May 20, 2011

MEMORANDUM TO: Gregory Suber, Chief
Low-Level Waste Branch
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

FROM: Nishka Devaser, Project Manager **/RA/**
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SUBJECT: APRIL 7, 2011 MEETING SUMMARY: MEETING TO DISCUSS U.S. NUCLEAR REGULATORY COMMISSION REVIEW OF THE U.S. DEPARTMENT OF ENERGY DRAFT WASTE INCIDENTAL TO REPROCESSING EVALUATION FOR THE VITRIFICATION MELTER AT THE WEST VALLEY DEMONSTRATION PROJECT IN NEW YORK

On April 7, 2011, the U.S. Nuclear Regulatory Commission (NRC) participated in a teleconference with the U.S. Department of Energy (DOE) to discuss the details of the NRC's consultative review of the Draft Waste Incidental to Reprocessing (WIR) Evaluation for the Vitrification Melter at the West Valley Demonstration Project in New York. The discussion included NRC asking clarifying questions about the WIR Evaluation to DOE and its contractors. Details of the meetings discussion are in the enclosure.

Enclosure: Meeting Summary

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Meeting Summary: Meeting to Discuss U.S. Nuclear Regulatory Commission Review of the U.S. Department of Energy Draft Waste Incidental to Reprocessing Evaluation for the Vitrification Melter at the West Valley Demonstration Project in New York
April 7, 2011

Background

On March 8, 2011, the U.S. Department of Energy (DOE) submitted the "*Draft Waste Incidental to Reprocessing Evaluation for the Vitrification Melter*" to the U.S. Nuclear Regulatory Commission (NRC) for review under an Interagency Agreement DE EM0000284 for consultative review. The submitted document evaluates whether the Vitrification Melter at the West Valley Demonstration Project (WVDP) in New York meets the waste incidental to reprocessing (WIR) criteria of DOE-Manual 435.1-1, Radioactive Waste Management. Demonstration that the criteria in DOE-Manual 435.1-1 are met allows DOE to make a determination to dispose of the used Vitrification Melter offsite as low-level radioactive waste. The NRC staff has performed a technical review to assess whether the draft evaluation is technically sufficient to demonstrate that the Melter meets the criteria in Section II.B (2) (a) of DOE-M 435.1-1 accompanying DOE-O 435.1-1 and is engaging in discussions with DOE for the purposes of clarifying questions NRC has regarding review of the document.

Summary

Shortly before the meeting, the NRC submitted a list of questions or discussion topics to be raised during the call. For purposes of transparency, the same list is presented below with discussion points and DOE response appended below each. The purpose of this teleconference was to clarify NRC's questions and suggested path forward for resolution for DOE.

Inventory Questions

IN-1. ***NRC Discussion Point***: Is there additional technical information to support homogeneity of the glass (e.g., samples with low variability, gamma readings that are fairly consistent after taking into account differences in geometry)? Was there a possibility of build-up of hardened glass in the melter from another waste stream or from variations in the waste stream over time that might have led to variability in the glass content over time? Did DOE take samples from the concentrator feed make-up tank or melter feed hold tank periodically and if so, is that data available? Is there additional description of the chemical processes taking place and effects on homogeneity – e.g., studies on the waste form itself?

DOE Response: West Valley Environmental Services (WVES) stated that there is information from sampling of the concentrator feed make-up tank and some other data pertinent to the assumption of melter glass homogeneity that can be summarized and provided to the NRC.

IN-2. ***NRC Discussion Point***: Were different screening criteria used for the 1987 inventory vs. the 2004 inventory? The 1987 characterization of the sludge and supernatant is a longer list of radionuclides so at first the list appears to be more exhaustive – that additional radionuclides were screened out for the 2004 list. However, there are also several radionuclides that do appear in the 2004 list, but

do not appear in the 1987 list (K-40, Mn-54, Zr-95, Eu-154, Th-228, Th-230, and U-232). Why were these not listed in the original inventory of the supernatant/sludge? In other words, what is the process for developing the list of radionuclides for which inventories are reported?

DOE Response: WVES stated that the radionuclide lists were different based on different purposes of the characterizations and agreed to clarify the lists and the screening criteria.

IN-3. ***NRC Discussion Point***: Were Data Quality Objectives (DQO) established for WMG 2004a? (By the year 2004, it seems like DQOs could have been established as good practice).

DOE Response: WVES indicated that a specific DQO was not generated for the melter sampling, however, all data collection was performed within the quality assurance program for the HLW program. WVES stated that additional details will be provided.

IN-4. ***NRC Discussion Point***: Was uncertainty taken into account in determining the scaling factors? Is there a basis for using the average of the samples instead of a lower (for Cs-137) or upper confidence limit (for Th-232 or actinides) for determining scaling factors? While the uncertainty for Cs-137 is about 3-5%, the uncertainty around thorium (20%) and the remaining actinides (50%) is significantly higher. Was this uncertainty considered in the scaling factor for Th or the other actinides?

DOE Response: WVES stated that they would provide more information on how much uncertainty was accounted for in the scaling factors.

IN-5. ***NRC Discussion Point***: Is there additional information supporting the technical basis for the volume estimate of residual waste in the Melter (8 inches at the bottom and 0.125 inches along the sides)? It is not apparent how these numbers were derived from (Brooks, 1993).

DOE Response: WVES stated that they would provide the NRC some additional references that better support the residual waste thickness assessments inside the melter. These references were L. Petkus and J.J. May.

Key Radionuclides Questions

KR-1. ***NRC Discussion Point***: Is there a screening criteria (e.g., short half-life or low total activity in the waste) that was used to eliminate the radionuclides that appear on the inventory listed in Table 2-2 from 2004, but do not appear in the key radionuclides list in Table 4-3 (i.e., K-40, Mn-54, Zr-95, Eu-154, Th-228, Th-230, Th-232, and U-232)?

DOE Response: WVES stated that the process for eliminating radionuclides in the basis document is straight-forward and stated that they would better explain the process and include this in responses to this inquiry.

KR-2. ***NRC Discussion Point***: The key radionuclides identified in the draft waste incidental to reprocessing (WIR) evaluation for the melter appear to be primarily based on the radionuclides listed in 10 CFR 61.55 and the Performance Assessments (PA) for the disposal facilities as opposed to identifying radionuclides from the actual melter inventory that most significantly contribute to disposal facility risk. Because the residual melter waste is derived from high-level waste, it is possible that the melter inventory contains risk-significant radionuclides not contemplated for near-surface disposal in the low-level waste regulations and/or the performance assessments for the potential low-level waste disposal facilities. Indicate why DOE is confident that no risk-significant radionuclides were omitted from the list of key radionuclides provided in Table 4-3.

Section 5.2 of the draft WIR evaluation discusses PA results for the Nevada National Security Site and concludes that the melter will result in negligible cumulative risk; however, the details of the calculations used to reach this conclusion are not provided in the draft WIR evaluation or supporting DOE 2010b reference. Furthermore, no calculations were performed to determine the potential contribution of the melter to disposal facility risk for the Waste Control Specialists facility. It is significant to note that the sum of fractions calculations to determine if the melter is greater than or less than Class C are close to unity, suggesting that the intruder dose for the melter might be significant. While it is acknowledged that problem/site-specific considerations may preclude significant risk to a potential inadvertent intruder due to melter disposal, this type of discussion is not provided in the draft WIR evaluation. The sum of fractions calculations for waste class indicates that Pu-238 and Am-241 are the primary dose contributors. DOE should indicate those radionuclides contributing most significantly to risk to members of the public, including inadvertent intruders, workers, and the environment based on the radionuclide inventory derived specifically for the West Valley melter considering uncertainty in the timing and magnitude of peak dose at a potential disposal facility.

DOE Response: DOE asked for additional clarification of the second paragraph of this question. NRC indicated that the demonstration of removal to the maximum extent practical entails identification of key radionuclides from the melter driving potential disposal facility risk. A cost-benefit analysis is provided to indicate the practicality (or lack thereof) of additional removal. NRC staff is seeking additional information on the benefit side of the equation or, in other words, the potential benefit of averted long-term dose through removal of key radionuclides. WVES stated that they understood the comment.

Removal of Radionuclides Questions

MEP-1. ***NRC Discussion Point***: Would nitric acid or demineralized water chemically remove Cs-137 or other key radionuclides to a greater extent than others? Is there additional technical basis for why flushing removed radionuclides in equal proportions?

DOE Response: WVES stated that they understood this comment and would begin preparing a response.

MEP-2. ***NRC Discussion Point***: What is the basis for the 3.0e4 µCi/cm^3 typical value of Cs-137 in the waste prior to the first flushing, and the typical 26 inches? The typical activity concentration would be different for different points in time since the start of the campaign. Is this a typical value for 2004? The Eisenstatt report estimate for 1990 decayed to 2004 is 2.5e4 µCi/cm^3. Also, it is stated that towards the end of the campaign, the liquids being retrieved from the tanks were increasingly dilute. What is the basis for claiming that the residual glass towards the end of the campaign was of typical activity for the rest of the campaign and not lower given that the waste was more dilute?

DOE Response: WVES stated that they understood this comment and would begin preparing a response.

MEP-3. ***NRC Discussion Point***: The draft WIR Evaluation, page 25, states that there was 4,062 Ci Cs-137 in the cavity and 252 Ci of Cs-137 in the plugged discharge tube, for a total of 4,314 Ci of Cs-137 (WMG, 2004a). This value does not match the value presented on page 38, which states that after the first three flushes and use of evacuated canisters, the Melter contained approximately 4,120 Ci of Cs-137 in the cavity and approximately 540 Ci "ex-cavity", for a total of 4,660 Ci Cs-137 (This number must come from Rev 1 (WMG, 2004a), not Rev 3). Recommend explaining the reason (different revisions) for this inconsistency (Rev 1 was not provided, but it is cited in Perdue 2004.)

Additional Discussion Point*:* NRC also discussed an apparent inconsistency in the final inventory if one set of assumptions reported in the draft WIR evaluation were used versus the inventory determined based on measured gamma readings. NRC performed independent inventory estimates using concentration and mass or volume data provided by DOE of remaining glass. NRC asked DOE to clarify the apparent differences in the calculational methods and which was more certain. DOE asked if residual glass outside of the melter cavity was considered in the calculation. NRC indicated that the total mass of residual glass referenced in the draft WIR evaluation was used and led to a significantly lower final inventory.

DOE Response: Regarding MEP-3, WVES stated that they understood this comment and would begin preparing a response.

MEP-4. ***NRC Discussion Point***: Is there a basis for the remaining Melter inventory in Ci after the first 2 flushes? The basis of the 4,460 Ci remaining after the 3rd flush is provided in (WMG, 2004a), but it is unclear how the other numbers were derived. Were measurements taken between flushes? How did DOE initially decide to do 3 flushes? Is there an uncertainty estimate on the 4,460 Ci remaining (e.g., from the uncertainty in the detection instrument used)?

Additional Discussion Point*:* NRC raised an additional concern regarding Table 4-5 of the draft Evaluation (regarding *Estimated Effectiveness of Continued Vitrification Melter Flushing*). NRC asked about the derivation of the remaining inventory after 1 flush (16,126.60 Ci). The NRC also asked about the reasoning for using a different method for inventory calculation for different flushes. Discussion continued regarding DOE's assumed effectiveness of the 12 additional flushes; it appeared that the first three flushes removed

approximately 50% of the inventory per flush and then the effectiveness in the 4th flush was dramatically lower. DOE asked if it wasn't clear from Perdue how the numbers were derived. NRC indicated that Perdue was not sufficiently descriptive.

DOE Response: Regarding MEP-4 and the additional discussion point, WVES stated that they understood this comment and would begin preparing a response.

MEP-5. ***NRC Discussion Point***: Did DOE consider modification of the flushing method to improve removal efficiency?

DOE Response: WVES stated that the flushing methodology used was for the vitrification system as a whole. DOE used a deliberate decision-making process to evaluate the best system flushing and shut down methodology based on potential melter failure and benefits to continuing its operation. Additional information will be provided in the document.

Follow-up Discussion

In closing, NRC staff requested any additional references used in Perdue 2004 that might be available. NRC staff stated that this would help to explain techniques used in the reference. Of particular help would be the expert elicitation meeting minutes as those minutes may have additional information regarding the basis for the assumptions in the analysis. WVES stated that it could provide these references.

References

Brooks, R., *Slurry Fed Ceramic Melter Disassembly Report*, West Valley Nuclear Services, West Valley, New York, April 23, 1993.

Eisenstatt, L. R., *Description of the West Valley Demonstration Project Reference High-Level Waste Form and Canister, DOE/NE/44139-26*. U.S. Department of Energy, West Valley, New York, 1986.

Perdue, R.K., *Economic Practicality Analysis for the West Valley Demonstration Project's Vitrification Facility Melter*. Westinghouse Electric Company Science and Technology Department, Pittsburgh, Pennsylvania, November 8, 2004.

U.S. Department of Energy., *Letter from DOE-Nevada Site Office to DOE-West Valley on Special Performance Assessment (PA) Results Summary of Impacts of the Disposal of the West Valley Glass Melter in Area 5 Radioactive Waste Management Site (RWMS)*, WMP:6655:JC, dated July 29, 2010b.

WMG, Inc., *Melter Characterization Results, Report 4005-RE-024, Revision 3*. West Valley Nuclear Services Company (WVNSCO), Peekskill, New York, May 2004a.

WVES, LLC., *Waste Profile Sheet for WVDP Vitrification Melter, WVDP-000000021, Revision 1 (and associated documentation)*. West Valley Environmental Services LLC, West Valley, New York, May 24, 2010.

Meeting Attendees

Cynthia Barr	U.S. Nuclear Regulatory Commission
Nishka Devaser	U.S. Nuclear Regulatory Commission
Christepher McKenney	U.S. Nuclear Regulatory Commission
Leah Spradley	U.S. Nuclear Regulatory Commission
Gregory Suber	U.S. Nuclear Regulatory Commission
Daniel Sullivan	U.S. Department of Energy-West Valley
Thomas Crandall	U.S. Department of Energy
Kathleen Martin	U.S. Department of Energy
John Chamberlain	West Valley Environmental Services
David Kurasch.	West Valley Environmental Services
Laurene Rowell	West Valley Environmental Services
Jim McNeil	Consultant to West Valley Environmental Services