1 of 1

F/H SEEPAGE BASIN GROUNDWATER INFLUENT, EFFLUENT, PRECIPITATED SLUDGE CHARACTERIZATION TASK TECHNICAL PLAN

by
J. L. Siler

Savannah River Site
Aiken, South Carolina 29808

DISCLAIMER

DOE Contract No. **DE-AC09-89SR18035**

This paper was prepared in connection with work done under the above contract number with the U. S. Department of Energy. By acceptance of this paper, the publisher and/or recipient acknowledges the U. S. Government's right to retain a nonexclusive, royalty-free license in and to any copyright covering this paper, along with the right to reproduce and to authorize others to reproduce all or part of the copyrighted paper.

DISCLAIMER

WESTINGHOUSE SAVANNAH RIVER COMPANY
SAVANNAH RIVER TECHNOLOGY CENTER

WSRC-RP-93-941, Rev. 1

Keywords: F/H Seepage Basin
Facility, Filtration,
Groundwater Remediation

October 29, 1993

CC: W. L. Tamosaitis, 773A
J. P. Bibler, 773A
P. E. Lowe, 773-42A
L. M. Nelson, 773-43A
R. N. Strom, 773-42A
J. A. Adams, CCC4
B. T. Butcher, CCC4
M. E. Gorden, CCC4
C. M. Lewis, CCC4
B. A. Hamm, CCC4
B. G. Schappell, CCC4
S. M. Serkiz, CCC4
M. R. Welty, CCC4
SRTC Records (4)

To: R. H. Hsu, 773-43A

From: J. L. Siler, 773-43A JLS

F/H SEEPAGE BASIN GROUNDWATER INFLUENT, EFFLUENT, AND PRECIPITATED SLUDGE CHARACTERIZATION TASK TECHNICAL PLAN(U)

1.0 INTRODUCTION

The Environmental Restoration (ER) Department is responsible for environmental remediation projects on Site. ER requested Interim Waste Technology Section (IWTS) to conduct a treatability study in support of the development of a remediation system which would reduce the contaminant levels in groundwater removed from the aquifers in the vicinity of the F/H seepage basins and southwest corner of the Mixed Waste Management Facility (MWMF). This work

was discussed in reports by M. R. Poirier (1992) and J. P. Bibler (1991). Poirier's work concluded that neutralization followed by ceramic micro filtration reduced the contaminant levels sufficiently. pH adjustment with NaOH to 6-8 used in conjunction with aluminum sulfate resulted in the greatest number of ions being precipitated.

The project has been re-baselined (following negotiations with SCDHEC) from one central treatment system for both areas to two smaller systems to treat F and H Areas separately. The two systems will have smaller capacities, but will be able to come on-line quicker.

The original work done by Poirier (1992) and Bibler (1991) dealt with a composite groundwater stream from F and H Area. No data has been generated on the precipitate characteristics of segregated streams. This need was the driving force for this task plan.

The purpose of this task is to determine whether precipitated sludge generated from the proposed remediation system will be hazardous as defined by RCRA. Several contaminants, such as lead and mercury, are above the groundwater protection standards (GWPS). The presence of radionuclides and other contaminants in the sludge does not present a problem, provided that the sludge can pass the Toxicity Characteristic Leaching Procedure (TCLP) test. Other goals that will be pursued in the study will be outlined in Section 3.0.

A final treatment technology has not been established for the re-baseline project. This study has been developed in such a manner as to cover the possible range of treatment options that may be used. A 0.45 Millipore filter disk will be used to conduct the filtration. This filter option should provide the best laboratory performance for the quantity of well water to be sampled, treated, and analyzed. Aluminum sulfate will be used as a flocculant as recommended by Bibler (1991).

Wells for this sludge study are listed in Table 1.

Table 1. Groundwater Wells to be used for the Sludge Study.

F Area	H Area
FSB 78	HSB 101D
FSB 93D	HSB 104D
FSB 97D	HSB 105D
FSB 98D	HSB 107D
FSB 109D	HSB 108D

This well selection is representative of the metal plumes and will

provide appropriate worst-case data.

An additional technology will be evaluated during this testing, if time permits. Reverse osmosis (RO) will be evaluated on the two composite samples. A lab-scale unit is avaliable in SRTC to study this problem.

2.0 TASK DELIVERABLES

Reports

Reports documenting the results of this research project will be compiled as internal WSRC reports. These reports will be received by ER and other appropriate organizations. The reports will be issued a WSRC-RP-#, and will be given permanent retention status.

3.0 TASK REQUIREMENTS

The requirements of this task are to:

- characterize the extracted and treated groundwater
- determine decontamination factors for the pH adjusted filtration, with and without alum
- determine whether the precipitated groundwater sludge is hazardous by performing the TCLP test (or approved analog) on the sludge
- perform a material balance on the influent, sludge, and effluent
- compare the sludge characteristics to the Waste Acceptance Criteria of the E-Area Vaults
- determine if the solids generated from drying the sludge will present a dusting problem
- compare (if equipment permits) analytical data generated on Site using inductively coupled plasma mass spectrophotometrometer (ICP-MS) to the off-Site EPA-approved methods
- collect groundwater samples for a settling experiment which will represent a shutdown condition of the treatment units (actual experiment to be performed under separate Task Technical Plan)
- perform a radionuclide characterization of the sludge so that shielding calculations for the B-12 containers can be performed

• evaluate the use of RO for removing salts and metals from the composite groundwater samples. This work will be performed as long as results from the filtration work are not impacted

4.0 TASK PREREQUISITES

Task Technical Plan

This task plan will be reviewed by ER. IWTS, ADS, AND ER will approve this Task Technical Plan.

Task QA Plan

IWTS will generate a Task QA Plan to support this Task Technical Plan. IWTS and SRTC-QS will approve the Task QA Plan. No special training is necessary. Chain of custody will be addressed in the Task QA Plan.

Procedure(s)

IWTS will generate the required procedure(s) for operation of the test equipment. IWTS will approve the procedure(s).

5.0 TASK ACTIVITIES AND DESCRIPTION

Experimental Procedure Outline

The experimental studies to be conducted will be performed in laboratory B-122 for the actual groundwater. The test solution will be actual wellwater from the F/H Area wells. All samples will be submitted for analysis in duplicate to SRTC and offsite laboratories. Listed below is the experimental procedure (see Figure 1 for a schematic representation).

Step 1. PROCURE WELL WATER - Individual well samples from H area will be obtained from the wells designated in Table 1. The samples will be taken by EMS, and then given to IWT TAs at the work site. IWT-TAs will record the actual process and information on all personnel involved in the sampling process in a logbook. Approximately five gallons of groundwater will be withdrawn from each well. The exact amount may vary once the actual sampling and testing begin. Containers will be provided by SRTC.

Step 2. COMPOSITE SAMPLE PREPARATION AND CHARACTERIZATION - The IWT TAs will generate the composite samples while in the field and place the samples in all appropriate containers for analysis. An example of "appropriate container" would be

zero-head-space vials for VOCs analyses. The IWT TAs will disinfect the composite samples with chlorine. An adequate portion of the composite will be submitted for Total Solids (TS), Total Dissolved Solids (TDS), and Total Suspended Solids (TSS). Adequate portions of the composite sample will also be submitted for analysis to test for specific constituents as outlined in Table 2.

Step 3. PROPORTION COMPOSITE SAMPLE - Split each composite into four parts. One part will consist of 4 gallons of groundwater to be used in the settling experiment to be defined under another task plan. The remainder of the volume of the composites will be equally divided into three subcomposites. Each of these subcomposites will be used in Steps 4a, 4b, and 4c.

Step 4. EXPERIMENTAL WORK - Each of the three equally divided subcomposites generated in Step 3 will undergo a specific treatment. The treatments are as follows:

a. One subcomposite will undergo aluminum sulfate addition, pH adjustment, flocculation, and filtration.

b. One subcomposite will undergo pH adjustment and filtration.

c. One subcomposite will be spiked with designated amounts of TCLP constituents and then treated by filtration and pH adjustment.

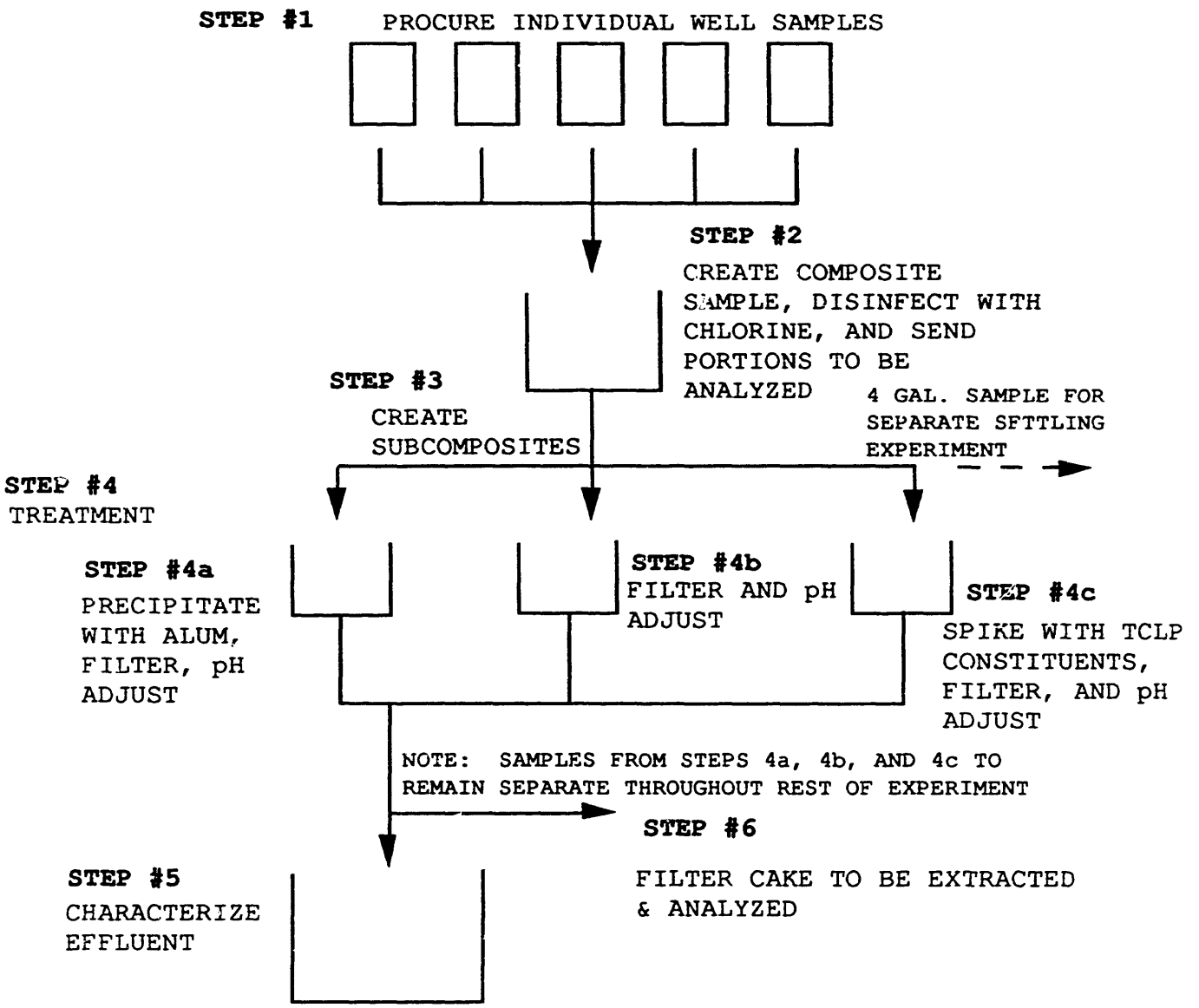
Step 5. EFFLUENT CHARACTERIZATION - Adequate portions of each effluent generated in Steps 4a, 4b, and 4c will be submitted for analysis for TS, TDS, and TSS. Adequate portions of the composite sample will also be submitted for analysis to test for specific constituents as outlined in Table 2.

Step 6. SOLIDS CHARACTERIZATION - Extract approximately 1.5 g of solids collected in steps 4a,b, and c using a modified TCLP procedure (ADS performs this test - similar to the TCLP procedure). The extracted solution is then sent to the off-site vendor for TC (Toxicity Characteristic) metals analysis (ADS handles the contract).

Step 7. RO TESTING - RO will be evaluated on the composite samples to determine the removal efficiency for the RCRA metals and salts. This testing will not impact the filtration work.

Steps 1 through 7 should be repeated for designated wells in F Area.

Figure 1. Diagram of Experimental Protocol



OVERALL SUMMARY OF PROCEDURE:

INFLUENT →	PRECIPITATE →	FILTER →	EFFLUENT
TS TSS TDS APPENDIX 9 ICP/MS LOW LEVEL COUNT RAD COUNT BOD COD	PH ADJUST WITH NITRIC ACID. ADD ALUM & ADJUST PH TO 7	EXTRACT CAKE FOR TC METALS COMPLETE DIGESTION	TS TSS TDS APPENDIX 9 ICP/MS LOW LEVEL COUNT RAD COUNT BOD COD

ANALYSES TO BE PERFORMED - The characterization to be performed on the composite samples, filtrates, and solids (in addition to the tests described in steps 3, 5, and 6), involves:

A. Appendix 9 analyses (offsite - certified)
B. ICP/MS (SRTC -- if possible - not certified)
C. off-Site EPA-approved method for TCLP metals analyses
D. low-level counting (SRTC - certified)
E. radionuclide content (offsite - certified)
F. biological oxygen demand (BOD) [offsite - certified]
G. chemical oxygen demand (COD) [offsite - certified]

Table 2 provides details as to what analyses will be used to detect each constituent, where the analyses will be conducted, and at the appropriate step the analyses will occur.

NOTE: Duplicate samples will be submitted for all analyses.

Experimental Logistics

These experiments will be conducted by J. L. Siler and IWT technicians using procedures/instructions. Data collected will be entered on data sheets by the technicians and also in a laboratory notebook by J. L. Siler.

The work with actual groundwater will be performed in the 773-A, B-122 laboratory. All onsite samples will be analyzed by ADS per QA Implementation Manual, 1Q31-3. Off-Site analyses will be handled by ADS.

6.0 EXPERIMENTAL ACTIVITIES

The following preliminary schedule outlines the experimental plan to be conducted:

1. Obtain samples from selected wells (August).

2. Perform precipitation experiments (August and September).

3. Report analytical results (February 1, 1994).

CHANGES TO THE TASK TECHNICAL PLAN

Minor changes to this task technical plan will be noted in laboratory notebook #WSRC-NB-90-256. Major revisions will result in a revised task technical plan.

7.0 REFERENCES

Bibler, J. P., "Treatability Studies on F/H-Area Groundwater Composite(U)", WSRC-RP-91-1030, October 29,1991.

Poirier, M. R., "Testing of Filter Technologies for the Remediation of F/H Area Seepage Basin Groundwater", WSRC-RP-92-597, May 4, 1992.

Table 2. Constituents to be Analyzed

Constituent	Analysis	SRTC/Offsite	Step
Organics			
Benzene	GC/MS	both	2,5,6
Chloroethylene	GC/MS	both	2,5,6
Dichloroethylene	GC/MS	both	2,5,6
Dissolved organic carbon	Filter then TC	both	2,5,6
Methylene chloride	GC/MS	both	2,5,6
Phenols	GC/MS	both	2,5,6
Tetrachloroethylene	GC/MS	both	2,5,6
Total Organic Carbon	TC/IC	both	2,5,6
Trichloroethylene	GC/MS	both	2,5,6
Trichlorflouromethane	GC/MS	both	2,5,6
Bis(2-ethyl(hexyl))Phlalate	GC/MS	both	2,5,6
Metals			
Aluminum	ICP/MS & AppIX	both	2,5,6
Antimony	ICP/MS & AppIX	both	2,5,6
Arsenic	ICP/MS & AppIX	both	2,5,6
Barium	ICP/MS & AppIX	both	2,5,6
Cadmium	ICP/MS & AppIX	both	2,5,6
Calcium	ICP/MS & AppIX	both	2,5,6
Chromium	ICP/MS & AppIX	both	2,5,6
Cobalt	ICP/MS & AppIX	both	2,5,6
Copper	ICP/MS & AppIX	both	2,5,6
Cyanide	ICP/MS & AppIX	both	2,5,6
Dissolved inorganic carbon	Filter then IC	both	2,5,6
Mercury	ICP/MS & AppIX	both	2,5,6
Lead	ICP/MS & AppIX	both	2,5,6
Manganese	ICP/MS & AppIX	both	2,5,6
Magnesium	ICP/MS & AppIX	both	2,5,6
Nickel	ICP/MS & AppIX	both	2,5,6
Chloride	IC & AppIX	both	2,5,6
Fluoride	IC & AppIX	both	2,5,6
Iron	ICP/MS & AppIX	both	2,5,6
Nitrate	IC & AppIX	both	2,5,6
Potassium	AA & AppIX	both	2,5,6
Selenium	ICP/MS & AppIX	both	2,5,6
Silver	ICP/MS & AppIX	both	2,5,6
Silica	ICP/MS & AppIX	both	2,5,6
Sodium	ICP/MS & AppIX	both	2,5,6
Sulfate	IC & AppIX	both	2,5,6
pH	pH meter	both	2,5,6
Thallium	IC & AppIX	both	2,5,6

Total Phosphates	EPA method	both	2,5,6
Tributyl phosphate	Oil & Grease	SRTC	2,5,6
Vanadium	ICP/MS & AppIX	both	2,5,6
Zinc	ICP/MS & AppIX	both	2,5,6
Tin	ICP/MS & AppIX	both	2,5,6
Radionuclides			
Total Uranium	EPA method	Off	2,5,6
U-233	EPA method	Off	2,5,6
U-234	EPA method	Off	2,5,6
U-235	EPA method	Off	2,5,6
U-236	EPA method	Off	2,5,6
U-238	EPA method	Off	2,5,6
Pu-238	EPA method	Off	2,5,6
Pu-239	EPA method	Off	2,5,6
Pu-240	EPA method	Off	2,5,6
Pu-241	Calculations	SRTC	2,5,6
Pu-242	Calculations	SRTC	2,5,6
Tritium (H-3)	EPA method	Off	2,5,6
Ra-226	EPA method	Off	2,5,6
Ra-228	EPA method	Off	2,5,6
Total Ra	EPA method	Off	2,5,6
Sr-90	EPA method	Off	2,5,6
I-129	EPA method	Off	2,5,6
Cs-137	EPA method	Off	2,5,6
Co-60	EPA method	Off	2,5,6
Cu-244	EPA method	Off	2,5,6
Tc-99	EPA method	Off	2,5,6
Th-228	EPA method	Off	2,5,6
Th-232	EPA method	Off	2,5,6
Th-234	EPA method	Off	2,5,6
Am-241	EPA method	Off	2,5,6
Am-243	Calculations	SRTC	2,5,6
C-14	EPA method	Off	2,5,6
Nb-94	EPA method	Off	2,5,6
Ni-59	EPA method	Off	2,5,6
Np-237	EPA method	Off	2,5,6
Se-79	EPA method	Off	2,5,6
Rb-87	EPA method	Off	2,5,6
Gross alpha	EPA method	Off	2,5,6
Gross nonvolatile beta	EPA method	Off	2,5,6
Cm-243	EPA method	Off	2,5,6
U-233	EPA method	Off	2,5,6
Ac-228	EPA method	Off	2,5,6
Sr-89	Calculations	SRTC	2,5,6
Th-230	EPA method	Off	2,5,6
Cm-242	EPA method	Off	2,5,6

Cm-243/244	EPA method	Off	2,5,6
Cm-246	EPA method	Off	2,5,6
Count pre-digested solids	EPA method	SRTC	2,5,6
Other			
Solids content	TS, TDS, TSS	SRTC	2,5,6
Particle size distr.	Size Analyzer	SRTC	2,5,6
BOD	EPA method	Off	2,5,6
COD	EPA method	Off	2,5,6
Determine oxidation state of chronium	EPA method	Off	2,5,6
Modified TCLP	Acetic Acid Ext.	SRTC/Off	6

REVIEW AND APPROVALS

Reviewed by:

M. R. Welty, Project Engineer, ER — Date: 11/1/93

Approved by:

B. T. Butcher, Manager, ERG-Central — Date: 11/1/93

R. H. Hsu, Manager, IWTS — Date: 10/29/93

P. F. Cloessner, Manager, ADS — Date: 11/1/93

J. C. Griffin, Manager, ADS — Date: 11/1/93

DATE
FILMED
1/24/94
END