not published any values for method-specific bias for any of the standards in Volumes 04.02 or 04.08 that are used at the Hanford Site.

Table 3-1. ASTM Standards from Volume 04.08 Utilized in Hanford Site CERCLA Investigations for Determination of Physical Properties. (ASTM 1992)

D 421-85	Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants
D 422-63(1990)	Method for Particle-Size Analysis of Soils
D 854-91[a]	Test Method for Specific Gravity of Soils
D 1140-54(1990)	Test Method for Amount of Material in Soils Finer than the No. 200 (75-μm) Sieve
D 2216-90[a]	Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
D 2217-85	Practice for Wet Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants
D 2325-68(1981)	Test Method for Capillary-Moisture Relationships for Coarse- and Medium-Texture Soils by Porous-Plate Apparatus
D 2434-68(1974)	Test Method for Permeability of Granular Soils (Constant Head)
D 3152-72(1977)	Test Method for Capillary-Moisture Relationships for Fine-Textured Soils by Pressure-Membrane Apparatus
D 4373-84(1990)	Test Method for Calcium Carbonate Content of Soils
D 4525-90	Test Method for Permeability of Rocks by Flowing Air

[a]ASTM has established data on precision of this standard.

Table 3-2. ASTM Standards from Volume 04.02 Utilized in Hanford Site CERCLA Investigations for Determination of Physical Properties. (ASTM 1991)

C 117-90[a]	Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing
C 127-88[a]	Test Method for Specific Gravity and Absorption of Coarse Aggregate
C 128-88[a]	Test Method for Specific Gravity and Absorption of Fine Aggregate
C 136-84a[a]	Method for Sieve Analysis of Fine and Coarse Aggregates

[a]ASTM has established data on precision of this standard.

4.0 WHC PROCEDURES

WHC procedures that apply to collection of samples for physical parameter analysis are the environmental investigation instructions (EII) (WHC 1988). EII applicable to sampling and analysis of soils for determination of physical properties include:

- EII 1.5 - Field Logbooks
- EII 1.7 - Indoctrination, Training, and Qualification
- EII 5.1 - Chain of Custody
- EII 5.2 - Soil and Sediment Sampling
- EII 5.4 - Field Decontamination of Drilling, Well Development and Sampling Equipment
- EII 5.7A - Hanford Geotechnical Sample Library Control
- EII 5.11 - Sample Packaging and Shipping
- EII 9.1 - Geologic Logging
- EII 14.1 - Analytical Laboratory Data Management."

The above EII provide adequate QA/QC for sampling, handling, and shipping of samples for physical parameter measurements. However, EII 14.1, Analytical Laboratory Data Management, may not be entirely applicable to management of geotechnical physical parameter data.

The onsite analyses of samples for physical parameters are conducted in accordance with the Geotechnical Engineering (GE) Procedures Manual (WHC 1991), which is subordinate to the EII manual (WHC 1988). The GE procedures manual does not address laboratory chain of custody and record keeping from sample receipt through to sample disposition at the end of testing. Four of the GE procedures: GEL-04,

Rev. 1; GEL-22, Rev. 0; GEL-23, Rev. 0; and GEL-27, Rev. 0; reference Quality Assurance Plan for Geotechnical Engineering for QA requirements. However, that document does not exist. In the four GE procedures, references to the QA plan for GE should be deleted and QA requirements revised. The other 25 GE procedures by WHC (1991) refer to EII 1.5, Field Logbooks, EII 1.6, Records Management, and GEL-01, Geotechnical Engineering Laboratory Control for QA requirements. The QA requirements section of the GE procedures should be updated to include the following:

- EII 5.1 - Chain of Custody
- EII 5.7A - Hanford Geotechnical Sample Library Control
- WHC-SD-EN-QAPP-002 - Environmental Technology Group Solids Characterization and Barriers Laboratory Quality Assurance Project Plan" (WHC 1992).

Chain of custody, sample and data flow, sample archival and disposal are addressed by WHC (1992) by reference to EII.

The GE procedures that address physical parameter testing often reference ASTM Standards from Volume 04.02, Concrete and Mineral Aggregates, not Volume 04.08, Dimension Stone, Soil and Rock, Geosynthetics. It may be appropriate to conduct a technical assessment and determine if ASTM Standards from Volume 04.08 should be used in the future.

5.0 CONCLUSIONS

The Region 10 EPA policy regarding QA/QC for sampling, handling, and analysis of physical parameter samples is to use standard methods, such as ASTM, and perform duplicate analyses for moisture content analyses.

There are no sample preservation requirements identified for the physical parameter samples except for samples that will be analyzed for moisture content. Samples that will be tested for moisture content must be sampled, handled, and packaged to prevent desiccation. There are no holding time requirements for physical parameter samples.

QC samples, i.e., replicate samples are recommended (EPA 1984) in the determination of physical parameters. At Fairchild AFB, field duplicates will be collected from soil borings at a 25% frequency for analysis of bulk density and grain size (Halliburton NUS 1991b). Field duplicates will not be collected from Shelby tube or from test pits samples (Halliburton NUS 1991b). At Fairchild AFB, duplicate samples will be analyzed on a 10% frequency when ASTM D 2216 percent moisture analyses are performed. Acceptance criteria for the data are stated as "precision within current control limits" (Halliburton NUS 1991a).

Specific guidance on analytical precision is available for six ASTM test methods. General guidance for the number of samples needed for a particular confidence level and precision is provided by EPA (1984). The WHC EII (WHC 1988) provide adequate QA/QC for sampling, handling, and shipping of physical parameter samples.

The Geotechnical Engineering Procedures Manual (WHC 1991) should be evaluated regarding laboratory chain of custody, scheduling of sequential analyses on individual samples, laboratory sample tracking, and use of ASTM Standards intended for aggregate in the analysis of soils. References to WHC-EP-0362, which does not exist, in the Geotechnical Engineering procedures, should be deleted and the QA requirements section of the procedures revised accordingly.

6.0 REFERENCES

American Society for Testing And Materials (ASTM), 1992 Annual Book of ASTM Standards, Section 4, Volume 04.08, Standards Relating to Dimension Stone; Soil and Rock; Geosynthetics.

American Society for Testing And Materials (ASTM), 1991 Annual Book of ASTM Standards, Section 4, Volume 04.02, Concrete and Mineral Aggregates.

EPA, see U.S. Environmental Protection Agency.

Halliburton NUS, 1991a, Installation Restoration Program (IRP) Remedial Investigation/Feasibility Study, Sampling and Analysis Plan Addendum for Priority One Operable Units, Volume I: Quality Assurance Project Plan (Revision V), Fairchild Air Force Base, Washington, December 1991, Final, Halliburton NUS Environmental Corporation, Pittsburgh, Pennsylvania.

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Olsen, R. E., and D. E. Daniel, 1981, Measurement of the Hydraulic Conductivity of Fine-Grained Soils in "Permeability and Ground Water Transport", eds. T. F. Zimmie and C. O. Riggs, ASTM Special Publication 746, p. 18 - 64.

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Laboratory Quality Assurance Project Plan, WHC-SD-EN-QAPP-002, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991, Geotechnical Engineering Procedure Manual, WHC-IP-0635, Westinghouse Hanford Company, Richland, Wahsington.

WHC, 1988, Environmental Investigations and Site Characterization Manual, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington.

U.S. Environmental Protection Agency, 1987a, A Compendium of Superfund Field Operations Methods, EPA/540/P-87/001, Washington, D.C.

U.S. Environmental Protection Agency, 1987b, Data Quality Objectives for Remedial Response Activities, Development Process, EPA/540/G-87/003, Washington, D.C.

U.S. Environmental Protection Agency, 1987c, Data Quality Objectives for Remedial Response Activities, Example Scenario, EPA/540/G-87/004, Washington, D.C.

U.S. Environmental Protection Agency, 1986, Test Methods for Evaluating Solid Waste - Physical Chemical Methods, Third Edition (Revised), SW-846, Washington, D.C.

U.S. Environmental Protection Agency, 1984, Soil Sampling Quality Assurance User's Guide, EPA-600/4-84-043, Washington, D.C.

APPENDIX A

FAIRCHILD AIR FORCE BASE CERCLA WORK PLAN EXCERPTS

R-49-8-91-17

INSTALLATION RESTORATION PROGRAM (IRP)

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

SAMPLING AND ANALYSIS PLAN ADDENDUM FOR PRIORITY ONE OPERABLE UNITS

VOLUME I: QUALITY ASSURANCE PROJECT PLAN (REVISION V)

FAIRCHILD AIR FORCE BASE
WASHINGTON

HALLIBURTON NUS ENVIRONMENTAL CORPORATION
FOSTER PLAZA 7
661 ANDERSEN DRIVE
PITTSBURGH, PENNSYLVANIA 15220

DECEMBER 1991

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ENVIRONMENTAL RESTORATION DIVISION (ESO-ER)
BROOKS AIR FORCE BASE, TEXAS 78235-5000

HALLIBURTON NUS
Environmental Corporation

TABLE 1.5.2
SAMPLE CONTAINERS, PRESERVATION METHODS, AND HOLDING TIMES (SOIL)(a)
FAIRCHILD AFB

METHOD	PARAMETER	CONTAINER MATERIAL	SAMPLE VOLUME	PRESER-VATION	HOLDING TIME
SW8240	VOCs	Wide-mouth glass jar with Teflon-lined lid (b)	120 ml (4 oz)	4 C	14 days
SW8270	Semivolatiles	Wide-mouth glass jar with Teflon-lined lid (b)	120 ml (4 oz)	4 C	Extract 7 days; analyze 40 days
SW8080	Pesticides/ PCBs	Wide-mouth glass jar with Teflon-lined lid (b)	120 ml (4 oz)	4 C	Extract 7 days; analyze 40 days
EPA 418.1	Petroleum Hydrocarbons	Glass	240 ml (8 oz)	4 C	28 days
SW6010	Metals (except Hg)	Wide-mouth glass jar with Teflon-lined lid	240 ml (8 oz)	4 C	6 months
SW7471	Hg	Wide-mouth glass jar with Teflon-lined lid	240 ml (8 oz)	4 C	28 days
SW7420	Lead	Wide-mouth glass jar with Teflon-lined lid	240 ml (8 oz)	4 C	6 months
SW9010	Cyanide	Glass	8 oz	4 C	14 days
Fed Register Vol 51, No. 114, 13 Jun 86	TCLP	Glass	32 oz	4 C	(c)
ASTM D4222	Grain Size	Glass	32 oz	None	None
29-3.5.3 (d)/ EPA 351.3/ EPA 350.2/ E365.2	TOC/ Kjeldahl-N Ammonia-N Total P	Glass	8 oz	4 C	28 days
Chapter 9 (d)	Bulk Density	Glass	32 oz	None	None
SW9100	Permeability	Shelby Tube	----	None	----
ASTM D4318	Atterberg Limits	Shelby Tube	----	None	None

TCLP - Toxic Characteristics Leaching Protocol
(a) From IRP Analytical Protocols, March 1988
(b) Amber sample containers are used or containers are wrapped in aluminum foil.
(c) TCLP holding times: VOCs - 14 days to TCLP Extraction, 14 days from extraction to analysis.
Semi VOCs - 14 days to TCLP extraction; 7 days from TCLP to preparative extraction; 40 days from preparative extraction to analysis
Metals - 180 days to TCLP extraction; 180 days from TCLP extraction to analysis
Mercury - 28 days to TCLP extraction; 28 days from TCLP extraction to analysis
(d) Methods of Soil Analysis, American Society of Argronomy

TABLE 1.10-1 SUMMARY OF INTERNAL QUALITY CONTROL PROCEDURES
FAIRCHILD AFB

ANALYTICAL METHOD	PARAMETER	QUALITY CONTROL CHECK	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
ASTM D2216	Percent Moisture	LABORATORY QUALITY CONTROL:			
		Duplicates	10%	Precision within current control limits. (C)	Reanalyze the duplicate and spotcheck 25% of the positive sample results.

(a) Reference: Methods for the Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Revised, March 1983.
or
Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, EPA 600/4-82-057, July 1982.

(b) Reference: Test Methods for Evaluating Solid Waste, USEPA SW-846, 3rd Edition, November 1986.

(c) Control limits are specified on Table 1.13-1.

R-49-8-91-17

INSTALLATION RESTORATION PROGRAM (IRP)

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

SAMPLING AND ANALYSIS PLAN ADDENDUM FOR PRIORITY ONE OPERABLE UNITS FT-1, IS-1, OU-1, SW-1 AND WW-1

VOLUME II: FIELD SAMPLING PLAN

FAIRCHILD AIR FORCE BASE
WASHINGTON

HALLIBURTON NUS ENVIRONMENTAL CORPORATION
FOSTER PLAZA 7
661 ANDERSEN DRIVE
PITTSBURGH, PENNSYLVANIA 15220

DECEMBER 1991

FINAL

PREPARED FOR
HEADQUARTERS STRATEGIC AIR COMMAND
COMMAND CIVIL ENGINEER (HQ SAC/DE)
OFFUTT AIR FORCE BASE, NEBRASKA 68113-5001

UNITED STATES AIR FORCE
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)
ENVIRONMENTAL RESTORATION DIVISION (ESO-ER)
BROOKS AIR FORCE BASE, TEXAS 78235-5000

HALLIBURTON NUS
Environmental Corporation

TABLE 1A-1
PROPOSED SAMPLING PROGRAM - FT-1
FAIRCHILD AFB, WASHINGTON

Number(1) of Samples	Field Duplicates	Equipment Rinsate Blanks	Ambient Condition Blanks	Trip Blanks	Analyses	Source of Analysis	Analytical Option	Number of Containers per Sample	Container Type	Preservation Requirements	Holding Times
SOIL BORINGS											
27	3	3	3	1 per day	TCL VOC's	NUS Lab	II	1	Calif. Sampler	Cool to 4° C	14 days to analysis
27	3	3	0	0	TPH	NUS Lab	I	1	8 oz. wide mouth glass jar	Cool to 4° C	28 days
5	1	1	0	0	PCB's & Pesticides	NUS Lab	II	1	8 oz. wide mouth glass jar	Cool to 4° C	7 days to extraction; 40 days to analysis
9	1	1	0	0	TCL Semi VOC's	NUS Lab	II	1	8 oz. wide mouth glass jar	Cool to 4° C	7 days to extraction; 40 days to analysis
9	1	1	0	0	TAL Metals/ Cyanide (2)	NUS Lab	II	1	8 oz. wide mouth glass jar	Cool to 4° C	180 days; Hg 28 days Cn 14 days
4	1	0	0	0	TCLP: TCL VOC's	NUS Lab	I	1	32 oz. wide mouth glass jar	none	(3)
4	1	0	0	0	TCLP: TCL Semi VOC's	NUS Lab	I	1	32 oz. wide mouth glass jar	none	(3)
4	1	0	0	0	TCLP: TAL Metals	NUS Lab	I	1	32 oz. wide mouth glass jar	none	(3)
4	1	0	0	0	Grain Size	NUS Lab	I	1	32 oz. wide mouth glass jar	none	none
4	1	0	0	0	TOC	NUS Lab	I	1	8 oz. wide mouth glass jar	Cool to 4° C	28 days
4	1	0	0	0	Bulk Density	NUS Lab	I	1	32 oz. wide mouth glass jar	none	none
4	1	0	0	0	Kjeldahl Nitrogen	NUS Lab	I	1	8 oz. wide mouth glass jar	Cool to 4° C	28 days
4	1	0	0	0	Ammonia Nitrogen	NUS Lab	I	1	8 oz. wide mouth glass jar	Cool to 4° C	28 days
4	1	0	0	0	Total Phosphorus	NUS Lab	I	1	8 oz. wide mouth glass jar	Cool to 4° C	28 days

TABLE 1A-6

PROPOSED SAMPLING PROGRAM - SW-1
FAIRCHILD AFB, WASHINGTON

Number(1) of Samples	Field Duplicates	Equipment Rinsate Blanks	Ambient Condition Blanks	Trip Blanks	Analyses	Source of Analysis	DQO Level	Number of Containers per Sample	Container Type	Preservation Requirements	Holding Times
TEST PITS											
16	2	2	2	1 per day	TCL VOC's	NUS Lab	II	2	4 oz. jar	Cool to 4° C	14 days to extraction
16	2	2	0	0	TAL Metals/Cyanide	NUS Lab	II	1	8 oz. wide mouth glass jar	Cool to 4° C	180 days; Hg 28 days; Cn 14 days
4	1	0	0	0	TCLP: TCL VOC's	NUS Lab	I	1	32 oz. wide mouth glass jar	none	(2)
4	1	0	0	0	TCLP: TCL Semi VOC's	NUS Lab	I	1	32 oz. wide mouth glass jar	none	(2)
4	1	0	0	0	TCLP: TAL Metals/Cyanide	NUS Lab	I	1	32 oz. wide mouth glass jar	none	(2)
4	0	0	0	0	Grain Size	NUS Lab	I	1	32 oz. wide mouth glass jar	none	none
4	1	0	0	0	TOC	NUS Lab	I	1	8 oz. wide mouth glass jar	Cool to 4° C	28 days
4	0	0	0	0	Bulk Density	NUS Lab	I	1	32 oz. wide mouth jar	none	none
SHELBY TUBE											
4	0	0	0	0	Permeability	NUS Lab	I	1	Shelby tube	none	none
4	0	0	0	0	Density	NUS Lab	I	1	Shelby tube	none	none
4	0	0	0	0	Grain Size	NUS Lab	I	1	32 oz. Shelby tube	none	none
4	0	0	0	0	Atterberg Limits	NUS Lab	I	1	32 oz. Shelby tube	none	none
SURFACE SOIL											
10	1	1	1	1	TCL VOC's	NUS Lab	II	2	4 oz. jar	Cool to 4° C	14 days to extraction
10	1	1	0	0	TCL Semi VOC's	NUS Lab	II	1	8 oz. wide mouth glass jar	Cool to 4° C	7 days to extraction; 40 day to analysis
10	1	1	0	0	PCB's & Pesticides	NUS Lab	II	1	8 oz. wide mouth glass jar	Cool to 4° C	7 days to extraction; 40 to analysis

INSTALLATION RESTORATION PROGRAM

PRIORITY 2 SITES

WORK PLAN

FAIRCHILD AIR FORCE BASE
WASHINGTON

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DECEMBER 1990

DRAFT

PREPARED FOR:

HEADQUARTERS STRATEGIC AIR COMMAND
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UNITED STATES AIR FORCE
HUMAN SYSTEMS DIVISION (HSD/YAQI)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

Table A-2
Analytical Methods and Analyses Per Area

WATER SAMPLE PARAMETERS	METHOD (a)	IS-3	SW-6	SW-10	SW-11	SW-12	SW-13
Volatile Organics	SW5030/SW8240 (b)	X	-	X	X	-	X
Semi-Volatile Organics	SW3510/SW8270	X	-	X	X	-	X
Petroleum Hydrocarbons	E418.1	X	-	X	X	-	X
Oil and Grease	E413.2	-	-	X	X	-	X
Total Disolved Solids	E160.1	-	X	-	-	-	-
Metals Analyses (c)	SW3005/SW6010	-	-	X	X	-	X
Pb	SW3005/SW7421	-	-	X	X	-	X
Cd	SW3005/SW7131	-	-	-	-	-	-
Gross Alpha & Gross Beta (Total, suspended, and dissolved)	A703	-	X	-	-	-	-
Temperature	E170.1	X	X	X	X	-	X
Conductance	E120.1	X	X	X	X	-	X
pH	E150.1	X	X	X	X	-	X
SOIL & SEDIMENT SAMPLE PARAMETERS							
Aromatic & Halogenated VOCs	SW8240	X	-	-	X	-	-
Semi-VOCs	3550/8270	X	-	-	-	-	X
Petroleum Hydrocarbons	SW3550/E418.1	X	-	-	X	-	X
Oil and Grease	SW3550/E413.2	-	-	-	X	-	-
Lead	SW3050/SW7420	-	-	-	-	-	-
TCLP	(d)	-	-	-	-	-	X
Soil Moisture Content	ASTM D2216	-	X	-	X	-	X
Gross Alpha & Gross Beta	ASTM D6438	-	X	-	-	-	-

(a) Detection limits are specified in the Sampling and Analysis Plan. Limits are "method detection limits" determined by the laboratory in accordance with the EPA procedure published in the FEDERAL REGISTER, VOL. 49, NO. 209, 26 OCTOBER 1984, pg. 199.
(b) Second-column confirmation on samples with a first-column detection up to 50% of total samples.
(c) Metals analyses will include unfiltered samples only.