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JUL 10 1997

DOE-1157-97

Mr. James A. Saric, Remedial Project Manager
 U.S. Environmental Protection Agency
 Region V-SRF-5J
 77 West Jackson Boulevard
 Chicago, Illinois 60604-3590

Mr. Tom Schneider, Project Manager
 Ohio Environmental Protection Agency
 401 East 5th Street
 Dayton, Ohio 45402-2911

Dear Mr. Saric and Mr. Schneider:

RESPONSE TO COMMENTS ON THE OPERABLE UNIT 4 VITRIFICATION PILOT PHASE I INTERIM TREATABILITY STUDY REPORT - CAMPAIGN 4

The purpose of this letter is to transmit the responses to comments on the above subject report and close out the reporting requirements for Phase I testing of the Vitrification Pilot Plant (VitPP). Please find enclosed the responses to the Ohio Environmental Protection Agency (OEPA) comments.

The letter transmitting the original *Operable Unit 4 Vitrification Pilot Plant Phase I Interim Treatability Study Report - Campaign 4*, indicated that the Department of Energy, Fernald Environmental Management Project (DOE-FEMP) would provide a final Phase I Treatability Study Report upon gathering additional Phase I data as a result of the recommendations from the Melter Incident Report. As discussed on June 30, 1997, the reevaluation of the selected remedy through the Operable Unit 4 Record of Decision (ROD) Amendment/Explanation of Significant Difference (ESD) process has prompted DOE to reevaluate the path forward for the remediation of OU4. The new path forward, which has been endorsed by the U.S. Environmental Protection Agency (U.S. EPA), OEPA, and the local stakeholders, does not involve any additional vitrification testing at the VitPP facility. Therefore, no additional testing is required to complete Phase I testing and it is DOE-FEMP's understanding that no further reports are required by the EPAs for the Phase I testing of the VitPP.

If you have any questions, please contact Nina Akgündüz at (513) 648-3110.

Sincerely,



Johnny W. Reising
Fernald Remedial Action
Project Manager

FEMP:Yockman

Enclosure: As Stated

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DOE FEMP MSL 531-0297 HAMILTON COUNTY COMMENTS
 OU4 VITPP PHASE I CAMPAIGN 4 REPORT

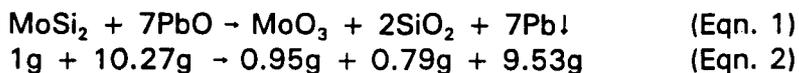
1) Commenting Organization: Ohio EPA Commentor: OFFO
 Section #: 1.3 Page #: 1-2 Line #: Code: C
 Original Comment #:

Comment: The text describes one of the objectives achieved in Campaign 4 was the successful handling of materials containing high lead concentrations. Seeing that one of the possible causes of the melter failure was the pooling of lead in the bottom of the chamber, Ohio EPA would tend to question the successful handling of lead in the slurry.

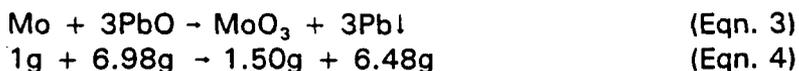
Response: The Campaign was successful in handling materials containing lead in concentrations between eight and ten weight percent of lead. This range represents a high lead concentration waste loading. However, there are two essentially independent issues dealing with lead that can be confused with the success of the Campaign. Issue 1 is the vitrification process. Issue 2 deals with the unique design of the supplied melter. The elemental lead seen in the melter and the bubbler that deteriorated in the melter are essentially unique to the 3-chamber bottom-bubbler system design of the melter, not the processing of the K-65 wastes. The issues will be described here separately.

Issue 1. High concentrations of lead simulated waste were processed and high lead-bearing glass was made which did well with the EPA TCLP test. Also, the Redox of the glass was sufficiently oxidized to prevent the precipitation of elemental lead or lead sulfide from the molten glass in the melter. For example, the Fe^{+2}/Fe_{total} ratio was < 0.20 for all the batches processed. This is well below the laboratory tests that showed the lead sulfide can precipitate from the glass melt if the ratio Fe^{+2}/Fe_{total} is > 0.6 .

Issue 2. The elemental lead in the melter came from the chemical reaction of molybdenum metal electrodes and molybdenum disilicide tubes which are unique to this melter. The molybdenum disilicide tubes chemically reacted with the lead in the glass as follows:



According to Equations 1 and 2, 1.0 gram of molybdenum disilicide produces 9.53 grams of molten lead metal. The molybdenum metal electrodes chemically reacted with lead-bearing center chamber glass that has leaked into the electrode side chambers as follows:



According to Equations 3 and 4, 1.0 gram of molybdenum metal will produce 6.48 grams of molten lead metal. The amount of elemental lead found in the melter upon visual inspection was on the order of tens-of-pounds which matches the above scenarios and is supported by the mass balance performed for Campaign 4.

The mass balance performed around the process for Campaign 4 (refer to Tables 5-10 through 5-14 from the Campaign 4 Interim Treatability Study Report) showed that Approximately 96% of the lead that was introduced into the system was retained in the glass product. A total of 70 pounds of lead was unaccounted for.

Action: Future melter designs will be closely scrutinized for such reactions and materials of construction will be tested in the laboratory before a melter design is accepted. In addition, subsequent melter design will accommodate the potential for reduction of lead in the bottom of the melter.

2) Commenting Organization: Ohio EPA Commentor: OFFO
 Section #: 2.4.9.2 Page #: 2-20 Line #: Code: C
 Original Comment #:

Comment: Urea has been successfully used to treat sulfate foaming in the melter. However, the document states water can also be used for the same purpose. Since water would be cheaper and easily obtainable, please describe why urea continues to be used instead of water.

Response: Both urea and water can be used to treat sulfates in the melter. However, they do it by different mechanisms. Water reacts with sulfates at high temperature to form sulfuric acid (H_2SO_4). Whereas, urea is a reductant that has an affinity for oxygen and destroys sulfates by taking oxygen from the sulfates. Together, water from the slurry and urea can compliment each other in the destruction of sulfates. Using water alone can be counter productive because excess water can dilute the feed and result in lower production levels. The cost of processing the extra water is much higher when compared to the cost of adding urea. During Campaign 4, it was determined that the best course of action would be the use of water in conjunction with urea. The amount of urea was usually below 1% of the total solids present in the slurry which contributed minimally to the cost of the project.

Action: None.

3) Commenting Organization: Ohio EPA Commentor: OFFO
 Section #: 2.7 Page #: 2-27 Line #: Code: C
 Original Comment #:
Comment: Explain the term "minors".

Response: When the surrogates were formulated, those components whose concentrations constituted more than 0.5 wt% (as the oxide) of the actual waste were simulated in the surrogate. These were called the major components, notably: Silicon, lead, barium carbon, aluminum, iron, sodium, sulfur, magnesium, potassium, phosphorous, and nitrogen. Those components with concentrations less than 0.5 wt%, called minors, were not included in the surrogates for the pilot campaigns because their presence at these concentrations would have little or no impact on the glass chemistry. Also, these components tend to be the more expensive and more toxic components of the K-65 wastes. Collectively, the minors constitute approximately 2 to 4 dry wt% of the actual waste.

Action: None.

4) Commenting Organization: Ohio EPA Commentor: OFFO
Section #: 3.1.2 Page #: 3-4 Line #: Code: E
Original Comment #:
Comment: Complete the last sentence in the first full paragraph on the page.

Response: Agreed, the sentence should read; "To prevent running the seals without cooling fluid, this switch was designed to shutdown the melter feed pump automatically when the low seal tank fluid level is low".

Action: The phrase "is low" will be added to the report and the amended page will be issued to personnel on the original distribution list of the Campaign 4 report.

5) Commenting Organization: Ohio EPA Commentor: OFFO
Section #: 3.4 Page #: 3-10 Line #: Code: C
Original Comment #:

Comment: Please provide a schematic drawing of the modifications made to the NOG system prior to the start of Campaign 4. A drawing showing the NOG before and after modifications would be easier to understand than a verbal description of changes.

Response: Attached are 2 sketches that identify the changes made to the VITPP Normal Offgas (NOG) treatment system for Campaign 4. For reference to the NOG components relative to the balance of the VITPP process, refer to the Campaign 4 Process Flow Diagram, Figure 3-1, page 3-2, of the Campaign 4 Treatability Report.

The changes shown on the Design Change Notice (DCN) sketch for Drawing # 94X-5900-N-00273 (DCN 40110-005) address the addition of the 6-inch NOG line (OG-6"-A-5650-ET) to route the NOG from the Quench Tower and Scrubber directly to the NOG HEPA Filters. The 6-inch NOG line routing bypasses the Off-Gas Desiccant Tower and the Carbon Bed Vessels; note the 'Abandon in

'Place' call out for the 4-inch NOG line (OG-4"-A-5608) that formally routed the NOG from the Quench Tower and Scrubber to the Off-Gas Desiccant Tower.

The DCN sketch for Drawing # 94X-5900-N-00273 shows the 'Abandon in Place' call out for the Off-Gas Desiccant Tower and ancillary piping and equipment.

The DCN sketch for Drawing # 94X-5900-N-00315 shows the installed 6-inch NOG line (OG-6"-A-5650-ET) tying in directly to the inlet lines (OG-4"-A-5622 and -5623) to the NOG HEPA Filters. Also shown are the 'Abandon in Place' call outs for the NOG Carbon Bed system.

Action: None

6) Commenting Organization: Ohio EPA Commentor: OFFO
 Section #: 3.5 Page #: 3-12 Line #: Code: C
 Original Comment #:

Comment: Is the recycle water used to flush the slurry lines the same water that is recycled for use in the off-gas system? If so, a settling or filter system is not mentioned and would be necessary to prevent damage to the off-gas system.

Response: No, while the recycle water was the source of the flush water for the slurry circulation line, slurry tank pumps, and the melter feed pump, the slurry flush discharge was not returned to the recycle water system. The flush discharge was returned to the slurry tanks, or in the case of the melter feed pump, the slurry was discharged directly into the melter. The slurry flush discharged to the slurry feed tanks was subsequently used as part of the makeup for follow on slurry mixes or was discharged as part of a slurry system clean out operation to the poly tanks or to 55 gallon drums where the water was decanted and transferred to the sump tank and the solids were reprocessed with new slurry batches.

Action: None

7) Commenting Organization: Ohio EPA Commentor: OFFO
 Section #: 5.1.2.4 Page #: 5-19 Line #: Code: C
 Original Comment #:

Comment: Is there any explanation why the power input dropped for 10 hours during the middle of Batch 6 while the bath temperature was maintained at 1250 degrees?

Response: The decrease in power input for the ten hour period indicated on Figure 5-8 of the Phase I Interim Treatability Report - Campaign 4 was due to four events: a twelve hour idle period between batches 5 and 6, the addition of lithium carbonate to the glass bath, the addition of urea to the slurry and the initiation of the Batch 6 feed.

The cyclical nature of the power/sulfate relationship has been noted on prior occasions. Batches preceding Batch 6 showed a significant amount of foaming. It was determined that the foaming events could be controlled by (1) increasing the amount of urea in the slurry which helps destroy sulfates before they enter the glass bath, and (2) making the glass bath less viscous. In order to decrease the viscosity of Batch 6, lithium carbonate was added to the center chamber of the melter. The decrease in viscosity of the glass allowed the SO_x bubbles to burst without forming a foam and allowed sodium and lithium sulfate to form and collect at the surface of the glass melt. Sodium and lithium sulfate can be destroyed at 880 °C, requiring less power than the destruction of barium or calcium sulfate.

Any time slurry feed was initiated, it was standard procedure to increase the power input to the glass melt in anticipation of a temperature drop. Figure 5-8 shows that this occurred at 16:00 hr and again at 19:00 hr. After the glass temperature reached 1250 °C, the power input was steadily returned to baseline since the twelve hour idle period between Batches 5 and 6 provided time to destroy any sulfates that were present in the glass bath. The power input was not increased until the necessity to destroy sulfates arose again at approximately 06:00 hr.

Action: None.

8) Commenting Organization: Ohio EPA Commentor: OFFO
Section #: 5.3 Page #: 5-48 Line #: Code: C
Original Comment #:

Comment: It appears the three TCLP runs were performed incorrectly. The text describes that in one run the glass was broken down into finer pieces than other batches and that runs were combined. A proper TCLP requires a constant sieve size and a separate run for each batch.

Response: The three TCLP runs were performed correctly. The preparation and analysis of the samples were within the procedural guidelines (method 256-S-5006).

The text refers to a batch of TCLP runs. The samples were not combined. A batch of TCLP runs is defined as a set of samples prepared at the same time; the procedure allows for up to 20 samples to be prepared in one batch. The TCLP tests to characterize the Campaign 4 glass were performed in three separate batches of TCLP tests.

The TCLP procedure requires that the sample pass through a 9.5 mm sieve but offers no other size restrictions. Since the glass samples from the VitPP were routinely monolithic in form, it was necessary for the laboratory to reduce the size of the glass sample by grinding it with a mortar and pestle. For the second

batch of TCLP runs, the glass samples were ground into very fine pieces. This increased the surface area of the material drastically, thus increasing the TCLP results. With the glass so finely ground, the sample is no longer representative of the waste product and therefore the TCLP result is not indicative of the ability of the glass to hinder the mobility of inorganic contaminants.

To address this concern, glass was taken from the same sample container from which the original aliquot of glass was taken. "Re-samples" were taken for four batches. The TCLP test was performed on each "re-sample." The samples were not ground to the extent that the original samples were (in the second batch of TCLP runs) thus, providing a more representative sample. The results of the re-analysis of the four samples showed a drop in lead concentration by a factor between 5 and 55 times lower than the original result (refer to figure 17b on p. 5-47). The results of the re-analyses had lead concentrations between 0.072 and 0.55 ppm.

Comment: "A proper TCLP requires a constant sieve size"

Response: A constant sieve size establishes a maximum size for a particle but does not establish a minimum size. As described above, without a minimum particle size established for certain stabilization techniques, the sample can be rendered non-representative and can adversely affect the TCLP result and still be within the guidelines of the TCLP procedure.

Action: None

9) Commenting Organization: Ohio EPA Commentor: OFFO
Section #: 5.5.8 Page #: 5-66 Line #: Code: C
Original Comment #:

Comment: Will a design change be made in the discharge chamber to keep migrating glass from blocking the discharge chamber orifice?

Response: The design of the melter and the materials of construction used in the VITPP supplied melter will be changed significantly if vitrification is chosen as the method for remediation. The discharge chamber was of significant concern during the operation of the VITPP melter. It added significant down-time to the facility. This is included in the VITPP Lessons Learned Database. Future melter designs will be evaluated and tested to ensure the discharge chamber performs efficiently. The above scenario will be evaluated at the time of testing.

Action: None

10) Commenting Organization: Ohio EPA Commentor: OFFO
Section #: 6.3.1 Page #: 6-5 Line #: Code: C
Original Comment #:

Comment: Further describe the Melter Feed Pump seal tank, including the purpose of the tank, contents of the tank and why it had to be filled repeatedly.

Response: The seal tank for the Melter Feed Pump is a manufactured reservoir tank that provides cooling and lubrication for the mechanical seals used with the pump. The seal tank holds approximately 1 ½ gallons of distilled water and is mounted approximately 2 feet above the pump seal. The tank has a sight glass for visual indication of the liquid level as well as a float type switch that indicates when the tank is low and requires filling.

There are two tubing connections to the seal which allow for flow of water through a closed loop. Due to the heat that is created in the seal, the heated water slowly flows to the seal tank inlet and is replaced by cooler water that returns to the seal providing cooling. The return inlet to the seal tank is higher on the tank than the cool water return to the seal, thus providing cooler water to the seal.

The mechanical seal provides isolation between the process fluid and the environment. This isolation is accomplished using one polished surface that rotates with the pump rotor and another polished surface that is fixed to the pump body. These surfaces ride against one another and provide the seal. O-Rings are provided to make the seal between the seal pieces and the pump rotor and pump body. Pressurized (~90 psi) water in the seal tank provides lubrication for the surfaces and prevents the process fluid from entering the seal. The air pressure applied at the top of the seal tank is set to a higher pressure than the pressure of the process fluid being pumped. Small amounts of seal tank water leakage, or leak-by at the seal is considered normal. Excessive amounts are indications of a problem.

If the seal is damaged or worn by process fluid the seal will begin to leak. Problems that could cause this would include loss of air pressure at the seal tank, the seal tank being empty, or the process fluid pressure being higher than the pressure of the seal tank pressure. In these instances, the seal tank may empty in a very short time due to the 90 psi air pressure being applied to the tank. Depending on how the seal failed the seal water could leak into the process fluid and not be detectable by observation at the seal, or it could leak out of the seal and be visible to an observer. Once the seal failed, frequent tank filling was required until the seal on the pump was replaced.

Action: None

11) **Commenting Organization:** Ohio EPA **Commentor:** OFFO
Section #: 7.3.3 **Page #:** 7-8 **Line #:** **Code:** C
Original Comment #:

Comment: Please describe the criteria for changing a HEPA filter.

Response: The criteria for changing the pre-filters or HEPA filters in the A or B train of the HVAC system was at the end of a campaign or when the differential pressure across the filters indicated that there was a build-up of solids on the filters. The filters were changed between campaigns to support the testing and monitoring tasks that were campaign-based.

Action: None

12) **Commenting Organization:** Ohio EPA **Commentor:** OFFO
Section #: 7.3.4 **Page #:** 7-9 **Line #:** **Code:** C
Original Comment #:

Comment: The text states that only data from the second sampling period was used during isokinetic sampling in Campaign 4. Were there any abnormal occurrences during the first sampling period that might indicate elevated levels of contaminants may have been released through the stack while it was not being sampled? Could an alternative method be used to help determine the release of contaminants?

Response: During the first sampling period, there were a number of pre-filter changes in the Normal Off-Gas System, but this was not abnormal and did not indicate that elevated levels of contaminants were released through the exhaust stack while it was not being sampled. There was no other monitoring device connected to the off-gas system that would provide flow rates through the system to support the determination of release of contaminants to the atmosphere. In future designs and operations of a facility, installation of a redundant monitoring system will be included.

Action: None

13) **Commenting Organization:** Ohio EPA **Commentor:** OFFO
Section #: 7.4 **Page #:** 7-10 **Line #:** **Code:** C
Original Comment #:

Comment: Are the BST wastewater samples that fail[ed] TCLP treated in the AWWT?

Response: Yes, all water transferred to the Building Sump Tank (BST) and samples collected from the BST were treated at the Advanced Waste Water Treatment Facility (AWWT), but the BST wastewater samples were not submitted for TCLP. The samples collected from the BST were submitted to the analytical laboratory for the following analysis: Total Metals, Total Suspended Solids, and Total Dissolved Solids. The pH was measured in the field. All waste water samples were returned to the VITPP from the analytical laboratory and re-introduced to the VITPP BST. The waste water from the BST was transferred to the High Nitrate Tank. The AWWT processes the waste water from the High

Nitrate Tank. Waste water from the BST was never released directly to an off-site receiving body of water.

Action: None

14) Commenting Organization: Ohio EPA Commentor: OFFO
 Section #: 7.8.2.2 Page #: 7-16 Line #: Code: C
 Original Comment #:

Comment: This section describes a "considerable time delay" between environmental sampling events and the time resulting data was available. In addition to the time delay, the text states that samples were sometimes lost. Please describe what steps are being taken to assure that these problems are being corrected.

Response: The delay in transmitting the analytical results of environmental samples was primarily the result of the lack of communications between field, office, and laboratory personnel. It was recognized during the operation of the VITPP that the communications between the field engineers and scientists, the office engineers and scientists, and the laboratory technicians and scientists needed to be improved. During the interim between Campaign 2 and Campaign 4, an organized effort was initiated to improve communications among the three teams. During Campaign 4, communication among the teams was significantly improved. The laboratory and operations personnel worked closer together to maintain process control of the water systems. This need for consistent and coordinated communications between the groups was noted in lessons learned for future operation facilities.

There is an analytical sample database that tracks samples through the analytical process once they are received at the Sample Processing Laboratory. The lost samples referenced in this section were at the preparation stage and were mistakenly thrown away. Once the mistake was realized, the cause was identified as weak communications. Communications within the laboratory sample processing program was improved. This effort helped ensure that losing samples is a very infrequent occurrence and is normally avoided with the use of the sample tracking system and good communications.

Action: Improvements need to be made to ensure strong communication among field, office, and laboratory teams and within each team. Improved communications will be the means for laboratory personnel to gain a better understanding of the purpose of the analytical data and for field engineers to gain a better understanding of the analytical process, strengths, and limitations. Improved communications between the laboratory teams will also facilitate the tracking and transfer of samples during the analytical process. This will be accomplished by developing more precise procedures on the handling and reporting of the

analytical laboratory process. This will be done by both the operational and the analytical procedural guidance procedure and the training and qualification on such procedures.