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1	/	Cog.Eng. DA Burbank	<i>DA Burbank</i>	9/22/94	6-47	J. A. Hunter	<i>J. A. Hunter</i>	9/26/94	L5-31	1	/
1	/	Cog. Mgr. CA Petersen	<i>CA Petersen</i>	9/26/94	6-47	Kristofzski	<i>Kristofzski</i>	10/3/94	T6-09 06	1	/
1	/	QA H. Spanheimer	<i>H. Spanheimer</i>	9-27-94	6-47	O. L. Kruger	<i>O. L. Kruger</i>	9/26/94	H5-33	1	/
1		Safety 377 Bldg.	N/A	9/26/94		M. J. Schliebe	<i>M. J. Schliebe</i>	9/29/94	S4-25	1	/
1		Env. 377 Bldg.	N/A	9/26/94		J. A. Swenson	<i>J. A. Swenson</i>	9/26/94	G6-45	1	/
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1	/	TL Erickson	<i>TL Erickson</i>	9/26/94	H5-33	T. L. Yount	<i>T. L. Yount</i>	9/26/94	G6-47	1	/

18. Signature of EDT Originator <i>DA Burbank</i> Date 9/22/94	19. Authorized Representative Date for Receiving Organization _____ _____ _____	20. Cognizant Manager <i>CA Petersen</i> Date 9/22/94	21. DOE APPROVAL (if required) Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments
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WHC Information Release Administration Specialist:

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WHC-SD-W100-AP-002

REV. 0

183-H BASIN SLUDGE TREATABILITY
TESTING PROGRAM PLAN

D. A. BURBANK
SEPTEMBER 1994

WHC-SD-W100-AP-002
REV. 0

183-H BASIN SLUDGE TREATABILITY
TESTING PROGRAM PLAN

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183-H BASIN SLUDGE TREATABILITY TESTING PROGRAM PLAN

1.0 PURPOSE

This document outlines the scope, data objectives, plan of action, responsibilities, cost, and schedule of a program to perform hot treatability testing on 183-H basin sludge samples. This plan is the top-level planning document for this activity.

2.0 SCOPE

This program will provide treatability test results to support the detailed design of the Waste Receiving and Processing Module 2A (WRAP 2A) particulate in grout treatment system. It will not determine operability windows or quality control limits, but will serve to demonstrate the viability of the process concept and selected formulation. Additional hot treatability testing will be necessary to verify the ranges and limits developed in the process model through cold surrogate testing.

3.0 BACKGROUND

Closure activities at the 183-H basins have generated over 12,000 drums of mixed waste. These drums are currently stored at the Hanford Central Waste Complex (CWC), awaiting the construction of the WRAP 2A low level mixed waste treatment facility, Project W-100. An analysis and testing program has been executed to obtain data supporting a treatability variance for these wastes (Westcott, 1993). During this effort, samples were collected from each drum opened. The samples were packaged in 1-liter plastic bottles and stored for future treatability testing. The samples are currently stored at the CWC inside five 55-gallon drum overpacks.

The Chemical Engineering Laboratory (CEL) has performed formulation development testing using synthetic non-radioactive surrogates. The surrogates were designed to exhibit chemical and physical properties that are similar to the actual wastes. From this testing, several formulations have been identified that will produce waste forms that meet all regulatory criteria for permanent disposal.

Surrogate test results will be evaluated to select a robust formulation. As the surrogates represent average compositions, the analytical data from the variance petition will be evaluated to select a waste sample that most closely resembles the surrogate that has been tested. This sample will be retrieved from storage and treated using the selected formulation. Specimens will be cured, tested and evaluated against predetermined criteria to demonstrate acceptable final waste form performance.

4.0 DATA OBJECTIVES

This treatability test has two goals. First, it will demonstrate that the proposed WRAP 2A cementitious stabilization process can be successfully applied to 183-H basin waste. Second, it will measure waste form performance including TCLP, compressive strength, Leachability Index, and water immersion durability for comparison to accepted performance criteria.

4.1 Demonstrate Successful Application of Treatment Technology

Successful application of the treatment technology means the waste can be readily processed via conventional stabilization techniques. The following steps must be performed to demonstrate successful technology application:

- a. Mix waste, water, and cementitious binders into a homogenous blend.
- b. Transfer mixture into specimen molds.
- c. Specimens reach initial set within 48 hours. Initial set is defined as penetrometer reading of 345 kPa (50 psi) or more.
- d. Less than 0.5 wt% free water after 48 hours.
- e. No obvious chemical incompatibilities (gas generation, excessive heat, etc.)

4.2 Measure Waste Form Performance

Waste form performance will be measured for comparison with minimum acceptable criteria. The test methods and performance criteria are described below:

- a. Concentrations of heavy metals in TCLP extract (EPA Method 1311) shall be less than the D00x non-wastewater concentrations as shown in 40 CFR 268.41, Table CCWE.
- b. Unconfined compressive strength (UCS) as measured by ASTM Method C39 (modified) shall be at least 3.45 MPa (500 psi) after 28 days of curing at room temperature.
- c. UCS following 90 days of water immersion shall be at least 75% of the minimum as-cured UCS and no less than 3.45 MPa (500 psi).
- d. The leach index, as measured by ANS/ANSI 16.1 shall be no less than 6.0 for any indicator species.

5.0 PLAN OF ACTION

This work will be carried out as a treatability test as defined in Washington Administrative Code (WAC) 173-303-071(s). The 183-H basin wastes carry waste codes corresponding to acutely hazardous waste, and as such will be subject to the quantity limitation of 1 kg of "as-received" waste per treatability study. The Hanford site has an existing approval to perform treatability studies involving the use of cementitious stabilization technology, and therefore this effort will not be subject to the 45 day notification requirement prior to

execution of the study. However, the status of this effort will have to be included in the quarterly report of Hanford site treatability study activities prepared by Pacific Northwest Laboratory, and all other treatability study requirements involving time limitations, quantity limits, reporting, and record keeping will be complied with.

The waste sample to be investigated will preferably be one with chemical makeup similar to the basin sludge surrogates used in the CEL mixture experiment. Due to the small scale of the laboratory specimens, the sample should be free of material with large particle size or debris-type material. Some waste conditioning or particle size reduction (e.g., crushing, grinding, sorting, etc.) may be necessary. Section 5.1 provides details and rationale for the sample selection.

Sample retrieval shall be performed by Solid Waste Operations (SWO) at a suitable location in the CWC. SWO will locate and retrieve the desired sample as directed by WRAP Process Engineering. Transportation of the sample to the 377 laboratory will be arranged by SWO. The 377 laboratory will receive the sample and provide interim storage for the sample and all test specimens. Mixing and test specimen preparation shall be conducted at 377 and will be directed, supervised and/or performed by CEL personnel familiar with the procedures being used.

Waste loading in the formulation shall be within the limits that have been investigated in the surrogate testing. The water to binder ratio and the fly ash to cement ratio of the binder will be selected to provide a mixture with good fluidity and low viscosity, no free water, and high compressive strength. Section 5.2 describes the details and rationale for the formulation selection.

The program will involve preparation of a minimum of nine (9) specimens; three (3) for 28-day as-cured UCS, with residues used for TCLP extraction, three (3) for water immersion testing, two (2) for Leach Index testing, and one (1) for penetrometer testing. The total quantity of waste used for specimen preparation will not exceed 1 kg. The entire sample shall be used for preparation of the specimens. If additional material is available, it shall be used for additional penetrometer test specimens. Section 5.3 provides more detail on specimen preparation.

Leach Index indicator species will include radioactive and non-radioactive indicators. Preferred indicators are ^{99}Tc and NO_3^- . TCLP leachate shall be analyzed for all metals detected in the raw waste analysis performed previously, including Ag, Ba, Cd, Cr, Pb, Hg, and Se. Metals analysis shall be by Atomic Absorption (AA) or Inductively Coupled Plasma (ICP) spectroscopy for non-radioactive species, and by radiochemical methods for radioisotopes. Nonmetals shall be analyzed by ion-specific electrode or ion chromatography. Section 5.4 provides additional detail regarding specimen testing.

Residues from testing shall be retained until the completion of the test program. Following receipt of analytical results, the residues will be disposed as RCRA-compliant listed mixed waste.

5.1 Sample Selection

The sample to be used for this treatability test will be from drum 183-H4-0736. This sample was chosen due to its chemical similarity to the surrogates used in cold testing, and the description which shows it to be a reasonably pure sludge sample (i.e., does not contain debris, plastic, etc.).

5.2 Formulation Selection

The formulation selected is based on run 1B-10, modified to achieve the 25 wt% waste loading which is the design basis for the particulate grout system, as described in the Single Immobilization Study, item 1604-1 in the WRAP 2A Advanced Conceptual Design Report. The mix ratios in this formulation are W:C of 1.0 and FA:C of 1.0. This will result in a recipe using the following quantities of material:

Waste:	1.0 Kg
Water:	1.0 Kg
Cement:	1.0 Kg
Flyash:	1.0 Kg

If there is less than 1 Kg of waste in the sample, material quantities shall be adjusted proportionately. Type I-II portland cement, Class F flyash, and demineralized water shall be used.

5.3 Specimen Preparation

Specimens shall be prepared in accordance with the procedures described in the CEL Working Procedures for WRAP 2A Formulation Development Tests (Duchsherer, 1994), with the exception that no ANSI spike solution is to be added to the mixture. At least eight (8) specimens shall be prepared. Three (3) specimens 50mm dia. x 100mm tall shall be for as-cured UCS. Three (3) specimens 50mm dia. x 100mm tall shall be used for water immersion test. Two (2) specimens 25mm dia. x 50mm tall shall be used for determination of ANSI leach index. The remaining grout mixture shall be used to make specimens for penetrometer readings.

5.4 Specimen Testing

Following specimen preparation, penetrometer readings shall be taken every 24 hours until the reading is at least 3.45 MPa (500 psi).

The remaining specimens will be allowed to cure in sealed containers at room temperature for 28 days. After curing, three specimens will be tested for UCS. Residue from as-cured UCS testing shall be crushed for use in TCLP

testing. TCLP extraction shall be performed in duplicate. One aliquot from each TCLP extract shall be analyzed for Ag, Ba, Cd, Cr, Pb, Hg, and Se by atomic absorption (AA) spectroscopy. A third extract aliquot shall be spiked with a known quantity of these metals prior to analysis. One blank leachant solution sample shall be analyzed for all metals.

The two small ANSI specimens will be subjected to the Leach Index procedure ANS/ANSI 16.1. Indicator species shall be nitrate and technetium-99. Extracts from this testing shall also be analyzed for gross beta-gamma content. Source term for leach index calculation shall be determined by analyzing a portion of the as-cured UCS residue for total nitrate, technetium-99, and gross beta-gamma.

The remaining three large specimens will be immersed in water for 90 days prior to determination of UCS.

6.0 RESPONSIBILITIES

The lead organization for planning and coordinating this effort is WRAP Process Engineering. Funding will be provided by the WRAP 2A Project. Sample retrieval and transportation will be the responsibility of Solid Waste Operations. Procedures for specimen preparation and testing have been prepared by the CEL (Duchsherer, 1994). All work involving opening and handling of radioactive samples and specimens, including physical testing and extractions will be performed at the 377 laboratory. All procedures to be used at the 377 laboratory will be reviewed and approved by 377 laboratory manager, engineer, safety, and quality assurance representatives. Analytical work will be performed at the 222-S laboratory. Table 1 presents a summary of the organizational responsibilities.

7.0 SCHEDULE

The milestone driving the program schedule is the Key Decision 2 for WRAP 2A, currently scheduled for January 1995. Preliminary test results are desired to support this milestone. The results that will support this milestone include as-cured UCS and TCLP results. Initial Leach Index results are also desired by the Key Decision date. Figure 1 depicts the schedule and tasks described below.

9/30/94	Planning documents review and approval complete
10/7/94	Sample retrieval and transport complete
10/14/94	Specimen preparation completed
11/11/94	28-day cure period complete
11/18/94	As-cured UCS tests complete
11/18/94	5-day Leach Index extractions completed
11/23/94	TCLP Extractions completed
12/16/94	Preliminary TCLP analysis completed
12/16/94	5-day Leach Index analyses completed
1/7/95	Interim Test Report complete
2/10/95	90-day Leach Index Extractions complete
2/17/95	90-day Immersion test UCS completed

Table 1. Responsibility Matrix

Task	Lead Organization	Lead Manager
Planning Program Plan Work Plan Hazardous Waste Operation Plan Transportation Plan Operating Procedures Ecology Notifications	WRAP Proc. Eng. WRAP Proc. Eng. 377 SWO CEL 377	CA Petersen CA Petersen JA Hunter MD Aichele MJ Schliebe JA Hunter
Retrieve and Transport Sample Retrieval and Staging Transport to 377 from CWC	SWO SWO	MD Aichele MD Aichele
Prepare Test Specimens Procure Materials Procure Equipment Prepare Specimens Cure Storage	377 377 377/CEL 377	JA Hunter JA Hunter JA Hunter/MJ Schliebe JA Hunter
Physical Testing Penetrometer Compressive Strength TCLP Extractions Leach Index Extractions Water Immersion Test	377 377 377/CEL 377/CEL 377	JA Hunter JA Hunter JA Hunter/MJ Schliebe JA Hunter/MJ Schliebe JA Hunter
Chemical Analysis TCLP Extract analysis Leach Index Extract Analysis	222-S 222-S	JG Kristofzski JG Kristofzski
Data Evaluation and Reporting	WRAP Proc. Eng.	CA Petersen

3/4/95 Draft Final Test Report issued for review
3/25/95 Final Test Report issued

8.0 COST

Total estimated direct costs for this effort is \$123,000. Addition of 10% contingency brings the budget for this program to \$135,000. The estimate is based on a single waste stream sample and a single formulation to be investigated. Additional feed stream samples or test protocols would require additional funding. There is no allowance for purchase of test equipment in this estimate. It is assumed that expendable supplies can be provided from stock on hand at either 377 or CEL. The cost breakdown is presented in Table 2.

Table 2. Cost Estimate

Task	Effort	Budget (\$)
Prepare planning documents, review and approve	3 man-months	36,000
Sample retrieval, transport to lab	1 man-month	12,000
Specimen preparation and cure	1 man-month	12,000
Specimen testing, on-site analytical work	3 man-month	36,000
Analytical lab		15,000
Data analysis and report preparation	1 man-month	12,000
SUBTOTAL DIRECT COSTS		123,000
Contingency	10%	12,000
TOTAL TASK BUDGET		135,000

9.0 QUALITY ASSURANCE

Standard NQA-1 laboratory quality assurance procedures shall be followed. Organizations that perform physical or chemical testing shall maintain calibration records as required by WHC-CM-4-2 "Quality Assurance Manual," and reported results shall include accuracy and precision statements along with supporting data. Blanks, spikes, and duplicates shall be performed as described in Section 5.4.

10.0 REPORTING

Routine status meetings will be held where the performing organizations will report the status of their respective tasks. The meeting will be held at a minimum of bi-weekly frequency, and will provide a forum to discuss progress and informally transmit results as they become available. The 377 laboratory will issue a complete, formal data package at the conclusion of the test program. WRAP Technology will prepare the final test report.

Regulatory compliance reporting will be the responsibility of the performing organization. All reporting requirements for treatability tests must be complied with.

11.0 REFERENCES

Westcott, J. L., 1993, "183-H Basin Mixed Waste Analysis and Testing Program," WHC-SD-W100-AP-001, Rev. 1, Westinghouse Hanford Company, Richland, WA

Duchsherer, M. J., 1994, "CEL Working Procedures for WRAP 2A Formulation Development Tests," WHC-SD-W100-TP-011, Westinghouse Hanford Company, Richland, WA

WHC, 1994, "Quality Assurance Manual," WHC-CM-4-2, Westinghouse Hanford Company, Richland, WA

FIGURE 1.

183-H BASIN SLUDGE 'HOT' TESTING SCHEDULE

9/12/94