OPERABLE UNIT 4 PILOT PLANT PHASE I TREATABILITY STUDY WORK PLAN

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

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REPLY TO THE ATTENTION OF:

HRE-8J

Mr. Jack R. Craig
United States Department of Energy
Feed Materials Production Center
P.O. Box 398705
Cincinnati, Ohio 45239-8705

RE: Operable Unit 4 Pilot Plant
Phase I Treatability Study
Work Plan

Dear Mr. Craig:

The United States Environmental Protection Agency (U.S. EPA) has completed its review of the Operable Unit (OU) #4 Pilot Plant Phase I Treatability Study Work Plan. The Phase I work plan describes the OU 4 Pilot Plant program for waste retrieval and vitrification. Although the work plan follows U.S. EPA guidance and provides a description of the preliminary design for the pilot-scale program, several deficiencies exist.

Treatability study objectives and intended data uses are presented in Section 3.0 for both engineering-related parameters and treatability study-related parameters. However, the information is presented in a confusing and erroneous manner. Also, the treatability study does not identify key study parameters and does not present any study objectives or performance goals based either on cleanup criteria or levels which protect human health and the environment. Moreover, the discussion of data quality objectives (DQO) focuses mainly on engineering-related parameters instead of treatability study parameters. The focus and clarity of this section can be improved and corrected if treatability study DQOs and parameters are discussed in the main body of the work plan while engineering-related objectives and data uses are appended to the work plan.

Section 4.0 of the work plan presents a preliminary engineering design for the pilot-scale treatability study units, instead of describing the experimental design of the treatability study testing. Key study parameters are not identified in this section, and there is no description of the types of testing to be performed to vary key parameters. Based on the description of the engineering design, it appears that some of the pilot-scale treatment units will be operated continuously while others will be operated in a batch mode. In summary, there is no clear description of the experimental design for the treatability study that builds on the objectives and key study parameters that should have been presented in Section 3.0.

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Subsequent sections of the treatability study state that treatability study activities will be performed in accordance with specifically cited plans and documents. However, for the treatability study work plan to be a usable, stand-alone document, the relevant portions of the cited documents and plans should either be incorporated directly into the work plan or be appended.

Therefore, U.S. EPA hereby disapproves the treatability study work plan pending incorporation of the attached comments.

Please contact me at (312) 886-0992 if you have any questions.

Sincerely,

James A. Saric, Remedial Project Manager
Technical Enforcement Section #1
RCRA Enforcement Branch

Enclosure

cc: Tom Schneider, OEPA-SWDO
Pat Whitfield, U.S. DOE-HDQ
Don Ofte, FERMCO
Jim Theising, FERMCO
Paul Clay, FERMCO

TECHNICAL REVIEW COMMENTS ON OPERABLE UNIT 4 (OU4) PILOT PLANT PHASE I TREATABILITY STUDY WORK PLAN, REVISION 0

GENERAL COMMENTS

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 1.0 Page #: NA Line #: NA
Original General Comment #: 1
Comment: This treatability study work plan references U.S. EPA guidance on conducting treatability studies (U.S. EPA 1992). Although the work plan includes all major sections identified in the guidance, it lacks specific information and details in several sections. For example, according to the guidance, one of the items Section 1 should provide is a summary of existing waste characterization data. However, the work plan provides only a general discussion of certain treated waste characteristics from previous laboratory and bench-scale vitrification testing. Without a complete characterization of the untreated waste materials in the OU4 silos, it is difficult to determine the suitability and adequacy of the proposed sampling and analysis procedures for this treatability study. The U.S. Department of Energy (U.S. DOE) should include characterization information for the untreated wastes.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 3.0 Page #: NA Line #: NA
Original General Comment #: 2
Comment: According to U.S. EPA 1992, Section 3 should present the objectives of the treatability study and the intended data uses. However, Section 3 of the treatability study work plan merely presents general performance objectives for three activities--hydraulic mining of silo material, solids dewatering, and vitrification--and only references data quality objectives in Table 3-1. Also, the information for performance and data quality objectives is presented in a confusing manner, where both engineering-related and treatability study-related objectives are combined and presented in no particular order in Table 3-1. The engineering-related objectives should be addressed separately from the treatability study objectives. Also, the treatability study objectives in Table 3-1 do not present performance goals based on either cleanup criteria or levels which protect human health and the environment. U.S. DOE should revise Section 3.0, especially Table 3-1, to address the noted deficiencies and to follow U.S. EPA's 1992 guidance for conducting treatability studies.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.0 Page #: NA Line #: NA
Original General Comment #: 3
Comment: According to U.S. EPA 1992 guidance, this section of the treatability study work plan should describe the experimental design of the treatability study. This section, for example, should present the volume of waste material to be tested, the critical parameters to be studied and how they will be varied, and the degree of replication. Instead, this section presents a preliminary engineering design for the individual components of the pilot-scale treatment system, as well as a description of construction and startup activities. Where certain relevant study parameters such as solids flow rates from the thickener and slurry tanks are mentioned, either a single value or a range of values is given for each parameter. No key study parameters are identified and presented in Section 3.0, nor is there a discussion of how these parameters will be varied during the study. U.S. DOE should revise this section to present all the information specified in the U.S. EPA 1992 guidance, especially the critical parameters to be studied and how they will be varied to meet the objectives in the revised Section 3.0, the volumes of waste materials to be tested, and the amount of sampling replication.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 6.0 to 10.0 Page #: NA Line #: NA
Original General Comment #: 4
Comment: These sections state that treatability study activities will be performed in accordance with certain specifically cited plans and documents. For the treatability study work plan to be a usable, stand-alone document, the standard procedures and other relevant portions of the cited documents should either be incorporated directly into, or appended to, the treatability study work plan.

SPECIFIC COMMENTS

Commenting Organization: U.S. EPA Commentor: Saric
Section #: NA Page #: viii Line #: 17
Original Specific Comment #: 1
Comment: The acronym "PCT" is listed but is not defined. This acronym should either be defined or deleted.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 1.3.1 Page #: 1-3 Line #: NA
Original Specific Comment #: 2
Comment: The first paragraph of this subsection states that OU4 personnel are preparing for the third tier of U.S. EPA's approach for conducting treatability studies at Superfund sites. The third tier is the RD/RA treatability study phase conducted after the ROD is signed. Because the final remedy for the Fernald site has not yet been selected and the ROD has not been signed, the work plan should address the issue of the vitrification alternative not being selected in the ROD.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 1.4.2 Page #: 1-8 Line #: NA
Original Specific Comment #: 3
Comment: The first paragraph cites a document that is not included in the references. This document should be listed in the reference section of the work plan.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 1.4.3 Page #: 1-13 Line #: NA
Original Specific Comment #: 4
Comment: This subsection states that the optimum formulation of materials for glass formation through vitrification will be based on several factors, including processability, phase stability, and the ability to handle variation in the waste feed composition. It further states that the chosen formulation will be optimized "through a statistically designed series of tests over a wide range of credible waste stream compositions." The text in this subsection should be clarified to explain, for example, how each of the factors will be measured, what comprises the statistically designed series of tests, and what is meant by a wide range of credible waste stream compositions.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 1.0 Page #: NA Line #: NA
Original Specific Comment #: 5
Comment: See Original General Comment #1. This section should summarize all existing waste characterization data for OU4, including data for treated and untreated waste. This data should be organized by matrix type and include concentrations for key treatability study parameters.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2.0 Page #: NA Line #: NA
Original Specific Comment #: 6
Comment: The work plan would become more useful if a box-type flow diagram of all pilot-scale treatability study components showing input, output, and sidestreams generated as a result of treatment or waste handling were included.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2.0 Page #: 2-1 Line #: NA
Original Specific Comment #: 7
Comment: Two documents cited in the first paragraph of this section are not included in the reference section. The work plan should be revised to include these two documents in the reference section.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2.3 Page #: 2-5 Line #: NA
Original Specific Comment #: 8
Comment: The subsection entitled "Treatment" discusses waste stabilization and the associated equipment for vitrification; however, similar information is not included for cement stabilization, as described in Alternative 2A, page 2-3. The missing text discussing cement stabilization equipment should be provided to fully describe this alternative.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 3.0 Page #: NA Line #: NA
Original Specific Comment #: 9
Comment: See Original General Comment #2. Also, this section discusses data quality objectives (DQO) by referencing the U.S. EPA-approved "Sitewide CERCLA Quality Assurance Project Plan (SCQ)" and by presenting corresponding analytical support levels (ASL) in the text and in Table 3-1. However, to make the work plan more usable as a stand-alone document, the relevant sections of the SCQ should be either directly incorporated into the text or appended to the work plan. Also, the correlation between ASLs and DQOs should be provided for easy reference. Finally, although performance objectives and DQOs/ASLs for engineering-related and site characterization-related activities are important to the overall treatability study, they are not directly associated with the experimental testing and should be included as an appendix to the treatability study work plan instead of being presented in the main text of the plan.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 3.1 Page #: 3-1 Line #: NA
Original Specific Comment #: 10
Comment: The second paragraph states that optimum process parameters for the treatability of K-65 and Silo 3 material will be identified in Phase II. This statement should be clarified to explain why optimum process parameters cannot be identified in Phase I.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 3.2 Page #: 3-1 to 3-3 Line #: NA
Original Specific Comment #: 11
Comment: This subsection mixes engineering-related objectives (Subsections 3.2.1, Silo Dome Modification; 3.2.2, Superstructure; and, 3.2.6, Support Systems) with treatability study objectives. Only treatability study objectives should be presented in the text of the work plan; engineering-related objectives should be appended. Also, the engineering-related objectives are qualitative rather than quantitative. Finally, the treatability study objectives should be correlated with DQOs presented in Table 3-1.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 3.2.5 Page #: 3-2 Line #: NA
Original Specific Comment #: 12
Comment: This subsection discusses performance objectives in general terms for vitrification. The text states that about 10 percent (dry weight basis) of additives such as sodium carbonate and trace amounts of metallic elements and sulfates will be added to the dewatered solids before they enter the vitrification furnace. The composition and quantities of the additives and metallic elements should be presented here and in Section 5.0, Equipment and Materials.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 3.3 Page #: 3-3 Line #: NA
Original Specific Comment #: 13
Comment: As mentioned in Original Specific Comment #11, DQOs related to the treatability study should be correlated with performance objectives in Table 3-1 and engineering-related DQOs and performance objectives should be appended rather than discussed in the main text of the work plan. In addition, the second paragraph in this subsection states that the "FEMP Site Characterization organization" will determine if additional soil sampling is required at Silo 4 to

characterize this medium for disposal purposes. Unless the treatability study includes treatment of soil removed from around Silo 4, this statement should be included in an appendix to the work plan rather than in the main text. Also, if the FEMP Site Characterization organization has any other responsibilities that directly affect the conduct of the planned treatability study, then this organization should be further discussed in Section 14.0, Management and Staffing.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Table 3-1 Page #: 3-4 Line #: NA
Original Specific Comment #: 14
Comment: This table outlines the sampling and analysis activities for Phase I of the pilot-scale treatability study. This table, however, does not present the information outlined in U.S. EPA's guidance for treatability studies. Based on this table's current organization and information presented, there is no description of test and performance objectives for key study parameters. This deficiency precludes the evaluation of sampling and analytical methods for suitability and adequacy to meet the objectives. Other problems with the table include the following: matrixes to be sampled are referred to as "parameters," reasons for sampling are referred to as "objectives," key study parameters are not identified or correlated with objectives, sampling procedures are either referenced to other sources or merely identified by type (for example, grab sample), sampling locations are not given, the frequency of sampling and sample preparation procedures are referenced to other sources or identified as "TBD," analytical methods are not always properly referenced by method source and number, ASLs are not correlated with DQOs, and the number of quality control samples is merely referenced to a method or listed as "duplicates." These deficiencies need to be corrected. Table 3-1 should also present project-specific information instead of merely referencing an analytical or sampling method, and should closely follow U.S. EPA's 1992 guidance document.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.0 Page #: NA Line #: NA
Original Specific Comment #: 15
Comment: See Original General Comment #3. As stated previously, engineering- and construction-related data and procedures should be appended instead of being described in the main text of the work plan. Also,

Section 4.0 should include the specific step-by-step measuring, monitoring, sampling, and analyzing procedures to be used during the treatability study. These procedures should be standardized and appended to the work plan so that the degree of supervision needed and the number of potential errors that may occur are minimized.

With regard to the engineering design and operation of the pilot plant, there is almost no discussion of how temperatures, flow rates, and other monitoring data will be collected, or what instruments will be used to monitor and control operating conditions, especially for the vitrification furnace. These deficiencies should be addressed in the revised work plan.

Finally, with regard to Figures 4-1 through 4-3, the image quality is very poor and much of the text is so small that it is illegible. These deficiencies should be corrected in the revised work plan.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Figure 4-2 Page #: 4-3 Line #: NA
Original Specific Comment #: 16
Comment: This figure shows the pilot plant process flow diagram for the solids dewatering and vitrification processes. This figure does not show "Flow No. 1, Silo 4 material (surrogate)." In addition, the figure shows neither where the blowdown from the cooling tower will be discharged nor does it address the aerial dispersion of cooling tower draft, which may contain some degree of radioactivity during Phase II testing. Finally, it is not clear why two sets of operating data such as solids flow rates, water flow rates, and operating times are presented for recycle water and thickener overflow. These deficiencies and questions should be addressed in the revised work plan.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.1.1 Page #: 4-4 Line #: NA
Original Specific Comment #: 17
Comment: This subsection discusses the removal of a portion of the reinforced concrete dome of Silo 4. The first sentence of the second paragraph states that, prior to cutting the dome section, a compression ring may be installed, if necessary. The text should clarify when this decision will be made and by whom. Also, the paragraph further states that other dome cutting methods will be considered if they are shown to be superior to the reference method. The text should

clarify when the final dome cutting method will be selected and by whom.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.1.2 Page #: 4-7 Line #: NA
Original Specific Comment #: 18
Comment: This section discusses the design for the vitrification facility. The text states that the system will be monitored to establish parameters to treat the off-gases generated during Phase II vitrification testing of radioactive material. The text should clarify what parameters will be monitored, what instruments or devices will be used for monitoring the parameters, and what parameters are proposed to be established.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.1.2 Page #: 4-9 Line #: NA
Original Specific Comment #: 19
Comment: This subsection discusses the vitrification furnace, or "melter." The text states that determining the required retention time in the furnace is a major objective of the treatability testing. Because this is a key parameter, it should be included in Table 3-1, along with its associated objective and measurement procedure. In addition, the range of retention times and any other parameters to be tested should be provided.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.3.1 Page #: 4-11 Line #: NA
Original Specific Comment #: 20
Comment: This subsection lists "checkout activities" to be performed on pilot plant equipment prior to startup. This section mentions treatment chemicals for the cooling tower water and glass additives for the simulated waste solids slurry mixture. The quantity and quality of these chemicals and additives should also be included in Section 5.0, Equipment and Materials.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.4 Page #: 4-13 and 4-14 Line #: NA
Original Specific Comment #: 21
Comment: This section discusses pilot plant testing of the vitrification furnace. The text refers to the term "heavy metal drain" when discussing testing of the furnace's operation. The term "heavy metal drain" should be clarified.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 5.0 Page #: NA Line #: NA
Original Specific Comment #: 22
Comment: This section lists the equipment and materials that will be used during the performance of the treatability study. The work plan, however, does not include the following items: quantity and types of reagents (additives and treatment chemicals), reagent grades and concentrations, calibration or scale for instrumentation, and equipment manufacturers and model numbers. These deficiencies should be corrected in the revised work plan.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 6.0 Page #: NA Line #: NA
Original Specific Comment #: 23
Comment: This section briefly discusses engineering-related and treatability study-related sampling and analysis. The main body of this section should focus on the treatability study sampling and analysis. Engineering-related sampling and analysis should be appended. Also, this section does not describe sampling objectives, locations, or frequencies; sample designation; sampling equipment and procedures; or sample handling and analysis. Moreover, the text makes only a brief reference to quality assurance/quality control requirements, which are presented in Table 3-1. If the SCQ is to be used for the treatability study, applicable sections of that document should be revised so that a project-specific quality assurance project plan (QAPP) is available for the treatability study. The revised SCQ or project-specific QAPP should be either incorporated into the body of the work plan or appended. Section 3.6 of U.S. EPA's 1992 guidance for conducting treatability studies discusses sampling and analysis plans and QAPPs, and cites additional references for guidance. Section 6.0 of the work plan should be completely revised to correct these deficiencies.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 7.0 Page #: 7-1 Line #: NA
Original Specific Comment #: 24
Comment: This section discusses data management related to the treatability study. The text states that data and records will be managed in accordance with several cited documents, including the SCQ. In addition, some of the text refers to "applicable sections" of the cited documents while other text states that if one of

two cited documents is not applicable, then another applies. This type of narrative indicates that a project-specific set of data collection forms and data management procedures have not been prepared. This section of the work plan should be revised to clearly describe the project-specific data collection and management forms and procedures that will be implemented during the treatability study. If existing documents such as the SCQ will be used, then the applicable sections should be either incorporated directly into the work plan or should be included in an appendix.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 8.0 Page #: 8-1 Line #: NA
Original Specific Comment #: 25
Comment: This section briefly discusses data analysis and interpretation. According to the work plan, only ASL C data will undergo data validation using "FEMP Data Validation program requirements." These requirements should be tailored specifically for the treatability study and should either be incorporated into the main text of the work plan or should be included in an appendix. In addition, these requirements should also discuss what corrective action will be implemented if quality assurance goals are not met. Moreover, this section does not discuss how data will be summarized or how statistically significant differences between two or more parameter values will be determined. These deficiencies should be addressed in the revised work plan.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 9.0 Page #: 9-1 Line #: NA
Original Specific Comment #: 26
Comment: This section discusses the health and safety plan (HSP) for the treatability study. The text states that a general HSP is being developed for all OU4 activities and that project-specific HSPs will be developed for Phase I activities as addendums to the general HSP, as specific activities dictate. The treatability study HSP should have already been prepared and included in this work plan. If the treatability study HSP will not be included in the revised work plan, then the revised work plan should, at a minimum, identify the general treatability study activities and associated hazards that will be covered in the HSP when it is finalized, as well as the level of personal protection (A, B, C, or D) required for each treatability study activity, decontamination procedures, and emergency procedures.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 10.0 Page #: NA Line #: NA
Original Specific Comment #: 27
Comment: This section discusses management of residuals generated as part of the treatability study and generally addresses most of the issues presented in U.S. EPA's 1992 treatability study guidance document. The text refers to specific operating procedures for characterizing treatability study waste streams. These procedures should be incorporated directly into the work plan or should be included in an appendix. In addition, an estimate of the amount of each treatability study waste should be included in the work plan.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 13.0 Page #: NA Line #: NA
Original Specific Comment #: 28
Comment: This subsection presents the master schedule of activities and milestones for OU4. This schedule shows that the Phase II work plan was to have been submitted on February 24, 1994. This schedule should be updated and corrected, as necessary.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 14.2 Page #: 14-4 Line #: NA
Original Specific Comment #: 29
Comment: This subsection discusses project staffing for the treatability study and includes an organizational chart for the pilot-scale treatability study. However, the text only discusses the roles of some of the departments shown on the organizational chart. The revised work plan should describe the roles and responsibilities of all key individual staff members associated with every department and office participating in the treatability study.