August 21, 2012

Mr. Frank Marcinowski
Deputy Assistant Secretary for
Technical and Regulatory Support
Office of Environmental Management
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, DC 20585

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION ON THE DRAFT WASTE INCIDENTAL TO REPROCESSING EVALUATION FOR THE CONCENTRATOR FEED MAKEUP TANK AND THE MELTER FEED HOLD TANK

Dear Mr. Marcinowski:

By letter dated June 20, 2012, the U.S. Department of Energy (DOE) submitted the *Draft Waste Incidental to Reprocessing Evaluation for the Concentrator Feed Makeup Tank and the Melter Feed Hold Tank* to the U.S. Nuclear Regulatory Commission (NRC) for review. The submitted document evaluates whether the Concentrator Feed Makeup Tank (CFMT) and the Melter Feed Hold Tank (MFHT) 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 dispose of the used components (CFMT/MFHT) 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 components meet the criteria in Section II.B (2) (a) of DOE-M 435.1-1 accompanying DOE-O 435.1-1. The NRC has conducted this consultative review per request of the DOE in accordance with Interagency Agreement DE EM0001931.

We have enclosed a Request for Additional Information (RAI), which is a list of comments for which the NRC staff needs responses from DOE before the NRC can complete its review. To meet the current schedule and complete our review by October 10, 2012, we request responses to the RAI on or before August 28, 2012. The NRC staff would be happy to meet with your staff and your contractors to clarify the RAI, or discuss proposed responses, as soon as you have had a chance to review the enclosed RAI comments.

The NRC is conducting its review according to the Interagency Agreement (IA) dated March 13, 2012, and as such, is focusing its review on waste characterization, waste form stability, waste classification, and removal of radionuclides to the maximum extent technically and economically practical; operational radiation protection at the West Valley site; and applicable quality assurance program elements. As outlined in the IA, this review does not include review of the key radionuclides, the sufficiency of the waste acceptance criteria or the sufficiency of the performance assessment for the potential disposal facility being considered to receive the waste. This review also does not include consideration of operational radiation protection at the disposal facility.

A copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's Agencywide Documents Access and Management System (ADAMS Accession Number ML12227A869). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

If you have any questions, please contact Nishka Devaser, Project Manager in the Division of Waste Management and Environmental Protection, by email at Nishka.Devaser@nrc.gov, or by phone at (301) 415-5196.

Sincerely,

/RA/
Larry W. Camper, Director
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No. P00M-032

Enclosure:
Request for Additional Information

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Enclosure:
Request for Additional Information

ML12227A869

OFC	DWMEP	DWMEP	DWMEP	DWMEP	DWMEP	DWMEP	DWMEP
NAME	NDevaser	L Parks (electronically)	TMoon	CMcKenney	GSuber	APersinko	LCamper
DATE	08/15/12	08/15/12	08/15/12	08/15/12	08/ 16 /12	08/20/12	08/21/12

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Request for Additional Information

U.S. Nuclear Regulatory Commission Consultative Review of the West Valley Demonstration Project: Draft Waste Incidental to Reprocessing Evaluation for the Concentrator Feed Makeup Tank and the Melter Feed Hold Tank

August 2012

Acronyms

Ci	Curie(s)
CFMT	Concentrator Feed Makeup Tank
DOE	U.S. Department of Energy
DQO	Data Quality Objectives
HLW	High-Level Radioactive Waste
IN	Inventory
LLW	Low-Level Radioactive Waste
MEP	Maximum Extent Practical
MFHT	Melter Feed Hold Tank
NRC	U.S. Nuclear Regulatory Commission
NNSS	Nevada National Security Site
PA	Performance Assessment
RAI	Request for Additional Information
WC	Waste Classification
WCS	Waste Control Specialists, LLC
WD	Waste Determination
WIR	Waste Incidental to Reprocessing
WVDP	West Valley Demonstration Project

Inventory (IN)

IN-1 **Comment**: Uncertainty accounted for in the calculation of the waste inventory presented in Tables 2-2 and 2-4 is difficult to interpret.

Basis: NUREG-1854, Section 3.1, states that NRC should verify that analytical uncertainties are either propagated into calculations of waste inventory or have been adequately bounded (NRC, 2007). Cs-137 concentrations are based on the dose conversion factor multiplied by the average of dose readings. Other radionuclide concentrations are determined through the use of an average scaling factor. The values in Table 2-2 seem to reflect this approach. The DOE concludes that the uncertainty associated with the radionuclide estimates is bounded by a +/-20% concentration range. As page 23 of the draft evaluation states, "*To account for uncertainties in the radionuclide activity estimates, the NNSS waste profile radiological technical basis document (CHBWV, 2011) identifies high and low activity ranges that are plus 20 percent and minus 20 percent, respectively, of the final waste form activity concentrations, which are based on the estimates in the characterization report (WMG, 2011) and shown in Table 2-2.*" This statement seems to imply that Table 2-2 reflects the upper bound of uncertainty, which does not seem to be the case.

Path Forward: Describe if the values in Table 2-2 or Table 2-4 reflect the average values or the upper 20% uncertainty bound. If the table reflects the average and not the upper 20% uncertainty, provide a basis for why the average adequately considers the uncertainty in the data, discussing impacts of uncertainty on removal to the maximum extent practical and the waste classification.

IN-2 **Comment**: The radionuclides listed in the inventory for the CFMT differ from those in the MFHT.

Basis: NUREG-1854, Section 3.1, advises that the NRC evaluate inventory estimates and verify the technical bases (NRC, 2007).

Path Forward: Please explain why certain radionuclides appear in the inventory MFHT but not in inventory for CFMT given that the same material was sent through both tanks.

IN-3 **Comment**: There is ambiguity surrounding the approach used in characterizing inventory values for the MFHT and CFMT.

Basis: NUREG-1854, Section 3.1, advises that the NRC evaluate the statistical metric of radionuclide concentrations used to calculate inventories in the waste determination (e.g., mean, 95-percent upper confidence limit) to ensure that the technical basis for the selection is adequate and the metric is properly calculated (NRC, 2007). The draft evaluation states that the characterization for the CFMT is based on the average of five analytical samples (page 23), four of which are from batches, and one of which is from residual liquid in the vessel following vitrification. The Attachment to CHBWV (2011), which lists the concentrations of these samples, includes four batch samples (microcurie/gram) and three liquid samples (microcurie/cubic centimeter). The values shown for each of the batch samples represents the arithmetic average of the nine analyses for each sample. The attachment also shows a last column labeled "*Average Value All Data Sets,*" which is a geometric average of the four batch samples and the three analyses for the single liquid sample.

The draft evaluation states that the analytical data used in characterization of the MFHT came from "*four of the samples used in characterization of the concentrator feed makeup tank – two samples of batch 72 taken at different times, one sample from batch 74, one sample from batch 77 – along with two glass shard samples taken from the two evacuated canisters used to remove molten glass from the vitrification melter (WMG, 2011). The batch samples were the same ones used in the concentrator feed makeup tank characterization*." However, the CFMT used a sample from batch 75, not from batch 77 and the attachment listing the sample data shows batch 75. DOE should confirm if this is a typo.

Path Forward: Verify that the last batch sample used for the MFHT is batch 75 and not batch 77. Explain why the liquid sample for CFMT was treated as three separate samples in the calculation of the geometric mean and describe any impacts on overall conclusions if this liquid sample had been treated as one sample instead of three.

IN-4 **Comment**: Please provide additional explanation as to the number and location of dose rate measurements taken and used in the MFHT and CFMT characterization.

Basis: NUREG-1854, Section 3.1, advises that NRC staff verify that the number of required samples provided in the sampling plan is based on accurate assumptions about the heterogeneity of the waste. NRC staff should also assess the technical basis for any identified limitations in the number or locations of samples (e.g., limited number of sampling ports or internal obstructions in tanks, difficulties in sampling specific phases of waste, significant worker hazards), and confirm that the resulting uncertainties in total inventory have been adequately represented or bounded. Prior to decontamination, the waste was not expected to be uniformly distributed around the interior of the vessel. Page 40 of the draft evaluation describes that the vessels were expected to have residual HLW slurry in the upper third of the vessel, as well as in dead spaces in the CFMT nozzles and on the MFHT. This could imply that after decontamination, the residual material would also be in the upper one-third of the vessel. The draft evaluation does not draw a connection between the location of the dose rate measurements taken and the expected distribution of the waste within the vessel prior to and after decontamination.

The draft evaluation is also not clear regarding the number of samples that were taken versus the number that were used in the calculation. Page 23 of the draft evaluation states, "…*the characterization made use of the average value of 10 dose rate measurements to calculate the amount of Cs-137 present in the [CFMT] vessel*." Page 24 of the draft evaluation states that "*…the use of the average value of the nine measurements taken in various locations on the concentrator feed makeup tank (WVNSCO, 2004c) minimizes the uncertainty in the Cs-137 activity estimate*." The diagrams in the reference WNVSCO (2004c) shows 12 dose measurements for the MFHT and 10 dose measurements for the CFMT. The QAD® computer model outputs[1] for each tank show 9 dose rate measurements, and utilize the average of these nine.

Path Forward: Provide a technical basis for the number and location of dose rate measurements. Describe how the number and location of required samples are based on assumptions about the heterogeneity of the residual waste within the tanks after cleaning. Explain why the number of measurements shown in the diagrams differs for the MFHT and CFMT. Explain why the QAD® computer output sheets seem to indicate that only nine of the measurements for each vessel were utilized in the calculation.

MEP-1 **Comment**: The assessment of the amount of radioactivity present prior to the flushing of the CFMT and MFHT is unclear.

Basis: NUREG-1854, Section 3.3.2, states that the reviewer should verify that reported removal efficiencies are reasonably reliable. The amount of Cs-137 in the vessels prior to flushing assumed an average 0.25 inch thickness in the upper one-third of the vessels and the Cs-137 concentration in the material was

[1] The QAD software is a computer code used in evaluation of radioactive waste packages and associated shielding and is used in the WIR evaluation (DOE, 2012).

assumed to be the same as that in the last batch of slurry sent to the concentrator feed makeup tank before the vitrification system flushing (batch 75), which had the second highest Cs-137 concentration ($1.16x10^4$ $\mu Ci/cm^3$) among the feed material (Kurasch, 2011). However, little detail is provided on why the upper one-third is assumed to be covered in residual material as opposed to some other proportion. There is also not sufficient detail about the volume, and surface area assumptions to reproduce the estimates before flushing provided in Table 4-4. In addition, it should be noted that in using the second highest Cs-137 concentration, DOE may be biased towards overestimating the amount of Cs-137 in the vessels prior to flushing. Since the material remaining in the melter is characterized by using batches 72, 74 and 75, it would be more intuitive to also use this combination of samples to characterize what was in the vessel prior to flushing. Overestimating the amount of activity (curies) before flushing could artificially inflate the reduction factor and is therefore not a conservative approach.

Path Forward: Please provide additional support for the activity estimates (curies) before flushing provided in Table 4-4 including the surface area and volume assumptions, further justification for assuming the upper third of the vessels is coated, and a technical basis for assuming the concentration of batch 75 only. Please also discuss the impacts of assumptions on overall conclusions regarding removal to the maximum extent practical.

MEP-2 **Comment**: Please provide additional information regarding the impracticality of chemical decontamination.

Basis: NUREG-1854, Section 3.3.2, states that the reviewer should identify any removal goals DOE established before radionuclide removal began, and also to consider whether DOE considered modifications to the removal process to improve removal if termination is based on declining removal efficiency (NRC, 2007). Section 4.2.4 of the draft evaluation states chemical decontamination was shown to be effective in testing, but that it was deemed impractical because the chemicals were incompatible with the requirements for an acceptable glass mixture. Since the resulting flush solutions would have been feed to the Melter and transferred to the evacuated canisters, this made the chemical decontamination approach unacceptable due to technical impracticality (WVNSCO, 2001). Later however, the draft evaluation states that sodium hydroxide solution was added to the CFMT in December 2003 after the vitrification system had been shut down. In this case, since the resulting fluids were sent to Tank 8D-4 instead of the vitrification system, the chemical approach was no longer technically disadvantaged for the CFMT at that point in time.

Path Forward: Please discuss if DOE considered the practicality of a chemical flush for the MFHT after the vitrification system had been shut down. If application of such technology would have been infeasible or impractical for the MFHT, please describe the reasons.

References

CHBWV, *Waste Profile Sheet for CFMT and MFHT, WVDP000000007, Rev. 0 (and associated documentation)*. CH2M Hill - Babcock & Wilcox West Valley, LLC, West Valley, New York. August 2011. ML12198A075.

Kurasch, *Melter Flushing Technical Report, WV:2011:0157*. West Valley Environmental Services, West Valley, New York. June 9, 2011. ML112620185.

U.S. Department of Energy (DOE), *West Valley Demonstration Project - Draft Waste Incidental to Reprocessing Evaluation for the Concentrator Feed Makeup Tank and the Melter Feed Hold Tank*, Washington, D.C., June 2012. ML12179A456.

U.S. Nuclear Regulatory Commission (NRC), *NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations, NUREG-1854, Draft Final Report for Interim Use*, U.S. Nuclear Regulatory Commission, Washington, D.C. August 2007. ML072360184.

WMG, *West Valley CFMT and MFHT Characterization, Report 4005-CA-041, Rev. 3*. WMG, Inc., Peekskill, New York. August 18, 2011. ML12198A077.

WVNSCO, *Waste Incidental to Reprocessing (WIR) Evaluation for Vitrification Facility Expended Materials, Rev. 1*. West Valley Nuclear Services Company, West Valley, New York. October 25, 2001. ML12198A070.

WVNSCO, *Characterization Rad Survey of Melter, CFMT, MFHT, HEME, and Various Equipment, Radiation and Contamination Survey Report 123427*. West Valley Nuclear Services Company, West Valley, New York, February 5, 2004c. ML12194A503.