Hanford Vitrified Low Activity Waste (VLAW) Draft WIR Evaluation
9/9/2021 DOE-NRC Teleconference Summary

By letter dated November 6, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20311A546), the Nuclear Regulatory Commission (NRC) issued a Request for Additional Information (RAI) to the Department of Energy (DOE) regarding its Draft Waste Incidental to Reprocessing (WIR) Evaluation for Vitrified Low-Activity Waste Disposed Onsite at the Hanford Site, Washington. The DOE provided its responses to these RAIs by letter dated June 21, 2021 and July 29, 2021 (ADAMS Accession No. ML21194A032 and ML21194A033).

On August 26, 2021 the DOE held a virtual public meeting with its contractors and the NRC to discuss its responses to the NRC RAI. During this meeting, the NRC identified RAI responses that would need further discussion, and as a result, the DOE established multiple public teleconferences to continue these discussions. The teleconference described below was the first of those teleconferences. Call-in information was posted on the DOE Hanford VLAW webpage (https://www.hanford.gov/page.cfm/VitrifiedLowActivityWaste) prior to the call.

The following attendance was observed for the teleconference:

- NRC Attendees: David Esh, Karen Pinkston, Maurice Heath
- DOE Attendees: Sherri Ross, Ingrid Milton, Gary Pyles, David Darling, Laura Cree, Kearn Lee, Buddy Cunningham, Dana Gribble, Jennifer Colborn, Robert Hanson, Rodney Skeen
- Public Attendees: There were no public participants identified during this meeting

Discussion

The information discussed during this call were the scope of the evaluation, and RAIs 1-3, 1-4, and 1-5. These topics were associated with the applicability of the WIR and citation process to secondary waste from the WTP and removal of key radionuclides. A summary of the key points of the discussion is provided below.

Scope of Draft WIR Evaluation

NRC asked about the basis for the conclusion that key radionuclides would be removed to the maximum extent practical considering that most of the risk significant radionuclides ^{14}C, ^{3}H, ^{99}Tc, and ^{129}I may end up in other waste streams (other than high level waste [HLW]).

- DOE stated that in terms of overall curies they achieve greater than 99% removal and that the amount of curies that end up in the non-HLW is not large by comparison. DOE also noted that the other waste forms is included in the performance assessment (PA) and the risk consequences from these waste forms is therefore evaluated.

NRC indicated that although it is important to get as much of the activity as possible into HLW, total activity is a crude measure of risk. Radioactivity based arguments can be misleading in some circumstances when risk can be driven by low activity radionuclides, such as if the risk drivers for the groundwater pathway are primarily in the secondary waste. The NRC then asked how does DOE include risk in the WIR (waste incidental to reprocessing) determination process.

- DOE indicated that they do not include secondary wastes in the definition of HLW, so these wastes would not be part of the WIR determination. However, the risks from the secondary wastes are evaluated in the performance assessment.

NRC stated that a number of DOE RAI responses indicate that the secondary waste material is out of the scope of the WIR determination. NRC asked how are we to interpret that language in terms of the NRC's technical review?

- DOE stated that if NRC has technical comments about waste being disposed as LLW in the IDF that DOE would welcome NRC's comments.

NRC indicated that the NRC's perspective of the WIR process is to remove, or treat, as much of the key radionuclides as possible to HLW and that what remains would be part of the WIR assessment in terms of risk. All remaining material, except for very low levels, should be within the scope of the evaluation. DOE's approach of limiting the scope of the WIR evaluation to only the direct feed vitrified low activity waste lends itself to complexity and possibly risk uninformed decisions. NRC indicated that if DOE is assuming the break between HLW and LLW happens upstream of the vitrification process, then DOE needs to justify that key radionuclide removal to the maximum extent technically and economically practical has occurred at that point.

- DOE stated that they are doing the key radionuclide removal prior to vitrifying the waste, such that anything that happens during or after vitrification is in their view secondary waste and therefore not within the scope of the evaluation.

NRC discussed DOE's reference to the WIR citation process in the RAI response. NRC reviewed the given reference and there seems to be a technical disconnect between what secondary waste is in that document and what secondary waste is in the glass vitrification process. The description of the secondary waste in the WIR citation process document includes items such as contaminated clothing whereas the secondary waste from glass production can have large fractions of some radionuclides that are risk drivers.

- DOE indicated that they think the WIR citation process is applicable but they would confirm this.

NRC stated that there seems to be a misalignment between the inventory in the draft WIR evaluation and the PA, which is understandable given the timing of the products. The final WIR evaluation should have this aligned or cleaner than in initial pass to avoid confusion among stakeholders (DOE agreed).

RAI 1-3 (Percentage of ^{99}Tc and ^{129}I Recycled vs. Removed)

NRC indicated that they did quite a bit of work to try and understand the fractionation of Tc and I between glass and secondary wasteforms when recycle is used. NRC wanted to understand the basis for the assumed single pass retention efficiencies for Tc and I and the values that result from recycling of the offgas. In the PA, this was the largest source of uncertainty in the analysis. However, these values increased quite a bit between the PA and the RAI response and are assumed to be fixed at constant values. NRC tried to pull the thread on the reference chain but kept running into documents that were not available and the request/release process was slow. NRC requested references for TOPsim and the Run ID case that was cited in the reference supplied in the RAI response.

- DOE stated they used TOPsim to evaluate partitioning between glass and secondary waste with offgas recycling. Changes occurred over time as the flow sheet matured and the PA and draft WIR evaluation were not caught up with those changes. When the PA was completed, the design for DFLAW was not complete and recycle was not yet included. With recycle of the offgas, Tc and I that is not retained in molten glass goes through the system and is combined with the incoming feed to the melter. In this manner, the Tc and I build up in the system over time and more gets retained in the glass. DOE indicated that there are hundreds to thousands of references on this topic such that they struggled with what would be the appropriate references to provide to answer the question. DOE indicated that they would get back with NRC with what they believe are the correct references. One of those documents may be the Bases Assumptions Requirements Document (BARD) that DOE will look into getting released.

NRC stated that if they could see the input values and the basis for what is put into the Run IDs in cases mentioned in the RAI response that would help the NRC to understand the basis for the new values. NRC looked at a variety of Vitreous State Laboratory (VSL) reports and noted that the single pass retention efficiencies had a wide range of values and were uncertain. NRC wanted to understand how DOE went from the values reported in the VSL reports to the TOPsim calculations.

- DOE indicated that they used the information directly from the underlying reports as input into TOPsim, and the BARD document was used as a reference.

NRC asked if the VSL experiments represent the largest scale experiments performed.

- DOE stated that the testing performed with VSL 1200 is a fairly large scale melter (1/8th scale).

NRC asked if DOE had plans to measure the actual concentration of Tc and I in the glass product when they go to production.

- DOE indicated that they did not intend to measure the concentration of Tc and I in the glass. DOE also stated that they will measure what is coming back from the evaporator as a concentrate and analyze the feed concentrations. Given those values they believe they can determine retention values.

RAI 1-4 and 1-5 (Alternative Technology Evaluation Impacting ^{129}I and ^{99}Tc, and Removal and Disposal of Separated ^{129}I)

NRC indicated the basis for the narrow technical and economic removal criteria interpretation made by DOE is not clear based on statements that the decision point for HLW vs. LLW was upstream of feeding material to the vitrification facility.

- DOE stated that they are not taking credit for removing key radionuclides from the waste with the vitrification process. The purpose of the vitrification process is to make a wasteform in a solid physical form that meets the performance objectives. DOE's goal is to retain as many curies, including key radionuclides, in the glass wasteform. DOE stated that it knows that there will be partitioning between glass and secondary wastes and that they account for it in their analyses. DOE also noted that the concentration of Tc is low in the incoming waste stream.

NRC stated that Tc makes up a high percentage of the risk even though it is present at a lower concentration compared to other radionuclides. Additionally, the high temperature of the vitrification process very efficiently removes Tc from the initial waste stream. The NRC stated that, in theory, DOE could drive Tc back into HLW with recycle at the Waste Treatment and Immobilization Plant (WTP) when vitrifying HLW like they plan to do with VLAW. The NRC asked what why the recycling technology would not work for WTP given that it works for VLAW. The NRC further asked if a high temperature system could be used to remove Tc earlier in the process and send it to WTP with a recycle system so that the Tc ends up in HLW rather than in VLAW disposed in the near surface disposal.

- DOE responded that using a recycle system to send the Tc to WTP is that the WTP HLW facility can handle Hanford liquid and solid tank waste.

NRC stated they were trying to understand how the WIR criteria were being applied at Hanford in terms of making risk smart decisions vs checking boxes in the WIR process. Unless there is a technical difference in waste that goes to WTP, it appears that DOE could be capturing more of the risk drivers in HLW. NRC stated it would be hard to change course at this point, but DOE should put a clear argument in place about how they came up with the overall strategy and system. Why were the systems designed the way they were? What was the thought process? How does it align with the WIR criteria? In the future, how could DOE incorporate the max removal earlier in the design process? NRC noted that DOE believes they removed a lot of the activity from the VLAW, but NRC suggested that in the future they could include a clearer evaluation of the effect of the overall system on the risk.

- DOE indicated that the original WTP design had an ion exchange system for Tc. That processing step was removed in the 2002 timeframe with consultation Washington Department of Ecology. The analysis at that time showed that if the VLAW performed well there was no economic or technical reason to include that processing step.