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DISAPPROVAL OF TREATABILITY STUDY WORK PLAN FOR OU #2

09-23-91

USEPA/DOE-FSO
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LETTER

[redacted]

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

2118

SEP 23 1991

REPLY TO ATTENTION OF:
5HR-12

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

RE: Disapproval of Treatability Study Work Plan for OU #2

Dear Mr. Craig:

The United States Environmental Protection Agency (U.S. EPA) has completed its review of the Treatability Study Work Plan for Operable Unit #2.

U.S. EPA hereby disapproves the Work Plan. The deficiencies are enclosed.

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

Sincerely,

James A. Saric
Remedial Project Manager

Enclosure

cc: Graham Mitchell, OEPA-SWDO
Pat Whitfield, U.S. DOE-HDQ

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General Comments

The major Comment regarding the Operable Unit #2 treatability study workplan is basically the same as that for Operable Unit #4. The scope of the treatment is only with hazardous materials. However, the major contaminants are uranium, thorium, and decay products. The study omits consideration for stabilization of radiological components, particularly radon. The study should add investigation of radionuclides/radon or else justify omitting it. The study could also be suitably modified to include leachability and stabilization of radioactive contaminants, radon will be particularly essential to validation of a particular treatment technology. 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.

GENERAL COMMENTS

1. The work plan document is well organized and in general contains the types of information that will result in successful treatability testing. However, the logic of the test methodology is an area of concern. Specifically, the design of the treatability study work plan and in particular, the selection and use of the stabilization/solidification (S/S) screening criteria, are not related the remedial action objectives (RAO) presented in the document. As noted in the work plan (Subsection 1.0, page 1, lines 8 through 11), the primary use of treatability test results is to select a remedial action technology that will result in attainment of RAOs, it is recommended that the design of the test methodology and the relevant sections of the work plan text be modified in accordance with the following comments and testing considerations.

2. The test plan proposes using the measurement of unconfined compressive strength as the primary screening criterium for the initial (preliminary) screening criteria. The toxicity characteristic leaching procedure (TCLP) test is the primary criteria used during the advanced testing. In both cases, specific measurement values are proposed to determine successful treatment; however, the justification for selecting these values (500 psi unconfined compressive strength and TCLP listing standards) is not related to RAOs. Because negotiations and discussions regarding the specificity of the proposed RAOs are still ongoing, it may be difficult to choose measurements and values that would definitely identify the ability of a treatment or individual formulation to meet RAOs. However, the testing should be designed to provide the best possible conclusions regarding (1) the feasibility of the technology and (2) specific cost information to facilitate alternative screening in the FS.

   It is recommended that the preliminary screening be based on the ability of formulations to chemically fix constituents of concern. Furthermore, it is recommended that the screening be based on qualitative analysis. 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). This will assure that the final formulation(s) will result in minimal volume increases, because the primary focus will be on the stabilization chemistry and not on the physical attributes. Once the formulation chemistry has been optimized, formulations can be fine tuned to produce desirable physical characteristics. Secondary screening of formulations should include physical properties or selection of formulations that require the least costly and least amount of chemical additives.

3. The methodology for conducting stabilization treatability studies should recognize several other issues related to the feasibility and optimization of treatment by S/S technology.

   As mentioned in general comment 1, the S/S treatability test methodology should consider that while the physical properties of the final waste form can be varied to limit the exposed surface area and enhance the treatment effectiveness, understanding and controlling the stabilization chemistry is crucial to successful and optimum treatment. The following observations outline recommended additions to the work plan experimental design test methodology that will not only enhance the treatability test results outcome for feasibility study screening, but that will improve the test results' usefulness for remedial design.

a) The work plan does not propose pH measurements of stabilization mixtures. The pH of the leaching solution strongly influences the solubility of heavy metals. 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 for (1) selecting the optimum pH of a stabilization mixture and (2) minimizing the leachability of the metals of concern.

Furthermore, during the leaching procedure (as proposed in the work plan using TCLP), chemical changes continue to occur in the stabilized matrix. For example, an acidic leach will neutralize some 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 a stabilized material is exposed on site to fairly neutral leaching (such as nonacidic 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 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.

c) The appendices prove a justification for the use of the 500 psi UCS measurement as a screening criteria. However, the test plan methodology should recognize that (1) the UCS measurement has different relevance to each of the proposed remedial alternatives and (2) the directive should be applied to site-specific aspects of Operable Unit (OU) 2 and the remedial alternatives being considered.

d) Leachability analysis is proposed for treated waste mixtures only and is not proposed for 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 procedures) before and after treatment. After treatment leaching results must be corrected for the dilution of additives in order to perform the qualitative analysis.

4. 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 a particular test mixture shows the best fixation for lead but the worst for thorium, what criteria will be used to rank the success of this formulation?

5. 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.

6. The test plan does not recognize the importance of particle size distribution in the evaluation of implementability of stabilization treatment. No mention is made in the text of the known size distribution of the wastes. Waste characterization performed as part of the treatability studies should address particle size distribution, and the screening of remedial alternatives should consider particle size distribution of the wastes.

7. Additional leaching tests, such as American Nuclear Society (ANS) 16.1 and a test that simulates long-term stability, such as a multiple extraction, should be considered.

SPECIFIC COMMENTS

1. Subsection 1.2.3, page 6, lines 26 and 27: This sentence does not mention that active fly ash was analyzed for semi-volatile organic compounds (SVOC). It is highly unlikely that volatile organic compound (VOC) will be present in fly ash from the combustion of coal; however, SVOCs are a much more likely to be present. Further characterization of all fly ash wastes (from both the inactive and active disposal areas) should concentrate on the quantification of SVOCs. The treatability test methodologies should also reflect this concern.

2. Subsection 1.3.3, page 17, lines 30 through 33: The test methodology and selection criteria should be reconsidered in accordance with general comments 1, 2 and 3.

3. Subsection 1.3.3, page 18, line 7 through 9: This paragraph should be rewritten to clarify specific ARARs and should take into consideration changes suggested in the general comments regarding test methology and objectives.

4. Subsection 3.1, page 1, general: The performance objectives should be revised in accordance with the changes made in response to the general comments above.

5. Subsection 3.1, page 1, lines 24 through 27: 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.

6. Subsection 3.1, page 2, Table 3-1: The information in Table 3-1 in not clearly presented. The table title implies that these are the suite of analyses to be performed on treated waste samples; however, the table reference in the text is inadequate, and the qualifiers listed as notes on the table are confusing and unacceptable. For example, what characterization study is being referenced in note b? How will note d be resolved within the scope of the treatability studies? The test plan must provide a definite plan for analysis of all parameters and reference test methods where appropriate.

7. Subsection 4.1, page 1, line 5: The text states herein that the purpose of the treatability testing is to define the stabilization mixtures that will provide optimal performance. The text should clarify that the remedial design phase and associated studies to be performed as part of remedial design are more appropriate for "optimal formula" investigation. The purpose of attempting to narrow down the formulations is so that fairly accurate cost information can be provided for feasibility study screening.

8. Subsection 4.1, page 1, line 11-12: Although Appendix A provides a good background on S/S techniques, the work plan should justify or explain the selection of potential stabilizing additives such as Type I and Type II Portland cement (instead of Types III or IV), attapulgite, or clinoptilotile. How do each of the additives relate to the known chemical makeup of the wastes? For example, do any of the wastes from OU 2 contain high levels of sulfate (especially the active fly ash from the electrostatic precipitators), which would necessitate the use of Type IV cement?

9. Subsection 4.1.6, page 1, line 22: 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? Screening prior to treatability testing could distort the results of the treatment (especially the physical measurements) if the waste samples contain significant amounts of large particles.

10. Subsection 4.1, page 1, line 27: While the use of a plastic container is common for bench-scale testing, caution should be exercised due to the potential for rapid heat release during the mixing of additives, waste, and water.

11. Subsection 4.1, page 5, line 1: The work plan text should clearly qualify the limited value of measuring temperature increase during the experiments. The text should recognize that in practice the actual temperature increase will be affected by the rate of chemical addition; by the size of the stabilized block; 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 thermometer (thermocouple) placement in the mixture. The work plan does not adequately address these potential influences on the measurement and therefore such measurements will be of nonquantitative value.

12. Subsection 4.1.1, page 5, lines 7 and 8: Provide justification for the procedures proposes to ash the Sanitary Landfill waste. What is the relevance of the 200° C and 500° C temperatures? Will the samples be subject to crushing and screening prior to ashing, or will the ashed samples be screened? If so, explain the relevance to field treatment processes.

13. Section 6.0 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. The suite of analysis for each type of measurement should be provided.

14. Section 8.0 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. Interpretation of leachability test results should also evaluate the results against treated sample results corrected for dilution, in order to separate the dilution effects of stabilization treatment from chemical fixation.

15. Section 13 general: The responsibilities of individuals in the management and staffing of the treatability testing project should be briefly described.