Hanford Waste Management Area C WIR Evaluation
10-25-2018 DOE-NRC Teleconference Summary

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

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

DOE Contractor Attendees: Marcel Bergeron (WRPS), Sunil Mehta (INTERA), Matt Kozak (INTERA), Paul Rutland (WRPS), Keith Quigley (Veolia), Raziuddin Khaleel (INTERA), Doug DeFord (WRPS), Bill McMahon (CH2M Hill), Mike Connelly (TecGeo), DJ Watson (WRPS)

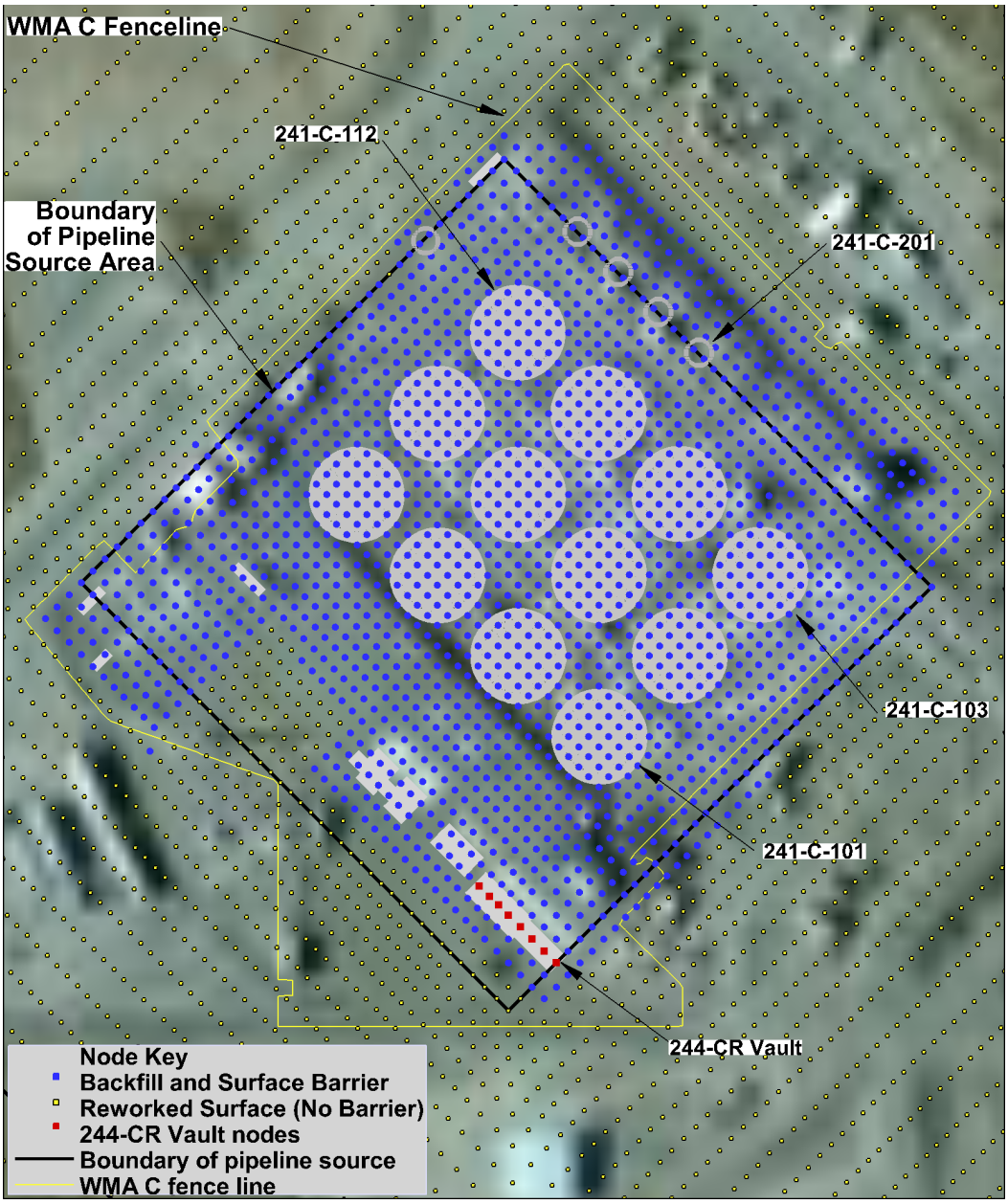
Member of the Public Attendees: Jeff Burright (Oregon Department of Energy)

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 an October 25, 2018 teleconference. These topics on Saturated and Unsaturated Flow and Transport were scheduled to be discussed on the 10-11-18 teleconference but were omitted due to time constraints. The following non-sequential numbering is used to be consistent with the topic listing for the 10-11-18 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

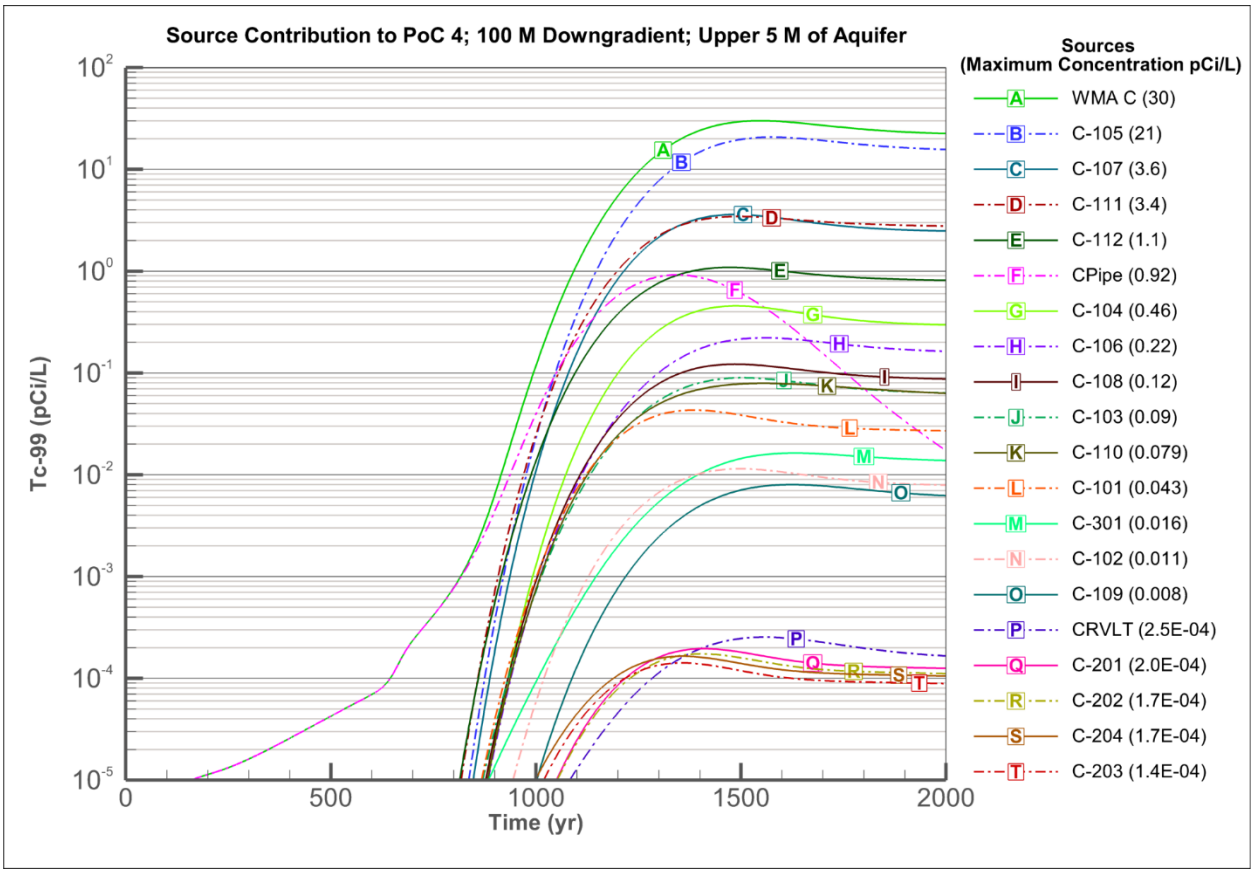
Unsaturated Flow and Transport

5. DOE provided additional detail regarding PA Figures 7-12, 7-13 and 7-14. DOE stated that the center point of the two cutaways is approximately Tank C-105 and confirmed that the largest contour interval presented in Figure 7-12 is 900,000 pCi/L. DOE additionally stated that there are 270 nodes with concentration greater than 900,000 pCi/L, and that the maximum concentration at any node is 6,055,749 pCi/L.

6. DOE provided the below figure illustrating the area used to represent the pipeline source within the STOMP model.



8. DOE provided the below supplemental figure to PA Figure 7-16 “Groundwater Concentration of Technetium-99 from Each Source at Point of Calculation 4”. The supplemental figure presents the same information as Figure 7-16 but with a time axis covering a range of 0 to 2000 years after closure.



9. DOE provided supplemental information related to sensitivity case vzp05, including a figure that shows the location of the clastic dike modeled and its effect on unsaturated flow and transport. DOE also provided the below hydraulic parameters that were used to represent the clastic dike.

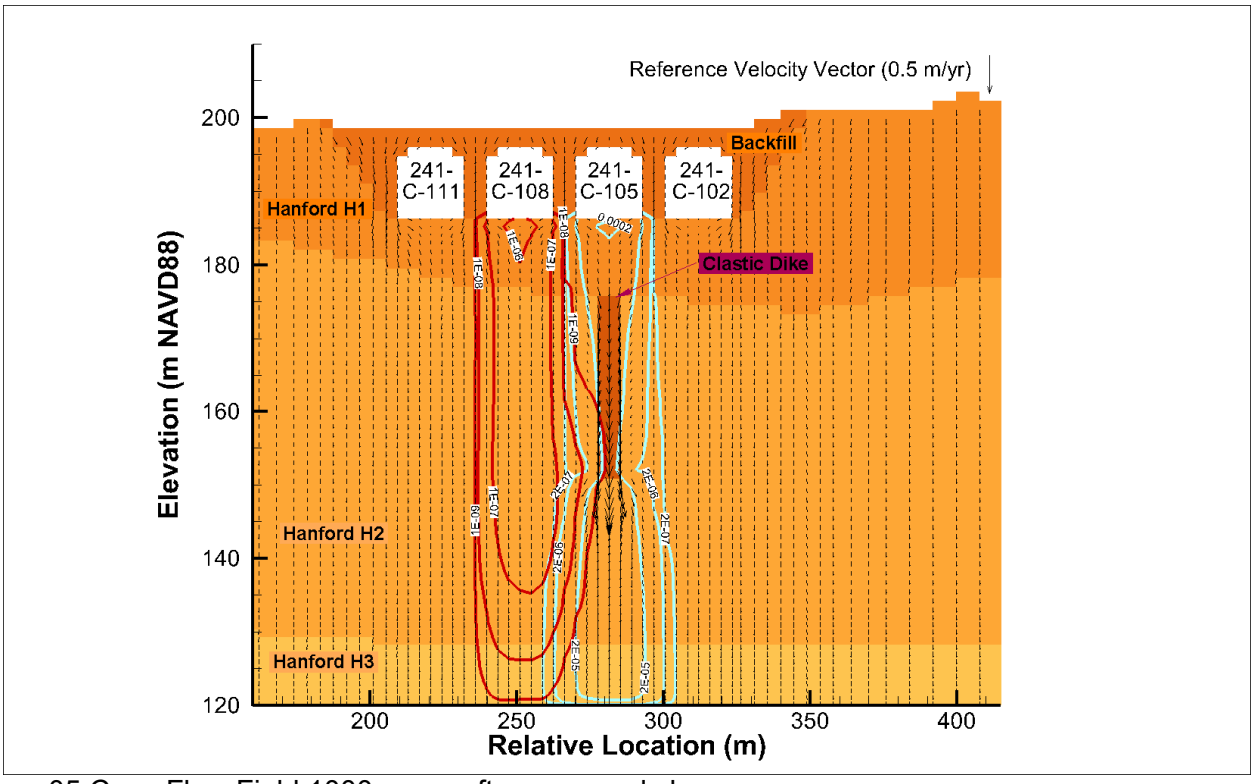
Table 12. Van Genuchten Parameters (Based on the Multistep Method), Saturated Hydraulic Conductivity, and Bulk Density for Seven Clastic Dike Samples (after Fayer and Ritter 1999)[2]

Sample	θ_s (cm^3/cm^3)	θ_r (cm^3/cm^3)	α (1/cm)	n (-)	Saturated Hydraulic Conductivity (cm/s)	Bulk Density (g/cm^3)
1	0.424	0.063	0.0839	1.33	5.97E-04	1.57
2A	0.446	0.019	0.0762	1.98	4.70E-03	1.50
2B	0.443	0.023	0.0741	1.84	3.14E-03	1.51
3A	0.424	0.025	0.0143	2.49	3.41E-03	1.46
3B	0.448	0.050	0.0593	1.54	1.14E-03	1.52
4A	0.454	0.030	0.0092	1.97	1.84E-03	1.49
4B	0.425	0.021	0.0823	2.09	5.43E-03	1.57

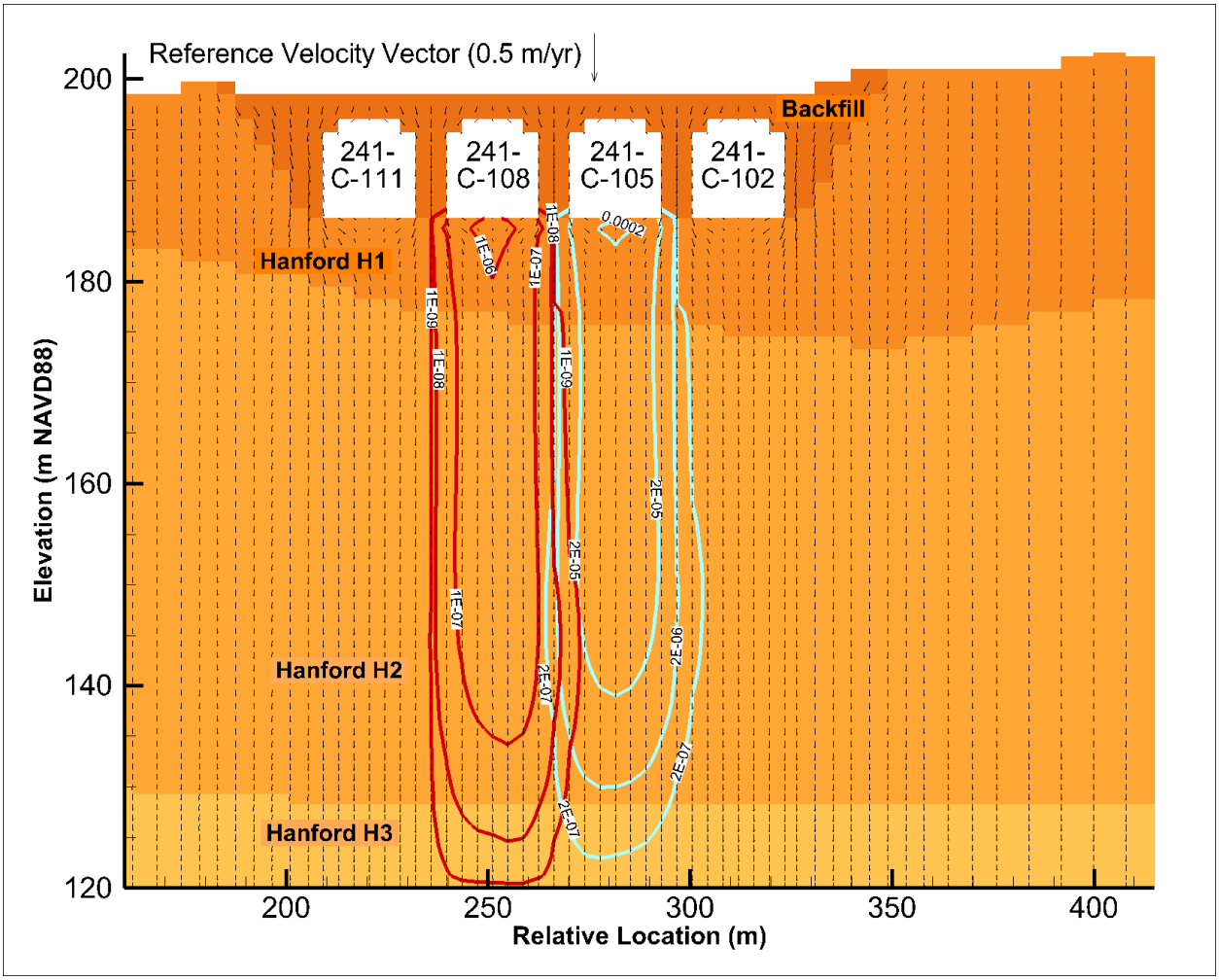
Table 12 in RPP-20621.

[2]Fayer M.J. and J.S. Ritter, 1999, "Physical and hydraulic measurements of FY 1998 elastic dike samples," Letter Report to Fluor Daniel Northwest, Inc. March, 1999. Pacific Northwest National Laboratory. Richland, WA

Sample #	Θ (m^3/m^3) at K = 1.11 x 10^{-8} cm/s (3.5 mm/yr) (Mualem m = 1 – 1/n)	V (cm/s)	V (mm/yr)
1	2.03E-01	5.47E-08	17.3
2A	5.25E-02	2.11E-07	66.7
2B	6.72E-02	1.65E-07	52.0
3A	4.44E-02	2.50E-07	78.8
3B	1.37E-01	8.11E-08	25.6
4A	7.14E-02	1.55E-07	49.0
4B	4.76E-02	2.33E-07	73.6



vzp05 Case Flow Field 1000 years after assumed closure



Base Case Flow Field 1000 years after assumed closure

11. Sensitivity case vzp04 was discussed. DOE stated that this case is based on an alternate geological interpretation provided by the Nez Perce tribe. DOE stated that the primary difference between the base case and the Nez Perce interpretation (called Alternative Geologic Model II) includes the separation of Hanford H2 sand unit into three distinct subunits: the H2 sand underlain by the H2 gravelly sand underlain by H2 silty sand layer. DOE stated that the effect of the alternate geological interpretation was negligible and that locating the silty layer elsewhere in the soil column would have a similarly negligible effect. NRC staff asked if lateral flow was observed in the model near the silty layer. DOE stated lateral flow was not observed and that the lack of lateral flow was likely due to the generally dry subsurface conditions.

<u>Saturated Flow and Transport</u>

20. PA document Figure 7-22 was discussed. DOE stated that the source of the Tc-99 plume shown in the figure 500 years post-closure is from a portion of the pipeline source, which in the STOMP model, is not overlain by the simulated closure cover. As a result of this cover configuration, a portion of the pipeline source area receives higher net infiltration and results in an earlier Tc-99 plume as compared to other sources which

are overlain by the closure cover. DOE provided a figure (same figure as provided for topic no. 6) illustrating the extent of the modeled closure cover.

22. NRC staff had questions about the discussion in the PA that stated that for aquifer hydraulic conductivities in the WMA C values derived from a calibrated model are regarded as more reliable than direct measurements by permeameter, slug, or pump tests. PA Figure C-1 was also discussed. DOE stated that pumping test information, not available when the PA was published, was now available and referred NRC staff to the document DOE/RL-2015-75.

23. NRC staff had pointed out inconsistencies between Table 3-1, Table 3-2, Figure 3-8, and Table 5-1 in RPP-RPT-46088, Rev. 2. NRC staff also had a question about assuming one homogeneous H3/CCU/R unit reaching up to the H2 sand unit. DOE stated that those were older documents and that PA relied primarily on document RPP-RPT-56356.

24. NRC staff had questions about the direction of the simulated groundwater flow for the (Central Plateau Groundwater) CPGW model near WMA C and its orientation with regards to the northern boundary of the box in PA Fig. C-5. DOE stated that the hydraulic gradient and specific discharge are consistent with the CPGW model, and they do not believe that any parameter estimation issues should arise due to the CPGW model volumetric flux calculation window not aligning with the orientation of the WMA-C STOMP model used in the PA.

25. NRC staff asked about the limitations of the CPGW model as given in Chapter 6 in CPP-47631 (Rev. 2). DOE stated it was aware of the limitations listed but stated that any uncertainty was captured with the analysis of the triangular distribution of aquifer flux and proportional hydraulic conductivity values as described on p. C-25 of the PA.

26. NRC staff was uncertain as to where WMA C is in comparison to the outline of the paleochannel discussed in the PA. DOE stated that documents describing WMA C being at the edge of the paleochannel were older reports and that PA Figures C-2 and C-8 were more representative of the current paleochannel conceptual model as applied in the PA with WMA C being within the paleochannel. DOE also stated that cross-sections that NRC staff was interested in could be provided to the NRC.

27. NRC staff initiated a discussion related to the differences in the conceptual hydrogeological models in CPGW model as compared to the STOMP model (e.g., the CCU and the Ringold units are present in the CPGW model), and also discussed the appropriateness of using the EHM approach for simulated CPGW results to obtain hydraulic conductivities for the STOMP model. DOE stated that they do not believe that any problems should arise from using the EHM approach to obtain a single representative value for the undifferentiated H3/CCU/RF unit from simulated CPGW model hydraulic conductivities of different saturated model layers.

28. Existing groundwater contamination as presented in PA Figure 3-35 was discussed. DOE stated that they could provide additional references that show the evolution of the plume over time. DOE stated that these figures suggest that the likely source of iodine-129 is the waste stream discharge to the cribs and ditches associated with the Plutonium Uranium Extraction facility.

29. The residual groundwater mound in the WMA C area was discussed. DOE stated that mounding occurred due to past operational practices that placed massive quantities of water in nearby ponds. DOE stated that the mounding is included in the CPGW model (including history matching). DOE indicated that the CPGW model was capable of simulating the observed relaxation of the mound. DOE stated that for the WMA C PA calculations, the groundwater mound is assumed to have completely dissipated since the transport times through the vadose zone take hundreds of years under the post-closure conditions.

30. NRC staff stated that DOE should include a fast pathway case to account for the potential for unknown features that may affect model results. NRC staff indicated that previously unknown features were identified when characterization was performed (PNNL-16407). DOE stated that the hypothetical clastic dike has been considered. Furthermore, the whole body of evidence (base case, sensitivity analyses and uncertainty analyses) presented in the PA should be considered to make decisions, not just the base case results.

Additional clarification topics:

A. NRC staff asked about the top, thin layers as seen in Fig. 3-3 in RPP-RPT-58949 and also the difference in the Darcy flux between the top of the model, represented by a thin green layer, and the vadose zone, represented by the orange field as seen in Fig. 6-34 of the PA. DOE stated that the thin layers as seen in Fig. 3-3 (RPP-RPT-58949) are an artifact of the contouring program and should be ignored. DOE did not discuss the difference in the Darcy flux between the top two layers represented in Fig. 6-34.

<u>Action Items</u>

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 10-25-18
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	pending
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.	Completed 10-25-18
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.	Completed 10-25-18
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
10-11.9a	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 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

Acronyms and Abbreviations

CPGW Central Plateau Groundwater
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
NRC	US Nuclear Regulatory Commission
PA	performance assessment
PNNL	Pacific Northwest National Laboratory
SST	single-shell tank
WIR	waste incidental to reprocessing
WMA	waste management area
WMA C	Waste Management Area C
WRPS	Washington River Protection Solutions, LLC