Hanford Waste Management Area C WIR Evaluation
11-15-2018 DOE-NRC Teleconference Summary

Department of Energy (DOE) Attendees: Sherri Ross (DOE-HQ), Jan Bovier (DOE-ORP), Rod Lobos (DOE-ORP)

Nuclear Regulatory Commission (NRC) Attendees: Hans Arlt, Dave Esh, Lloyd Desotell

DOE Contractor Attendees: Sunil Mehta (INTERA), Matt Kozak (INTERA), Paul Rutland (WRPS), Keith Quigley (Veolia), Doug DeFord (WRPS), Bill McMahon (CH2M Hill), DJ Watson (WRPS), Marcel Bergeron (WRPS), Dan Parker (WRPS), Mike Connelly (TecGeo), Raz Kahleel (INTERA), Nazmul Hasan (INTERA), Bob Hiergesell (WRPS)

Member of the Public Attendees: none

The following topics regarding NRC's review of the Draft Waste Incidental to Reprocessing (WIR) Evaluation for Closure of Waste Management Area C (WMA C) at the Hanford Site were discussed during a November 15, 2018 teleconference. This teleconference was open to the public. The call in information for this teleconference was posted on the following DOE Hanford webpage: https://www.hanford.gov/page.cfm/WasteManagementAreaC

Topic: FEPs Analysis, Future Scenarios, and Conceptual Models

1. NRC staff asked DOE to provide the reference documenting the results for the Features, Events, and Processes (FEPs) evaluation procedure presented in Appendix H in the performance assessment (PA) (RPP-ENV-58782, Rev. 0). DOE stated that they don't use the four step process presented in Appendix H but rather they use a top down approach to map safety functions to identify which calculation cases to develop.

2. NRC staff asked if there was a process or methodology used to conclude that the site will evolve in one specific way and that there are no additional alternative future scenarios. DOE stated that the future scenario considered is based on an evaluation of safety functions and added that a workshop was held to determine significant FEPs. Details of the workshop used and the results of the evaluation of safety functions and their relationship to FEPs are provided in the PA, Appendix H.
3. NRC staff asked DOE which of the four conceptual models of the WMA-C system (the base case, the alternative geological model II, the clastic dike case, and heterogeneous media model) are plausible alternative conceptual models and which are essentially what-if models? DOE stated that the clastic dike model is more of a what-if case and the rest are plausible alternatives. There is no evidence for dikes at WMA C, and some counter evidence based on the lack of clastic dikes seen in reactor compartment trench observations just north of WMA C. In addition the alternative models considered in the PA, DOE referred NRC staff to the other reference documents that include PNNL-24740 and RPT-59197, Rev. 1 (Analysis of Impacts of Past Tank Waste Leaks and Losses in the Vicinity of Waste Management Area C at the Hanford Site, Southeast Washington) which examined a variety of other alternative conceptual models.
4. NRC staff asked DOE to provide additional explanation relative to text in the PA that indicates that not all processes that are considered conceptually are included in the numerical models. DOE stated that some features, events, and processes may not

need to be included because of the way other phenomena are represented. The list of key assumptions and processes considered in the PA are discussed in Section 6 and summarized in Appendix A.

5. NRC staff asked DOE if it is known what recharge rate is required for lateral flow to occur within the vadose zone in the alternative geological model II. DOE stated that the models indicated a small amount of lateral flow or spreading at minimal recharge rates, but that even at higher recharge rates, most contaminants, while spreading laterally, do move vertically downwards. DOE added that field data relative to characterization at UPR-82 and C-105 generally supports these modeling results.
6. NRC staff asked DOE to discuss what features and processes related to the tank system were not included in the conceptual site model (CSM). DOE stated that the model neglects several features (e.g. tar layer, steel shell) that would restrict releases and referenced PA Figures 6-7 and 6-28. NRC staff indicated that a figure illustrating what features are accounted for and which are neglected in the model might be useful.
7. NRC staff asked DOE to discuss the total void volume associated with unstabilized pipelines and concrete ducts and if this void volume can this lead to subsidence of the engineered cover. DOE stated that the volume inside the pipelines is 3,600 ft^3, and that there would be additional volume associated with pipe liners/ducts. DOE indicated that subsidence has not been explicitly evaluated but that they didn't believe the volume was sufficient to lead to subsidence.
8. NRC staff asked DOE to discuss how seismic impacts were included in the PA. DOE stated that seismic impacts could disturb the concrete and grout. DOE stated that the inclusion of early failure sensitivity cases represents (in a bounding manner) the potential effects of seismic impacts on grout properties. In these cases, they assumed the grout properties change from impermeable to a much more permeable end state where the tank structure and the embedded grout is given the hydraulic properties of sand at differing times after closure.
9. NRC staff stated that Table H-1 (p. H-4) and Table 1-2 (p. 1-20) of the PA do not match. DOE stated that there is no intention for those tables to have different information and indicated that NRC should use the information Table H-1. The entries in Table 1-2 will be corrected to correspond with the safety function entries in Table H-1 in the updated PA.

<u>Topic: Results of Analysis, Sensitivity Analyses, and Uncertainty Analyses</u>

10. NRC staff asked DOE if there are any simulated groundwater concentrations higher than the maximum modeled concentration at the point of compliance at a distance greater than the point of compliance. DOE stated that groundwater concentrations decrease with distance outside the tank farm.
11. NRC staff asked DOE about text in the PA states that, "DOE M 435.1-1 and DOE G 435.1-1, Chapter 4 state that the sensitivity-uncertainty analysis time frame should include calculation of the maximum dose regardless of the time at which the maximum occurs, …" NRC staff asked if DOE staff knows if the maximum dose was reached within their simulation that was conducted for a 400,000-yr timeframe. DOE followed guidance by examining potential peak doses from the facility reached within the 400,000-yr simulation period. DOE did state that their interpretation of the guidance is not to conduct simulations indefinitely, but rather to ensure the predicted dose does not

increase significantly after the compliance period. In DOE's review of the PA, the long-term simulation case examined was deemed to be more than adequate for meeting the intent of this guidance.

12. NRC staff asked if a 100 mm/yr recharge rate is reasonably conservative for the operations period. DOE stated that results from scoping analysis performed in the past leak analysis suggest that use of 100 mm/yr recharge during the operations period provided arrival times of contaminants in groundwater that are consistent with observed data. DOE added that use of the term "conservative" relative to the 100 mm/yr value should be removed from the PA.
13. NRC staff asked why, as shown on PA Figure 7-23, the plume in the southern corner of WMA C increased tenfold from 0.01 to 0.1 pCi/l from 500 to 1000 yr while other areas underneath the same modeled pipeline source area, e.g., east of tank C-110, saw concentrations remain below 0.005 pCi/l. DOE staff stated they would look into the analysis to determine the reason for these specific results and share their findings in the next meeting.
14. NRC staff asked if DOE could reproduce PA Figure 7-24 with the visual model results of groundwater concentrations down to 0.0005 pCi/l (see Fig. 7-22). DOE staff stated they would look into it and revisit this item on the next call.
15. NRC staff asked DOE to describe what DOE did to ensure the conceptual site model was consistent with past observations and historical operating experience. DOE stated that they previously discussed the basis for the inventory and added that they presented a verification of the model in Section 6.4 of the PA. DOE also stated that they conducted scoping sessions to identify what issues were important to regulators and stakeholders.
16. NRC staff asked DOE what limitations are there to extrapolating relatively short-term observations to 1,000 years and longer. DOE indicated that they attempt to bring all information they have to support the performance assessment. They indicated that there are clearly uncertainties introduced by projections into the future. These are addressed through extensive uncertainty and sensitivity analyses in the PA. Long-term simulations required in PA preclude the conventional approach of validating PA model simulations. Section 6.4 details how key processes (geology, recharge, field-scale macroscopic flow behavior) are tested and verified.
17. NRC staff stated that DOE evaluated a variety of sensitivities with localized (one-at-a-time) analyses and asked how do these analyses reflect the global uncertainty with the analyses? DOE indicated that the system model was used to evaluate the effects of parameter uncertainty on the base case model. DOE also stated that they chose a deterministic approach so that clarity regarding safety function performance would not be lost. DOE stated they are trying to avoid probability weighting. DOE stated that some uncertainty in the inventory is accounted for.
18. NRC staff asked DOE to explain how the base case that takes centroid values for key inputs is protective of public health and safety when it does not reflect the uncertainty and variability in the inputs. DOE stated that the totality of information associated with the base case, the sensitivity cases, and the uncertainty analysis represent the safety case for their decision. DOE stated that for all cases the peak dose is below the performance objectives.
19. NRC staff asked DOE to explain the basis for using maximum entropy in choosing probability distributions. NRC staff indicated there is potential for risk dilution. DOE

stated that risk dilution could only be a potential issue if any of the realizations approached the dose constraint, and is not an issue for WMA C. The basis for using maximum entropy approaches is well established in literature. More to the point, however, is that these approaches only define the shape if the distribution, which only affects the shape of the output distribution. Since the whole distribution is well below the performance objective, the approach for selecting the distribution does not affect the case for safety.

20. NRC staff stated that it does not appear that correlation in inventory uncertainty was used. NRC staff asked DOE to explain the basis why the inventory uncertainties were simulated as being independent. DOE stated that the waste has been mixed and reprocessed multiple times and that processing has changed over time such that correlation may not be possible. DOE stated that uncertainty in the sludge phase is being estimated for sampling of tank residuals. There is no information about any correlation being present among the radionuclides. DOE further added that the dose is mostly due to one radionuclide, Tc-99.
21. NRC staff stated that the uncertainty in source term release for uranium appears to be limited to the maximum observed from a set of limited measurements. NRC staff asked DOE to explain the basis for assigning the ranges to the source term release parameters. DOE stated that the estimated solubility values used for uranium isotopes were developed laboratory analysis from real waste residual samples. Waste residuals from four tanks had this experimentation done. Waste residuals from tank C-202 had the highest U concentration. NRC stated that due to the limited number of samples, the range may not be fully captured.

Action Items

Item Number	Date	Action	Status
9-6.3a	9-6-18	NRC to provide GoldSim run log to DOE	Completed 9-25-18
9-6.3b	9-6-18	DOE to provide NRC with GoldSim model for 400,000 year simulation	Completed 9-27-18
9-6.5	9-6-18	DOE to provide additional details regarding the scaling for other uranium isotopes	pending
9-6.6	9-6-18	DOE to provide the aqueous relative permeability parameters assigned in STOMP model	pending
9-6.8	9-6-18	DOE to provide map showing the location of node 69 in relation to the tank footprint	Completed 10-28-18
9-6.9	9-6-18	DOE to provide a water budget table with inflow at the surface and inflow/outflow at the four aquifer boundaries	pending
9-6.12	9-6-18	DOE to provide the simulated hydraulic heads from the STOMP model for the monitoring wells as seen in Fig. C-11, page C-22	pending
9-6.14	9-6-18	Future presentation on Leapfrog geological model	pending
9-6.15	9-6-18	DOE to check the discrepancy between 580 m^3/d on PA p. C-8 and 730 m^3/d on p. C-12.	pending
10-2.10	10-2-18	DOE to send information on tank specific retrieval technology selection information	pending

10-2.12	10-2-18	NRC to check information in NUREG 1854 on waste classification criterion guidelines	Completed 11-13-18
10-2.a	10-2-18	DOE to check posting on website	Completed 10-02-18
10-11.5	10-11-18	Item #5 from the 10-11-18 clarification call list will be revisited next call when Bill McMahon is available.	Completed 10-25-18
10-11.6	10-11-18	DOE will generate a figure that represents the pipeline source area used in the STOMP model.	Completed 10-25-18
10-11.7	10-11-18	DOE will review the discussion of Figure 7-16 on page 7-24 of the PA document and make corrections as needed.	pending
10-11.8	10-11-18	DOE will produce a revised figure showing the early times (0 to 2000 years) for figures 7-15 and 7-16.	Completed 10-25-18
10-11.9	10-11-18	Item #9 from the 10-11-18 clarification call list will be revisited next call when Bill McMahon is available.	Completed 10-25-18
10-11.11	10-11-18	Item #11 from the 10-11-18 clarification call list will be revisited next call when Bill McMahon is available.	pending
10-11.13	10-11-18	DOE to provide access to WRPS document RPP-ENV-334418 and CH2M Hill Hanford Group Inc. document RPP-32681	Completed 10-11-18
10-11.15	10-11-18	DOE to provide NRC document that discusses how the unsaturated zone is effective at filtering colloids.	pending
10-11.16	10-11-18	DOE to provide access to PNNL document PNNL-15226	Completed 10-11-18
10-11.18	10-11-18	DOE to provide access to Washington Closure Hanford document WCH-520	Completed 10-11-18
10-11.20	10-11-18	Item #20 from the 10-11-18 clarification call list will be revisited next call when Bill McMahon is available.	pending
10-11.21	10-11-18	NRC will locate the Sr-90 plume map it referenced in Item #21 from the 10-11-18 clarification call list.	pending
10-11.31	10-11-18	DOE will address the typographic errors identified in Item #31 from the 10-11-18 clarification call list.	pending
10-11.9	10-25-18	DOE will correct the text on p. 8-80 related to the vertical extent of the modeled clastic dike	pending
10-11.22	10-25-18	DOE to provide access to DOE/RL-2015-75	Completed 10-25-18
10-11.26	10-25-18	DOE to provide cross sections shown in Fig. 2.7 in PNNL-13024, and the cross-section G – G' from Fig. B-1 in RPP-RPT-46088, Rev. 2	pending
10-11.30	10-25-18	NRC staff to provide reference (PNNL-16407) to support discussion of y unknown subsurface features	Completed 11-05-18
10-11.a	10-25-18	DOE to provide the most appropriate reference supporting the use of a no-flow bottom boundary in the 3D STOMP model	pending
10-30.6	10-30-18	DOE to provide access to DOE/RL-2016-37	Completed 10-30-18
10-30.10	10-30-18	DOE to provide access to CERCLA documents that relate to closure of the pipelines outside WMA C	Completed 11-09-18
10-30.15	10-30-18	DOE to provide access to RPP-RPT-55804	Completed

			11-01-18
10-30.16	10-30-18	DOE to provide access to GRT4 GoldSim file	Completed 11-09-18
10-30.25	10-30-18	DOE to search for references related to equipment that will remain in the tanks at closure	pending
10-30.27	10-30-18	DOE to provide access to PNNL-15503 Rev 1	Completed 11-09-18
10-30.29	10-30-18	DOE to search for additional references related grout degradation	pending
11-01.1	11-01-18	DOE to provide reference that supports land use assumptions	Completed 11-09-18
11-01.2	11-01-18	DOE to provide reference that supports the farmer scenario assumptions	pending
11-01.13	11-01-18	DOE stated they would look for a report that describes regional drilling practices	pending
11-01.25	11-01-18	DOE stated they would provide a map showing the pipelines	Completed 11-09-18
11-01.26	11-01-18	DOE stated that the would provide NRC access to RPT-24257	Completed 11-09-18
11-01.28	11-01-18	DOE stated that the would provide NRC access to SD-RE-EV-001	Completed 11-09-18
11-01.39	11-06-18	NRC will search for the figure it referenced regarding low uranium content in Tank C-106	pending
11-15.13	11-15-18	Revisit this item on the following call	pending
11-15.14	11-15-18	Revisit this item on the following call	pending

Acronyms and Abbreviations

CPGW	Central Plateau Groundwater
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
DOE U.S.	Department of Energy
DOE-ORP	U.S. Department of Energy Office of River Protection
DOE-HQ	U.S. Department of Energy Headquarters
EHM	equivalent homogeneous media
FEP	Features, Events, and Processes
INL	Idaho National Laboratory
NRC	US Nuclear Regulatory Commission
PA	performance assessment
PNNL	Pacific Northwest National Laboratory
SST	single-shell tank
SRS	Savannah River Site
UPR	unplanned release
WVDP	West Valley Demonstration Project
WIR	waste incidental to reprocessing
WMA	waste management area
WMA C	Waste Management Area C
WRPS	Washington River Protection Solutions, LLC