U-003-306.11

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RESPONSE TO COMMENTS RECEIVED ON THE OPERABLE UNIT 1 DRAFT TREATABILITY STUDY WORK PLAN DOCUMENT DATE - AUGUST 1, 1991 OHIO EPA COMMENTS - AUGUST 29, 1991

10/01/91

RESPONSE TO COMMENTS

RECEIVED ON THE OPERABLE UNIT 1

DRAFT TREATABILITY STUDY WORK PLAN

DOCUMENT DATE - AUGUST 1, 1991

OHIO EPA COMMENTS - AUGUST 29, 1991

U.S. EPA COMMENTS - SEPTEMBER 10, 1991

OCTOBER 1991

OHIO EPA COMMENTS AND RESPONSES
OPERABLE UNIT 1 TREATABILITY STUDY WORK PLAN

General Comments

Commenting Organization: OEPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #1

Comment **The treatability study work plan for OU 1 concentrates on physical treatment (cementation, vitrification) of the waste pits material. Why are no chemical separation/stabilization/ vitrification combinations (such as those proposed in the OU 4 Treat. W.P.) to separate radioactive from hazardous substances being considered?**

Response: Noted. Chemical separation was not proposed for Operable Unit 1 due to the calcium content of the wastes. Extraction technologies that would extract metals from the waste would also extract large amounts of calcium thus limiting the volume reduction. Operable Unit 4 (OU 4) wastes did not have this constraint, and it was therefore potentially possible to achieve a high degree of volume reduction through separation. To achieve a level of volume reduction similar to that of OU 4 would require the separation of calcium from the extracted metals, which was considered impractical and was not considered further.

This information has been provided in the EPA-approved "Operable Unit 1 - Initial Screening of Alternatives" (DOE 1990). Further information concerning the treatment methods specified can be obtained therein.

Action: None required.

Commenting Organization: OEPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #2

Comment: The work plan should indicate that the treatability study will be conducted to comply with 40 CFR 261.4(e) and (f) and Ohio Administrative Code 3745-51-04(E) and (F).

Response: Agree. The text will be revised to state that the treatability study will be conducted in accordance with 40 CFR 261.4(e) and (f) and the OAC 3745-51-04 (E) and (F).

Action: Text revised (see Section 1.3.1).

Commenting Organization: OEPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #3

Comment: Following the EPA's "Guide for Conducting Treatability Studies under CERCLA", the following section is missing or omitted:

a) Schedule - Since schedules were recently negotiated with USEPA, a detailed schedule for the treatability study should be available and incorporated into the document.

Response: Agree. Schedules for the treatability study will be incorporated into Section 13.0.

Action: Figures added to present schedules in Section 13.0.

Commenting Organization: OEPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #4

Comment: a) A contaminant of concern for the waste pits is radon, yet radon emissions are not confronted within this work plan. The work plan should address how radon (and possibly thoron) emissions will be affected by the proposed treatment options. The following, at a minimum should be addressed: What level of radon would be released during actual remediation via the specific treatment option? How much radon will be emitted by the waste form following treatment? If this can not be directly measured, then can it be estimated via some other measure (i.e., pore size)?

b) The proposed treatment options may also result in the volatilization of various organic contaminants within the waste pit materials. An analysis of the magnitude of these emissions during and following the specific treatment options should be addressed.

Response: a) Noted. The constituents of concern are listed in Table 1-2. Radon will be added to the lists presented in that table. Gaseous radon emissions from the treated material final form will be measured in the advanced phase. While the leachability of dissolved radon from the treated materials is of academic interest, the short half-lives of the isotopes of radon limit its transport in groundwater systems to a few feet from its source. Beyond this point, radon will be in equilibrium with its radium precursors in the surrounding soil and water. Thus, DOE feels that efforts should be directed at determining the leachability of radon's parent nuclide (radium) instead. However, the concentration of radon in leachate will be measured at the optional phase in response to specific EPA requests.

b) Noted. The air emission tests should be done during the remedy design phase when bench- and pilot-scale testing occurs.

Action: a) Radon and will be added to the constituents of concern. Test procedures for measuring radon emissions from the treated material will be included in the revised work plan in Appendix C.

b) No action required.

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Commenting Organization: OEPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #5

Comment: A number of analytical methods have been proposed within this work plan (MTCLP, Bulking Factor, etc.). Few if any of these refer to approved QAPP SOPs or ASTM methods. All new analytical methods should be incorporated into the revised site-wide QAPP to be submitted in September, 1991. Approved analytical methods are essential to using the data in risk assessments as well as assuring the quality of data in choosing remedial actions.

Response: Noted. These analytical methds will be explained in this work plan to the extent necessary for QA purposes. This work plan will then be incorporated into the RI/FS work plan through the normal document change request (DCR) process. This methodology will achieve the objective of utilizing approved analytical methods for data incorporation into risk assessment.

Action: Analytical methods that are not currently in the RI/FS QAPP will be explained adequately in the Treatability Study Work Plan so that this plan can be incorporated in a timely fashion into the RI/FS work plan. These analytical methods will be provided to the organization developing the new QAPP for consideration for incorporation.

SPECIFIC COMMENTS

Commenting Organization: OEPA Commentor:
Pg. #1 Section #1 Paragraph # Sent./Line #18
Original Comment #1

Comment: Section 1, pg. 1, line 18: The date of the EPA guidance (1988) does not agree with the date in the reference list (1989). Please correct this discrepancy.

Response: Agree. The correct date should be 1989.

Action: Text revised.

Commenting Organization: OEPA Commentor:
Pg. # Section #1.2.2 Paragraph # Sent./Line #
Original Comment #2

Comment: Provide the definition for raffinate being used in the text. Is this the same definition as used in the OU 4 treatability work plan?

Response: Noted. The word raffinate is a general term referring to the treated liquid mixture that remains undissolved and is not removed by the selective solvent in solvent refining. This is the same definition as used in the Operable Unit 4 treatability work plan. Inclusion of this definition in this section is not considered necessary.

Action: None required.

Commenting Organization: OEPA Commentor:
Pg. #7 Section #1.2.2 Paragraph # Sent./Line #12
Original Comment #3

Comment: Start new paragraph with "Waste Pit 3 ... ".

Response: Agree. This typo will be corrected.

Action: Text revised.

Commenting Organization: OEPA Commentor:
Pg. #7 Section #1.2.2 Paragraph # Sent./Line #14-15
Original Comment #4

Comment: This sentence needs rewording, it sounds like the lime neutralized the radioactive raffinate concentrate.

Response: Agree. The text will be revised to state "...consisting of radioactive, lime-neutralized, raffinate concentrate....".

Action: Text revised.

Commenting Organization: OEPA Commentor:
Pg. #8 Section #1.2.3 Paragraph # Sent./Line #26
Original Comment #5

Comment: In Table 1-2, footnote "a" states that chemicals are expected to reach the aquifer within 500 years. How was the 500 year time period calculated?

Response: Noted. The 500-year time period was calculated during preliminary fate and transport modeling. This work will be incorporated into the feasibility study when it is prepared. It should not be necessary to repeat the modeling calculations at this point.

Action: The footnote will be revised to indicate that the 500-year time period was based on preliminary fate and transport modeling.

Commenting Organization: OEPA Commentor:
Pg. #10 Section #1.2.3 Paragraph # Sent./Line #
Original Comment #6

Comment: Table 1-2, SEDIMENT: Contaminants within Paddys Run may be attributable to this operable unit. Specifically radium contamination within the sediments.

Response: Noted. Radium-226 will be added to the waste pit media section of Table 1-2; however, Paddys Run contamination is considered under Operable Unit 5.

Action: Table revised.

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Commenting Organization: OEPA Commentor:
Pg. # Section #1.2.4 Paragraph # Figure 1-2Sent./Line #
Original Comment #7

Comment: a) **The actual remedial action goals for non-carcinogens are to be based upon maintaining a Hazard Index of less than 1. Simply maintaining doses of non-carcinogens at less than the specific RfD will not necessarily achieve a Hazard Index of less than 1.**

b) **The site wide remedial action goal for carcinogens is to maintain lifetime cancer risks to between 10^{-4} and 10^{-6}. Simply meeting this goal for each pathway for each operable unit will not necessarily result in an additive site-wide cancer risk range of 10^{-4} to 10^{-6}. This section should reference the methodology recently negotiated in the Amended Consent Agreement between USEPA and DOE for ensuring the attainment of site-wide risk levels.**

Response: a & b) Agree. Figure 1-2 (Figure 1-3 in revised document) does not deal clearly with combined effects of constituents of concern in its present form. The risk assessment methodology alluded to in part "b" of the comment has been presented in the Risk Assessment Work Plan Addendum.

Action: a & b) Figure will incorporate text changes clarifying the RAOs in situations where more than one constituent and/or pathway is present.

Commenting Organization: OEPA Commentor:
Pg. #25 Section #1.3.1 Paragraph # Sent./Line #12-13
Original Comment #8

Comment: The paragraph addresses the 1991 sampling effort. A brief summary of the effort would be useful.

Response: Agree. A summary of the 1991 sampling effort will be provided in Section 6.0 as well as a figure showing the sample borehole locations. Text will also be revised in Section 1.2.3 to summarize and call out Section 6.0.

Action: Sections 1.2.3 and 6.0 sample revised to include a summary of the 1991 sampling effort.

Commenting Organization: OEPA Commentor:
Pg. #25 Section #1.3.1 Paragraph # Sent./Line #18
Original Comment #9

Comment: Correct bullet to read, "change in treated waste volume". Vitrification may decrease volume.

Response: Agree. The text will be modified to state "change in treated waste volume."

Action: Text revised.

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Commenting Organization: OEPA Commentor:
Pg. #25 Section #1.3.1 Paragraph # Sent./Line #
Original Comment #10

Comment: bullets: An additional objective should be to determine the leachability of the radionuclides present in the final waste forms. Also see general comment #3.

Response: Noted. Section 1.4.1 has been revised to state, "The objectives of the treatability study are...decrease leachability of metals and radionuclides as measured with..."

Action: Text revised.

Commenting Organization: OEPA Commentor:
Pg. #26 Section #1.3.1 Paragraph # Sent./Line #10
Original Comment #11

Comment: When stating the objectives of the treatability study, it appears that all objectives should be attained, not "have pocket penetrometer values of approximately 500 psi or greater, metal concentrations in the modified TCLP (MTCLP) near to the TCLP limits, or a relatively low bulking factor". Also the objective should state an "unconfined compressive strength of 500 psi" instead of the pocket penetrometer. Clarify this sentence.

Response: Agree. The sentence should read "...to the TCLP standards, and a relatively low..."

Action: Text revised.

Commenting Organization: OEPA Commentor:
Pg. #26 Section #1.3.1 Paragraph # Sent./Line #17
Original Comment #12

Comment: Is any information available on the comparability of results from the proposed MTCLP to results obtained from TCLP analysis? Is it reasonable to look for results near the TCLP regulatory limits using the MTCLP? While it seems acceptable to utilize the MTCLP for the Preliminary Phase testing, perhaps the results should be viewed in a strictly comparative sense. That is the most promising formulation will have the lowest metal concentrations in the MTCLP and achieve the other desired performance criteria

Response: Noted. The MTCLP is a scaled-down version of the full TCLP tests. The extraction fluids used (i.e, TCLP Type 1 and 2) and the ratio of leachant to solid are the same in both tests. The extraction efficiency of the two methods should therefore be the same. The limit of detection is dependent on the analytical instrument used to analyze the metal content of the leachate. It is therefore reasonable to look for results near the TCLP regulatory limits with the MTCLP.

The MTCLP is being used only during the preliminary phase. The standard TCLP will be used in the advanced phase. The selection criteria for the most promising cement based

formulations are that the treated sample will have an unconfined compressive strength of approximately 500 psi, meet the TCLP standards, and have a minimum volume increase after treatment. The third criteria will be a secondary requirement. For vitrification, the formulations should meet all of the TCLP standards, form a durable glass, and have minimum volume increase. In addition, all leaching data will be evaluated by the persons in the Risk Assessment Group to assist in the selection of the most promising formulations for further analysis and testing.

Action: The text will be revised in some sections to clarify the use of the MTCLP.

Commenting Organization: OEPA Commentor:
Pg. #27 Section #1.3.3 Paragraph # Sent./Line #
Original Comment #13

Comment: Please discuss location/source of onsite soil.

Response: Noted. The location/source of on-site soil has yet to be determined. Consequently, the source will be reported in the final Treatability Study Report following the conclusion of the study.

Action: None required.

Commenting Organization: OEPA Commentor:
Pg. #28 Section #1.3.4 Paragraph # Sent./Line #22
Original Comment #14

Comment: An additional test relating to the long-term effectiveness and permanence needs to be considered for the cement stabilization forms at least. The Wetting and Drying Test of Solid Wastes (ASTM D4843) would provide information about the long-term stability of the stabilized waste form. It would be an appropriate test to conduct because it cannot be assured that the treated waste will not be subjected to repeated cycles of wetting and drying following final disposal. The treatability testing data should provide supplemental information necessary to fully evaluate the alternative technologies.

Response: Disagree. Tests relating to the long-term stability, e.g., free-thaw and wetting and drying tests should be conducted during the remedy design phase. The choice of which battery of tests to conduct will be determined later. As currently planned, the University of Cincinnati and Oak Ridge National Laboratory will conduct aging and durability studies.

Action: None required.

Commenting Organization: OEPA Commentor:
Pg. #1 Section #3.0 Paragraph # Sent./Line #7
Original Comment #15

Comment: This section does not actually establish performance objectives for the treatment technologies, as stated. It does establish specific objectives for the treatment tests to be performed.

Response: Agree. The text will be revised to indicate what the objectives are for the treatment tests.

Action: Text revised.

Commenting Organization: OEPA Commentor:
Pg. #3 Section #3.1 Paragraph # Sent./Line #
Original Comment #16

Comment: Table 3-1: In Table 3-1, footnote "a" refers to a "Characterization Study." What the characterization study does this footnote refer to?

Response: Agree. The characterization study referred to will be performed prior to the stabilization portion of the treatability work plan. The study will provide information pertaining to the initial mixtures used to stabilize the samples.

Action: Text revised to clarify footnote.

Commenting Organization: OEPA Commentor:
Pg. #4 Section #3.2 Paragraph # Sent./Line #8
Original Comment #17

Comment: Section 3.2, pg. 4, line 8: It is stated that the establishment of DQOs is the part of the process that defines the data quality needs of the project. The process should work in the opposite fashion. The DQOs are determined by the intended uses of the data or data needs. For example, if the data needs are to support the design of the remedy, the DQOs would have a higher analytical level that would be required for a technology screening analysis. Please revise.

Response: Agree. The text will be revised to state that data quality needs are used to establish DQOs.

Action: Text revised.

Commenting Organization: OEPA Commentor:
Pg. #4 Section #3.2.1 Paragraph # Sent./Line #29
Original Comment #18

Comment: Provide a copy of the MTCLP method. Discuss how the changes in the method would still provide for valid results for use in the treatability study.

Response: Agree. The Modified Toxicity Characteristics Leaching Procedure is identical to the Toxicity Characteristics Leaching Procedure with the exception that the sample size is smaller than that used in the standard TCLP and other parameters are proportionally adjusted. The procedure will be included in Appendix C.

Action: Text revised.

Commenting Organization: OEPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #19

Comment: Define at what depths top, middle and bottom samples were collected.

Response: Agree. The depths at which samples were collected will be included in Section 6.0.

Action: Text revised.

Commenting Organization: OEPA Commentor:
Pg. #9 Section #3.2.3 Paragraph # Sent./Line #22
Original Comment #20

Comment: Explain why ASTM 2166, a test for cohesive soils, is considered to be the appropriate test for the stabilized waste. It is understood that the stabilized waste form will be cement-like. As such, the Unconfined Compressive Strength for Cylindrical Cement Specimens (ASTM D1633-85) would seem to be more appropriate.

Response: Noted. The following table compares the key elements of ASTM D2166 (as modified for the work plan) to ASTM D1633.

ASTM D2166 as Modified for the Work Plan Versus ASTM D1633

ASTM D2166 (as modified)	ASTM D1633
Pretreatment	
Sieve	Dry/sieve/soak/dry
Curing	
Room temperature in sealed mold	Temperature controlled and at 100 percent relative humidity
Mold Size	
Preliminary phase 1.5 by 3 inches Advanced phase 2 by 4 inches Particle size to mold ID maintained less than equal to 10 to 1	2.8 by 5.6 inches

	Preparation Before Final Test
None	Soak 4 hours in water

ASTM D2166 was selected as the UCS testing procedure instead of D1633 for the following reasons:

It was determined that the curing procedure in the sealed mold was more representative to the final waste form. During the site remediation, the waste could be molded into large blocks. The method proposed in the work plan will provide a curing environment that is similar to the environment that the interior of the monolith would encounter. That is, only the moisture that is in the sample mixture is available for the waste and reagents to use.

The reduced mold size was chosen to reduce the volume of material necessary for the test program, thereby reducing the exposure to the radionuclides present.

The final waste form will be disposed of in a managed facility and will not be subjected to soaking conditions as represented in D1633 prior to compression testing.

D1633 also requires that the initial aggregate material that passes through the 3/4-inch sieve but remains in the #4 sieve be soaked for 24 hours in water, then surface dried prior to use. This is not possible for the Fernald projects because the aggregate material is the waste material and significant contaminants could be lost in this soaking procedure.

Action: No action required.

Commenting Organization: OEPA Commentor:
Pg. #10 Section #3.2.3 Paragraph # Sent./Line #3
Original Comment #21

Comment: The title of this document should be provided and it must be included in the References Section.

Response: Agree. The title should read "Stabilization/Solidification of CERCLA and RCRA Wastes." This will be incorporated into the text, which will be moved to Appendix C.

Action: Title will be added to text in the Appendix C.

Commenting Organization: OEPA Commentor:
Pg. #10 Section #3.2.3 Paragraph # Sent./Line #8
Original Comment #22

Comment: An adequate rationale must be provided for the use of the 5-Day Static Leach Test. This should include and explanation of how the data generated will support the remedy selection process. The work plan does not identify what data will be generated by the proposed procedure. The American Nuclear Society Leach Test (ANS-16.11986) from

which the procedure is derived is intended to provide values for an effective diffusion coefficient and a leachability index. The static leach test cannot provide those values.

Response: Agree. The 5-day static leach test is a procedure that more closely resembles the actual conditions that will be encountered by the final waste form. This test is explained in Appendix C and will generate data that may be used for risk assessment. The data will help determine the effects of the pH of the leachant (which has an initial low ionic strength) on the leachability of the stabilized waste.

Action: The text in part of this section has been moved to Appendix C where the tests are described in greater detail.

Commenting Organization: OEPA Commentor:
Pg. #10 Section #3.2.3 Paragraph # Sent./Line #21
Original Comment #23

Comment: The work plan should identify the methods (EM-1110-2-1906) which will be used to determine permeability and provide the rationale for selection of the methods identified.

Response: Agree. The method of choice for determining permeability of treated samples is described in SW-846, Method 9100, Section 2.8. This is the constant head method using a triaxial-cell with back pressure. This method is applicable to cohesive samples that are supplied in molded form.

The constant head triaxial cell method may take a couple of days longer to run, but there is more control over sample conditions during the test, and a wide range of field conditions can be simulated.

There will be one slight modification to the method. A permeability cell will be substituted for the triaxial cell. The permeability cell is similar to the triaxial cell, but does not have the plunger for applying a load to the sample. This plunger is not used in permeability testing, and its absence has no effect on the test.

It is anticipated that all of the samples for permeability testing will be of the cohesive, molded type. If a sample is in a form that precludes the above test, there are several options available in the referenced method. Items that would preclude the above test may include: small sample size due to radioactivity level, noncohesive sample, loose sample requiring remolding, and chemicals in the sample that are incompatible with the latex membrane.

A small sample size may require permeability testing in a consolidation cell. This method is not addressed in SW-846, but is found in the Army Corps of Engineers Manual EM 1110-2-1906, Appendix VII, Paragraph 8.

Noncohesive samples will require the use of a solid wall permeameter, such as a compaction or standard permeameter. These methods are found in SW-846, Method 9100, Section 2.5, 2.6, and 2.7, and include both constant-head and falling-head methods. The selection of constant or falling-head methods is not critical as both methods provide similar results. These methods are also applicable to samples containing chemicals incompatible with the latex membrane.

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If a sample requires remolding, a modeling density should be supplied. A moisture/density relationship curve can be generated to aid in the determination of remolding density. The permeability of remolded samples may be determined by any of the above methods. If the sample is cohesive, the constant head method, using a triaxial cell with back pressure, is again the method of choice.

Action: This discussion concerning the permeability procedure has been added to Appendix C.

Commenting Organization: OEPA Commentor:
Pg. #10 Section #3.2.3 Paragraph # Sent./Line #22
Original Comment #24

Comment: Describe which methods might be used and in what situations they will be used.

Response: Refer to OEPA Comment #23.

Action: None.

Commenting Organization: OEPA Commentor:
Pg. #1 Section #4.1 Paragraph # Sent./Line #26
Original Comment #25

Comment: Explain the rationale for using composite samples for Pits 5 and 6 and the Clearwell in the advanced phase of testing.

Response: Noted. Samples from Pits 5 and 6 and the Clearwell are only available in composite form. Due to the consistency of these areas, undisturbed samples were impossible to obtain. This information will be provided in Section 6.0, as per the EPA "Guide for Conducting Treatability Studies under CERCLA."

Action: Text revised in Section 6.0. Further characterization of these areas will be available at a future date, with the completion of additional sampling.

Commenting Organization: OEPA Commentor:
Pg. #4 Section #4.1 Paragraph # Sent./Line #
Original Comment #26

Comment: Figure 4-1:

a) **Testing for the Advanced Stage should include the Wetting and Drying Test of Solid Wastes (ASTM D4843)**

b) **Complete testing should follow Advanced Stage II reformulations (i. e., TCLP/5 Day Static Leach) . See Figure 4-2.**

Response: a) Disagree. The type and location of the disposal facility has not been determined. The Wetting and Drying Test of solid waste, if appropriate, should be done as part of the remedy design phase.

b) Noted. Figure 4-2 includes a leach test in the Advanced Stage 2. For vitrification, a PCT will be used instead of a 5-day static leach test. The justification for using the PCT is provided in Appendix C.

Action: None required.

Commenting Organization: OEPA Commentor:
Pg. #5 Section #4.1.3 Paragraph # Sent./Line #33
Original Comment #27

Comment: It appears that a word was omitted before the word "formulations."

Response: Agree. The text should read "The two most promising stabilization formulations..."

Action: Text revised.

Commenting Organization: OEPA Commentor:
Pg. #6 Section #4.1.6 Paragraph # Sent./Line #22
Original Comment #28

Comment: Explain the rationale for using a 3/8 inch mesh screen. Define "obvious debris."

Response: Noted. The 3/8-inch mesh screen size was selected due to its use in the standard TCLP. The screen size was not meant to be representative of remedial field methods but was meant to follow standard EPA-approved procedures (SW-846, Method 1311).

The data-required sections will be changed to include a record of the maximum particle size treated, if the material was crushed/ground before use, and the weight/percentage of material sieved out from the raw waste before treatment. The data required section has been revised to include:

- The maximum particle size treated, weight and percentage of material sieved out from the raw waste before treatment.

- General description of the waste from before and after reagents are mixed, this includes a description of any grinding of the sample to meet particle size requirements for UCS.

Obvious debris refers to any large chunks of wood or metal, which would interfere in the stabilization process. Such items will be segregated as part of the remedy design if a stabilization alternative is chosen as the preferred alternative.

Action: Text revised in Section 8.1 also includes data required additions. Examples of obvious debris have been included where necessary.

Commenting Organization: OEPA Commentor:
Pg. #10 Section #4.2.1 Paragraph # Sent./Line #
Original Comment #29

Comment: Table 4-2: Justify not conducting a replicate of run #6 with 50 w/w site soil.

Response: Noted. A replicate will be run for No. 6. The table will be revised to show this.

Action: Table revised.

Commenting Organization: OEPA Commentor:
Pg. #1 Section #6.0 Paragraph # Sent./Line #20, 23
Original Comment #30

Comment: On line 20, it is stated that the composite and strata samples will potentially be sampled for the parameters listed in Table 6-1, however on line 23, it is stated that these parameters will be analyzed for. Please eliminate the discrepancy.

Response: Agree. Tables 6-1 and 6-2 list which parameters have <u>been</u> analyzed for. The word "potentially" is a typo and has been removed.

Action: Text revised.

Commenting Organization: OEPA Commentor:
Pg. #11 Section #4.2.6 Paragraph # Sent./Line #8
Original Comment #31

Comment: Add full TCLP for final waste form.

Response: Agree. Full TCLP should be included in the first bullet.

Action: Text revised to state "MTCLP (for preliminary phase), <u>or TCLP</u>, and PCT (for strata sample experiments)...."

Commenting Organization: OEPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #32

Comment: Table 5-1, "Equipment and Materials": This table should include the manufacturer and manufacturing number.

Response: Disagree. Listing the equipment manufacturer and manufacturing number will not contribute to the quality of the data nor will it help meet the performance objectives of the study.

Action: None required.

Commenting Organization: OEPA Commentor:
Pg. #1 Section #6 Paragraph # Sent./Line #9
Original Comment #33

Comment: Section 6, pg. 1, line 9: Please identify the location of the 13 borings. This would reference useable information.

Response: Agree. An appropriate figure will be included in this section which will identify the location of the 13 borings.

Action: Figure 6-1 provided in Section 6.0 to indicate boring locations.

Commenting Organization: OEPA Commentor:
Pg. #1 Section #6 Paragraph # Sent./Line #19-24
Original Comment #34

Comment: Section 6, pg. 1, lines 19-24: These sentences could be written more clearly so that they would not be construed to be contradictory.

Response: Agree. See comment No. 30.

Action: Text revised.

Commenting Organization: OEPA Commentor:
Pg. # Section #8.4 Paragraph # Sent./Line #
Original Comment #35

Comment: Provide a reference for these formulas.

Response: Agree. The formulas are obtained from the EPA document, "Preparing Perfect Project Plans," EPA/600/9-89/087.

Action: The text will be revised to include the reference.

Commenting Organization: OEPA Commentor:
Pg. #2 Section #Appendix C Paragraph # Sent./Line #23
Original Comment #36

Comment: Has the ASTM subcommittee approved or commented on the PCT?

Response: No. The ASTM subcommittee has neither approved nor disapproved of the PCT method. However, the PCT method has been used by several laboratories with consistent and generally accepted results.

Action: None required.

U.S. EPA COMMENTS AND RESPONSES
OPERABLE UNIT 1 TREATABILITY STUDY WORK PLAN

General Comments

Commenting Organization: U.S. EPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #1

Comment: The scope of the treatment study appears to be primarily with hazardous materials. However, the major contaminants of Operable Unit 1 are uranium, thorium, and their associated decay products. The study appears to add consideration for stabilization of radiological components, but needs to give more detail and emphasis to this facet. Otherwise, the evaluation of the technology for compliance with ARARs, performed in the feasibility studies may have to be performed over again. The long term stabilization of radioactive contaminants will be essential to validation of a particular treatment technology. Treatability and feasibility studies that ignore or minimize stabilization of the radionuclides, particularly radon, cannot be assured to meet compliance with the ARARs and the remedial action objectives. Therefore, the study in its current form cannot be used to make a definitive selection of treatment technology which would be best for comprehensive treatment of the residues preparatory to disposal.

Response: Noted. The constituents of concern are listed in Table 1-2. This table identifies radionuclides that are being considered in this treatability study. Radon and Pb-210 will be added to the list is presented in that table. Gaseous radon emissions from the treated material final form will be measured. Although the leachability of dissolved radon from the treated materials is of academic interest, the short half-lives of the isotopes of radon limit its transport in groundwater systems to a few feet from its source. Beyond this point, radon will be in equilibrium with its radium precursors in the surrounding soil and water. Thus, DOE feels that efforts should be directed at determining the leachability of radon's parent nuclide (radium) instead. However, radon concentrations will be measured in leachate during the optional phase of the study at EPA's request.

Action: Radon and Pb-210 will be added to the constituents of concern. Test procedures for measuring radon emissions from the treated material will be included in the revised work plan.

Specific Comments

Commenting Organization: U.S. EPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #1

Comment: Table 1-1 needs to include estimates of the uranium and thorium daughters for each pit. The data which is presented does not give a complete picture of the radiological characteristics and suggests this is "source material". The process information given earlier in Chapter 1, page 2, suggests this is by-product material.

Response: Noted. Materials found in Operable Unit 1 consist of both "source material" and "by-product" material. Appendix E, "Radiological and Chemical Constituents of the Waste Pits," contains additional information concerning the Operable Unit 1 waste pits. This information should fill in any gaps concerning the waste pit contents.

Action: Appendix E added to document.

Commenting Organization: U.S. EPA Commentor:
Pg. #7 Section #1.0 Paragraph #2 Sent./Line #
Original Comment #2

Comment: All waste pits are characterized by only the quantity of waste expressed as weight of uranium and thorium, which is misleading and disconnected from process information given previously on use of the yellowcake, pitchblende, etc. which references the presence of uranium and thorium decay products. The presence of uranium and thorium daughters in the waste is important to treatability and disposal and should be addressed in this study.

Response: Noted. Information will be included in Appendix E concerning waste pit contents. Also, the presence of uranium and thorium daughters is in fact considered in this study. Table 3-4 lists the radionuclides that will be analyzed for during the preliminary and advanced stages of the study. See previous comments.

Action: Appendix E added to document to show waste pit contents.

Commenting Organization: U.S. EPA Commentor:
Pg. #13 Section #1.0 Paragraph #1 Sent./Line #
Original Comment #3

Comment: The concentrations of Ra-226 in each pit should be included in the waste pit contents as per comment 2.

Response: Agree. Appendix E will be added to detail the radiological and chemical contents of the waste pits.

Action: Appendix E added to document.

Commenting Organization: U.S. EPA Commentor:
Pg. # 9&14 Section # Paragraph #3 Sent./Line #
Original Comment #4

Comment: Other potential contaminants of concerning the surface and groundwater are Radium-228 and radon. Of particular concern is radium and radon since the new proposed drinking water standard includes radon, and revises radium MCLs.

Response: Agree. Radium-228 will be added to the surface and groundwater media sections of Table 1-2, "Radionuclides and Chemicals of Potential Concern for Operable Unit 1." See general comment no. 1 concerning radon.

Action: Table revised.

Commenting Organization: U.S. EPA Commentor:
Pg. # 16 Section # Paragraph #Sent./Line #
Original Comment #5

Comment: Figure 1-2, One remedial action objective for air must be the prevention of a dose to the public due to airborne emissions from exceeding 10 mrem per year.

Response: Agree. Figure 1-3 will be revised to state the additional remedial action objective - "Prevent doses from radionuclides emissions at the FEMP from exceeding 10 mrem/yr...."

Action: Figure revised.

Commenting Organization: U.S. EPA Commentor:
Pg. #1 Section #3.0 Paragraph #Sent./Line #
Original Comment #6

Comment: The 5-Day Static Leach Test, PCT, and TCLP for radionuclides need to be explained in relation to the performance objectives of the study. The effect on data quality of the modification of the American National Standard Measurement of the Leachability of Solidified Low-Level Radioactive Waste by a Short-Term Procedure, American National Standards Institute, 1986 (ANSI/ANS-16.1-1986) leaching procedure needs to be addressed.

Response: Agree. The above-mentioned tests will provide the information required to meet the performance objectives. The 5-day static leach test is a procedure that more closely resembles the actual conditions that will be encountered by the final waste form. The test is explained in Appendix C and will generate data that may be used in risk assessment. The data will also help measure the effects of the pH of the leachant on the stabilized waste. The information in the appendix describes the difference between the 5-day static leach test and the ANS-16.1 test.

Action: Appendix C revised to include this information.

Commenting Organization: U.S. EPA Commentor:
Pg. #6 Section #4.1.4 Paragraph #2 Sent./Line #
Original Comment #7

Comment: The tests run for full TCLP and 5-Day Static Leach Test in Advanced Experiments - Stage II need to be more completely developed to show how they relate to remedial action objectives for radionuclides.

Response: Noted. Remedial action objectives (RAOs) do not relate directly to radionuclides. RAOs are medium-specific cleanup goals for protecting human health and the environment. The 5-day static leach test and TCLP will be used to attain data that will be considered in the risk assessment portion of the FS. Appendix C will be revised to include more information on the 5-day static leach test in advanced experiments. Also the appendix includes much more detailed information on the methods that will be used during the treatability study.

Action: Appendix C revised.

General Comments

Commenting Organization: U.S. EPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #1

Comment: The methodology for conducting stabilization treatability studies does not clearly address several issues which are common to stabilization/solidification (S/S) technologies. The following observations on the work plan experimental design outline the issues not adequately addressed.

a) **The work plan does not propose pH measurements of stabilization mixtures. The solubility of heavy metals is strongly influenced by the pH of the leaching solution. For each metal the optimum pH for minimum solubility is unique. Most metals, particularly lead, exhibit amphotericity, which means they have high solubility at both high and low pH. Because each metal has a different solubility curve, the combination of metals to be stabilized is critical in selecting the optimum pH of a stabilization mixture in order to minimize the leachability of the metals of concern.**

Furthermore, during the leaching procedure (as proposed to be simulated in the work plan using toxicity characteristic leaching procedures (TCLP)), chemical changes continue to occur in the stabilized matrix. For example, an acidic leach will achieve some neutralization of the basicity common in cementatious materials. If a metal is soluble at a high pH, the acidic leach may offset its solubility. However, if in reality, a stabilized material would be exposed on site to fairly neutral leaching (such as being exposed to non-acidic rainwater), no neutralization will occur as the leaching occurs, and the metal in question will in fact leach out of the matrix at a much higher rate than observed in a bench scale demonstration with an acidic leach.

b) **Advanced screening of the stabilization formulations should address site-specific aspects of the alternatives proposed in the feasibility study. Consideration should be given to testing with a prepared leach that simulates the carbon dioxide concentration (carbonic acid content) and pH of leachate filtering through on site soils, a cap, or through local ambient air. Site-specific testing should include modification of the TCLP test protocol to address realistic waste-to-leaching solution ratios and exposed surface areas for the various remedial alternatives. Additional leaching tests, such as American Nuclear Society (ANS) 16.1 should be considered.**

Unconfined compressive strength (UCS) should be measured but since the measurement has a different relevance to the different alternatives, the use of UCS as a screening criteria should be reconsidered.

c) **The leachability analysis is proposed to be performed on treated waste mixtures only and is not proposed on the untreated samples. The efficiency and quantifiable effectiveness of a mixture to fix heavy metal constituents cannot be exactly determined without measuring TCLP (or other leaching procedure) before and after treatment. It should be noted that after treatment leaching results must be adjusted for the dilution of additives.**

Response: a) Disagree. It is well understood that the solubility of metals is a function of pH. However, the critical pH is the final pH of the extraction fluid at the end of the extraction methods prescribed contact time. These values will be measured and the formulas adjusted to minimize the leachability of the metal constituents of concern.

b) Disagree. The TCLP procedure was selected because it is a regulatory accepted standard test method as identified in the third edition of SW-846. It is not within the scope of a remedy screening/remedy selection treatability study to develop and validate new extraction testing procedures when the EPA has established standard methods upon which the Land Disposal Restrictions are based. EPA, in formulating the TCLP, performed 34 laboratory leaching tests on four different wastes to assess accuracy of the method to be selected as TCLP. These tests involved four leaching media: sodium acetate buffer, carbonic acid, water, actual municipal waste leachate. As a result of this testing, two leaching procedures were found to be acceptable and subjected to further testing along with the original EP Tox method. These two leaching procedures involved the sodium acetate buffer solution and the carbonic acid solution.

During additional testing, it was found that the carbonic acid leaching medium was less aggressive toward inorganics than the sodium acetate buffer system and that it did not produce results that correlated with actual field generated data. Based on this, the use of the TCLP sodium acetate buffer solution, which was selected over the carbonic acid solution for TCLP, will provide more accurate and conservative numbers than using a carbonic acid leaching medium.

The TCLP extraction procedure was selected because it presents a worst-case situation based on reduced particle size and surface area to volume ratios. This procedure results in conservative contaminant concentrations for input into the risk calculations and does not take into account the effect of the Engineered Waste Management Facility (EWMF).

c) Noted. The TCLP will be conducted on similar waste pit samples as part of the 1991 sampling program (summarized in Section 6.0). The data gathered from this sampling program will be used in comparison with data obtained during the treatability study.

The current regulatory position of the EPA RCRA permitting division, Washington, D.C., is that stabilization is a recognized (legal) form of treatment that only requires that the levels be met, and as such, the stabilization media cannot be considered diluted. Because of the way the regulations are set up, EPA has recognized the dilution factor as part of treatment by stabilization. Rulemaking is being formulated to address this situation but proposed rules have not been published. However TCLP results will be reported with and without dilution.

Action: Text will be revised to include reporting TCLP results in three ways: (1) actual analysis of extract, (2) results adjusted for spike recovery, and (3) results adjusted for spike recovery and dilution by stabilization reagents.

Commenting Organization: U.S. EPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #2

Comment: The objectives of the treatability study (section 1.0, page 26, lines 10 through 12) do not clearly relate to the remedial action objectives or remedial alternative screening. A clear justification is not provided as to how screening criteria (especially TCLP results) relate to the feasibility study screening. What is the justification for selecting the characteristic listing standards as the pass/fail standards for the stabilization formulas?

It is recommended that qualitative criteria be considered as performance criteria, especially during the preliminary screening tests. The stabilization formulations should be screened by choosing those which demonstrate the highest reduction in constituent leachability on a percentage basis (when corrected for additive dilution). Secondary screening criteria should include selection of formulations which result in the lowest volume increases and/or require the least amount of chemical additives. The UCS should be used as a secondary screening criteria because it has a different relevance to each of the proposed remedial alternatives.

Finally, the work plan should clearly provide a framework for screening formulations based on both the primary and secondary criteria. For example, must a formulation meet all of the criteria in order to be included in the advance testing?

Response: Noted. We believe that the purpose of the treatability study is to gather data and if possible, to identify stabilization formulations that will be acceptable from the health risk point of view. TCLP is recognized as an acceptable method for determining if the health risk associated with exposure from the leachate of a stabilized, landfilled waste is acceptable. Because remedial action objectives (RAOs) have not been finalized, we believe it is prudent to attempt to meet standards (TCLP) that are based on acceptable groundwater concentrations. The UCS of 500 psi was chosen and included because of an NRC technical position on waste form for low-level radioactive waste. A UCS of 500 psi will not be considered a criterion but will be considered a target. UCS and TCLP data are not the only performance data being collected.

Leachate from the TCLP will also be analyzed for radionuclides. These data will be factored into a groundwater model. The results and the model will be used in the evaluation of the method of disposal (i.e., on site or off site). If on-site disposal is chosen, the engineered waste management facility will be designed to meet RAOs.

It is expected that the inorganic inhibitors, e.g., MgF_2 and inorganic or organic phosphate compounds, will cause more problems that the organic contaminants. Due to the anticipated problems resulting from the inorganic inhibitors and the potential organic constituents, a wide range of cement and fly ash concentrations will be investigated in the preliminary phase. In Stage 1, the proposed range of reagents in Table 4-1 will be investigated. The experiments were designed such that trends could be identified and utilized in the subsequent experiments in this treatability study. When possible, graphs of UCS and MTCLP results versus reagent loadings will be created to aid in visualization of the trends. Based on the results of the tests, the ranges for each reagent may be adjusted before Stage 2. In Stage 2, graphs will also be used. The graphs will separately plot UCS, bulking factor, and MTCLP results versus reagent loadings.

The general procedure of this work plan is an iterative process where the results from matrices of experiments are used to determine the course of the next set experiments.

See Sections 1.4.4 and 3.0 for general approach to selection and performance criteria.

Compliance with ARARs would be determined by whether the treated material meets compressive strength requirements for disposal, whether these leachates exceed established discharge standards, and on factors relating to waste form. A full evaluation of the technology for compliance with ARARs will be performed in the FS.

Treatability testing that relates to a technology's long-term effectiveness and permanence includes its shear strength and durability for handling and disposal purposes, its solubility as measured by leachability, and the extent to which it transmits water based on permeability. The waste form itself (glass or cement) also influences long-term stability. A glass for instance would tend to be a more stable waste form provided the glass is of good quality.

The ability of a technology or formulation to reduce the toxicity, mobility, or volume will be measured by indicators such as bulking factor for volume reduction; leachate analysis for toxicity, mobility, and permeability; and waste form for mobility reduction.

Short-term effectiveness is impacted primarily by bulking factor, which is an indicator of the volume of treated waste that must be handled and disposed of and by the specific technology chosen. The short-term impacts associated with implementing cement stabilization would be different from vitrification because they have significantly different requirements to construct, operate, and maintain during remediation.

The implementability of a particular technology is influenced by the volume of waste to be handled as measured by bulking factor and by the waste form itself (glass versus cement). As with implementability, cost is impacted by the technology selected and the volume of waste to be generated. Because cement stabilization and vitrification are radically different processes, each will require different equipment and facilities.

The final two evaluation criteria, state and community acceptance, are influenced by the results of all the data and by the other seven criteria.

Additional information on use of the evaluation criteria and treatability data in the FS process can be found in "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA 1988) and the Initial Screening of Alternatives for Operable Unit 1 (DOE 1990).

Action: Text revised to include the elements of the above response.

Commenting Organization: U.S. EPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #3

Comment: The test plan does not clearly identify which constituents of concern will be used to measure the success of the leachability tests. For example, if during preliminary screening of stabilization formulations a particular test mixture shows the best fixation for lead but the worst for thorium, what criteria will be used to screen the formulations for the next phase.

Response: Noted. The contaminants of concern that will be analyzed for are listed in Table 3-4.

Preliminary phase - Stage 1 is a range-finding set of experiments. The treated waste will need to achieve a UCS value of approximately 500 psi to be considered for Stage 2. At the discretion of the investigator, formulations that have UCS values much greater than 500 psi may be eliminated.

Before any formulation can be accepted for the advanced phase, it must pass through two tiers of decision making. The treated waste should achieve a UCS value of approximately 500 psi, meet TCLP standards, and provide the best formulation evaluation from a risk perspective. The second tier of decisions will be applied to those samples that pass the first tier. The professional judgment of the investigator will be used to determine a reasonable compromise between leaching and minimization of the bulking factor and reagent loadings. The investigator will consider the fact that the data will be used to develop risk assessment models and will take this into account when determining which formulations provide the "best mixture." Formulations that provide this reasonable compromise between leaching and minimization of the bulking factor, reagent loadings, and future worth from a risk perspective, will be considered for the advanced phase.

Action: None required.

Commenting Organization: U.S. EPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #4

Comment: While the work plan provides a good summary of the site history and nature and extent of contamination, a table summarizing the range of constituent concentrations and known physical properties should be added.

Response: Agree. Appendix E, "Radiological and Chemical Constituents of the Waste Pits," will be added to the work plan to detail the contents of the waste pits. Physical properties will be determined by the geotechnical characterization that will accompany the treatability study.

Action: Appendix E added to document.

Commenting Organization: U.S. EPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #5

Comment: The work plan has many decision points in the test design defined by ambiguous terms such as "if necessary", "if warranted", "the most promising formulation", and so forth. The work plan should replace all such terms with concrete decision criteria if possible. Where it is not possible to provide specific decision criteria, the test should explain the process by which a decision is to be made.

Response: Noted. The work plan has been prepared in this manner to allow for flexibility in the formulations. Experiments of this nature are impossible to predict and will require decisions to be made based on the conditions of the experiment at the time. These decisions will involve items such as modifying reagent volumes if it appears that the current formulations will not be adequate for stabilization of the wastes, etc. An attempt will be made to clarify the text.

Action: Text revised to clarify decision points.

Commenting Organization: U.S. EPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #6

Comment: The work plan does not justify or explain the selection of potential stabilizing additives. How do each of the additives relate to the known chemical makeup of the wastes? For example, the wastes from operable unit (OU) 1 contain organic constituents which interfere with bonding in cement-based technologies and also contain halides such as fluoride which can retard the setting of stabilized mixtures.

Response: Noted. The work plan was written to reflect the known constituents in the waste. It is expected that the inorganic inhibitors, e.g., MgF_2 and inorganic or organic phosphate compounds, will cause more problems than the organic contaminants. Due to the anticipated problems resulting from the inorganic inhibitors and the potential organic constituents, a wide range of cement and fly ash concentrations will be investigated in the preliminary phase. In

Stage 1, the proposed range of reagents in Table 4-1 will be investigated. The experiments were designed such that trends could be identified and utilized in the subsequent experiments in this treatability study. When possible, graphs of UCS and MTCLP results versus reagent loadings will be created to aid in visualization of the trends. Based on the results of the tests, the ranges for each reagent may be adjusted prior to Stage 2. In Stage 2, graphs maps will also be used. The graphs will separately plot UCS, bulking factor, and MTCLP results versus reagent loadings.

The general procedure of this work plan is an iterative process where the results from matrices of experiments are used to determine the course of the next set of experiments.

Action: Text revised to include the discussion; also see Appendix A for further justification of the use of stabilizing agents.

Commenting Organization: U.S. EPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #7

Comment: The work plan should reference the origin of the samples to be used in the treatability studies in the forward sections of work plan. Currently, explanation of the sample origins first appears in section 6.0 although the "composite samples" are referenced frequently throughout sections 1.0 to 5.0.

Response: Noted. The work plan was written to conform to the EPA "Guide for Conducting Treatability Studies under CERCLA," where the outline states that sampling will be presented in Section 6.0. However, additional information concerning the origin of the composite sample (and others) will be included in Section 6.0. The text will be revised to point this out and to include a summary of Section 6.0 early in the document.

Action: Text revised in Sections 1.2.3 and 6.0.

Commenting Organization: U.S. EPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment #8

Comment: The work plan does not recognize that fly ash materials contain heavy metals and possibly trace amounts of organic materials. The work plan should include analysis to quantify the metals in the fly ash additives and the data analysis should address their presence.

Response: The reagents will be mixed with clean sand (or quartz) and water. The mixture will then be analyzed (after solidification) for metals by TCLP/MTCLP. Characterization information from Operable Unit 2 and from commercial supplies of ash will be used for comparison purposes.

Action: Text revised to clarify procedure.

SPECIFIC COMMENTS

Commenting Organization: U.S. EPA Commentor:
Pg. #14 Section #1.2.3 Paragraph # Sent./Line #17-19
Original Comment #1

Comment: In this sentence, a reference is made to the DOE-Derived Concentrations Guide (DCG) limit of 500 and 600 picoCuries per liter (pCi/L) for U-234 and U-238, respectively. The DOE DCG may not be the correct maximum concentration limit (MCL). These levels should corrected to the federal and state guidelines for radionuclide MCLS.

Response: Agree. The proposed MCL for uranium is 20 µg/L. The uranium concentrations for the two samples mentioned in the text are approximately 8520 µg/L and 7520 µg/L of total uranium.

Action: A comparison of the two uranium concentrations to the proposed MCLs will be added to the text.

Commenting Organization: U.S. EPA Commentor:
Pg. #27 Section # Paragraph # Sent./Line #27&28
Original Comment #2

Comment: One selection criteria for the vitrification formula screening is durability. If durability is to be a criteria, the work plan should include an objective measurement to quantify durability.

Response: Noted. The chemical durability as defined by leachability, of the glass will be measured with the PCT test. Appendix C describes this test in detail. The physical durability of the glass is not measured.

Action: Table 3-7 to reference Appendix C for the PCT.

Commenting Organization: U.S. EPA Commentor:
Pg. #6&7 Section #3.2 Paragraph # Sent./Line #
Original Comment #3

Comment: Table 3-3: As described in the general comments section above, pH measurement of the formulated waste mixture should be added to the stabilization test objectives. Waste mixture viscosity should be considered for measurement as a process parameter.

Response: Noted. Refer to general comment No. 1. Viscosity is applicable to the remedy design phase and will be considered during that phase. A list of all chemical analyses and geophysical tests during sample characterization is given in Section 6.0. The methods used to conduct these tests are also provided.

Action: Text and tables revised to include pH measurement in the stabilization test objectives.

Commenting Organization: U.S. EPA
Pg. #1 Section #3.1
Original Comment #4

Commentor:
Paragraph #Sent./Line #27-29

Comment: The potential evolution of gases and vapors during stabilization should be identified as a phenomena to be observed and recorded during testing. Such occurrences can affect remedy selection, influence the testing protocol in future studies, and require specific address in the remedy design.

Response: Agree. The text will be revised to include making and recording observations of gases and vapors being released.

Action: Text revised.

Commenting Organization: U.S. EPA
Pg. #6 Section #4.1.6 Paragraph #
Original Comment #5

Commentor:
Sent./Line #22

Comment: Section 4.1.6, page 6, line 22 and section 4.2.5, page 11, line 2: A justification should be provided for the use and selection of a 3/8-inch screen in the test procedures. How will this be representative of remedial field methods?

Response: Disagree. The 3/8-inch mesh screen size was selected due to its use in the standard TCLP. The screen size was not meant to be representative of remedial field methods but was meant to follow standard EPA-approved procedures (SW-846, Method 1311).

The data-required sections will be changed to include a record of the maximum particle size treated, if the material was crushed/ground before use, and the weight/percentage of material sieved out from the raw waste before treatment. The data required section has been revised to include:

- The maximum particle size treated, weight, and percentage of material sieved out from the raw waste before treatment.
- General description of the waste from before and after reagents are mixed, this includes a description of any grinding of the sample to meet particle size requirements for UCS.

Action: None required.

Commenting Organization: U.S. EPA Commentor:
Pg. # 7 Section #4.1.7 Paragraph # Sent./Line #16
Original Comment #6

Comment: Explanation should be provided as to how the measurement of the temperature rise after stabilization treatment will be accomplished in a controlled manner to be of value in this phase of treatability testing. Temperature rise could theoretically be calculated and will be strongly affected in practice and in testing by the rate of chemical addition, by the adequacy of mixing, by the ambient conditions in the laboratory or field, by physical occurrences such as wind, air conditioning, temperature of the containment vessel, and by such factors such as placement in the mixture. What is the justification for selection of the 10 minute reaction time? Is this based on the proposed sample size and a predicted peak of heat release? The work plan does not adequately address these potential influences on the measurement and therefore such measurements will be of non quantitative value.

Response: Noted. The measured temperature rise is a qualitative test. It is conducted as a screening test to alert of potential problems and hazards during scale-up. Further investigations of the actual temperature rise may be made during the remedy design phase when larger equipment, which has a design similar to the full-scale equipment, will be used. The data from the temperature rise measurement will be DQO Analytical Level I.

Action: The temperature rise procedure (see Appendix C) has been modified to indicate the test is a qualitative test.

Commenting Organization: U.S. EPA Commentor:
Pg. #76 Section #4.2 Paragraph # Sent./Line #26
Original Comment #7

Comment: The work plan should provide justification for the selection of 1250 degrees centigrade as the vitrification temperature. The work plan should also consider the testing of several different temperatures or provide an explanation as to why a temperature matrix is not being considered.

Response: The effects of the addition of sodium hydroxide, site fly ash, and site soil will be demonstrated. As a target, the reagent waste mixture will have between 40 and 60 percent combined SiO_2 and Al_2O_3 content and 10 to 20 percent sodium oxide content when dried. It is expected that this range of SiO_2 and Al_2O_3 content will produce a durable glass. The melting point of the glass mixture can be lowered by increasing the sodium oxide content of the glass. Sodium hydroxide may be added to the mixture before heating to increase the sodium oxide content of the vitrified waste. Enough sodium hydroxide will be added to cause the mixture to melt at 1250°C in a muffle furnace. This temperature was chosen to give a reasonable compromise between the cost of addition of sodium oxide content to lower the melting point, the expected increase in leachability as the melting point of mixture is lowered, and the energy cost to melt and form the vitrified material. It is generally recognized in the glass manufacturing industry by companies such as Corning that to form homogeneous and durable glass mixture with hazardous waste that melt temperatures between 1250 and 1350°C

are needed. If this vitrification process is carried forward to the remedy design phase, the effect of melt temperature will be investigated.

Action: Text revised to include justification.

Commenting Organization: U.S. EPA Commentor:
Pg. # 10 Section #4.2.1 Paragraph # Sent./Line #
Original Comment #8

Comment: Table 4-2: According to this table, the mass increases potentially required to affect vitrification is 50 to 70 times the weight of the waste. If reduction in volume is considered a criteria for selection of a remedial alterative, the feasibility and applicability of vitrification to remediate OU1 wastes should be discussed in an appropriate section of the work plan. Reevaluation of vitrification should be considered.

Response: Disagree. The reviewer has misunderstood the contents of the table. The numbers indicate a weight percent and not a multiplier. The table will be revised to clarify this fact.

Action: Table 4-2 revised.

Commenting Organization: U.S. EPA Commentor:
Pg. # Section #6.0 Paragraph # Sent./Line #
Original Comment #9

Comment: general: The sampling and analysis methods for all of the proposed testing should be specifically provided within Section 6.0. This section should address all sampling and analytical methods for raw waste characterization, treated sample analysis, and additive characterization.

A summary of the sampling and analysis plan (SAP) for collection of the test samples should be provided.

Response: Noted. Information will be added to Section 6.0 of the document as requested. A summary will be provided of the sampling plan; however, detailed information can be obtained from the EPA-approved Sampling and Analysis Plan for Operable Unit 1 (DOE 1991). All of the methods introduced in this study will be described in Appendix B and C.

Action: Section 6.0 revised to include the above.

Commenting Organization: U.S. EPA Commentor:
Pg. # Section #8.0 Paragraph # Sent./Line #
Original Comment #10

Comment: general: The exact quantities of raw waste, liquid, and dry additives should be recorded. Interpretation of leachability test results should include the evaluation of the sample

leachability before and after treatment and should include and evaluation of the results with the treated sample results corrected for dilution in order to separate the dilution effects of stabilization treatment from chemical fixation.

Response: Noted. The above-mentioned information will in fact be recorded as part of the treatability program. See general comment No. 1c for discussion regarding dilution. Section 8.0 will be revised to clarify the extent of data that will be presented at the conclusion of the treatability study.

Action: Text revised.

Commenting Organization: U.S. EPA Commentor:
Pg. # Section #13 Paragraph # Sent./Line #
Original Comment #11

Comment: general: The responsibilities of individuals in the management and staffing of the treatability testing project should be briefly described.

Response: Agree. Section 14.0 will include a brief summary of the project personnel responsibilities.

Action: Text revised.