STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Richland Field Office
3100 Port of Benton Blvd., Richland, WA 99354 • 509-372-7950

July 22, 2025 25-NWP-116

Anders J. Wiborg, Director
Tank Farms Program Division
Hanford Field Office
United States Department of Energy
PO Box 550
Richland, Washington 99352

Re: The Department of Ecology Transmittal of Review Comment Record (RCR) for AX-101
Request to Forego a Third Retrieval Technology

References: See page 2

Dear Anders J. Wiborg:

The Department of Ecology (Ecology) has reviewed the *Practicability Evaluation Request to Forego a Third Retrieval Technology for Tank 241-AX-101*, RPP-RPT-65531, Rev. 1 (Reference 1).

Ecology required additional time to complete our review of RPP-RPT-65531, Rev. 1 and transmitted a letter on June 11, 2025, to extend our review (Reference 2).

Enclosed is the RCR with Ecology's comments. Ecology looks forward to working with United States Department of Energy (USDOE) in resolving these comments.

If you have any questions, please contact Eric Pierce, Permit Lead, at (509) 410-5273 or eric.pierce@ecy.wa.gov or Luissa Johnston, SST Coordinator, at (509) 975-1285 or luissa.johnston@ecy.wa.gov.

Sincerely,

Elizabeth A. Rochette
Cleanup Section Manager
Nuclear Waste Program

ep/bp
Enclosure

cc: See page 2

References:

1. Letter 25-TWO-0058, dated April 28, 2025, "The U.S. Department of Energy, Hanford Field Office Requests that the Washington State Department of Ecology Agree to Forego Implementing a Third Retrieval Technology in Tank 241-AX-101"
2. Letter 25-NWP-087, dated June 11, 2025, "Request to Forego a Third Retrieval Technology for Tank AX-101"

cc electronic w/enc:

Laura Buelow, EPA
Benjamin Leake, EPA
Michelle Mullin, EPA
Ricky Bang, USDOE
Dave Saueressig, H2C
Kalli Walton, H2C
Jon Perry, HMIS
Mason Murphy, CTUIR
Anthony Smith, NPT
Alyssa Buck, Wanapum
Laurene Contreras, YN
ERWM Staff, YN
Susan Coleman, HAB
David Reeploeg, Hanford Communities
Max Woods, ODOE
Jackson Davis, Ecology
Cathrene Glick, Ecology
Edward Holbrook, Ecology
Luissa Johnston, Ecology
Marissa Merker, Ecology
Steve Needles, Ecology
Eric Pierce, Ecology
Elizabeth Rochette, Ecology
Jonathan Rogers, Ecology
Stephanie Schleif, Ecology
John Temple, Ecology
Environmental Portal
Hanford Administrative Record
Hanford Facility Operating Record
H2C Correspondence Control
HAB Correspondence Control
HMIS Correspondence Control
USDOE Correspondence Control

Review Comment Record	Washington State Department of Ecology Nuclear Waste Program	Date: 05/30/2025 Page 1 of 17

Document Title(s)/Number(s): Practicability Evaluation Request to Forego a Third Retrieval Technology for Tank AX-101, RPP-RPT-65531

Document Manager	Telephone Number	Project Manager	Telephone Number	Facility Site ID	Cleanup Site ID
Eric Pierce	509-410-5273				

Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/ Close	Reviewer Initials
1	General	Tank 241-AX-101 retrieval after two technologies has resulted in 29-158% more residual waste volume left in the tank compared to previous AX tank retrievals. Specifically, AX-102 had 393 cubic feet, AX-103 had 785 cubic feet, and AX-104 had 688 cubic feet. Considering the residual waste volume left over and the following criteria for "limits of technology" found within Appendix C of Consent Decree No. 08-5085-FVS: "... the recovery rate of that retrieval technology for that tank is, or has become, limited to such an extent that it extends the retrieval duration to the point at which continued operation of the retrieval technology is not practicable, with the consideration of practicability to include matters such as risk reduction, facilitating tank closures, costs, the potential for exacerbating leaks, worker safety, and the overall impact on the tank waste retrieval and treatment mission." Ecology believes the supporting information contained within RPP-RPT-65531, Rev. 1 has not adequately addressed the aforementioned criteria for determining if the limits of technology have been reached.	Prior to assessing a third technology, permittees need to evaluate the applicability of utilizing existing two technologies to continue waste removal in order to get down to waste volume levels closer with previous AX tanks and closer to coinciding with retrieval goals.	AX-101 has more volume left (1013 or 1428 cubic feet) in the tank than previous AX retrievals after two retrieval technologies were utilized to their limit. The Consent Decree dictates 360 cubic feet as the *goal* for waste retrievals. While Ecology understands there may be instances where this is difficult, AX-101 presents a predicament for Ecology because it has significantly more residual waste volume in the tank than previous AX tanks after two technologies. Before ECY may approve this request to forego a third technology, ECY believes more can be done with existing technologies before evaluating the "practicability" of a third retrieval technology.				EP

Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/ Close	Reviewer Initials
2	General	Many of the documents referenced have not been made available to the public, or in some cases shared with Ecology.	Please add the following documents to Hanford AR: RPP-27195 **RPP-RPT-64992** RPP-RPT-58620 RPP-CALC-66709 SRNL-STI-2009-00500 WRPS-2101488 WSRC-TR-2003-00401 and the following from RPP-CALC-66224: RPP-RPT-58620					JHD
3	RPP-RPT-65531, Rev 1 TOC-PRES-24-4412-VA Revision 0	RPP-RPT-65531, Rev 1 indicates that 1,013 ft^3 of waste remains in tank AX-101 however the presentation provided on April 29, 2025 (TOC-PRES-24-4412-VA Revision 0) indicates that 1,428 ft^3 of waste remains in tank AX-101	Please provide clarification of the volume of waste remaining in tank TX-101.	Clarification of volume of waste.				CDG
4	RPP-RPT-65531, Rev 1 TOC-PRES-24-4412-VA Revision 0	Provide clarification of the locations, extents, and distributed volume of the residual waste in tank AX-101 (upper/lower structural support/stiffener rings, air circulators, tank bottom, etc.)	Clarification of volume and location of residual waste.	Clarification of volume and location of residual waste and determine if additional slucing as previously done could further reduce residual waste volume.				CDG
5	Executive Summary, Page i, General	**Note: This comment involves a clarification request from Ecology reminiscent of a previous Request to Forego a Third Retrieval Technology (AX-103).** In the Executive Summary, please mention the radiological and non-radiological constituents used to measure efficacy of retrieval in terms of risk reduction for Tank AX-101.	Specify what radiological and non-radiological inventory constituents were used to evaluate effectiveness of retrieval risk reduction within Tank 241-AX-101. (e.g., Tc-99, Se-79, I-129, total uranium, chromium, nitrate, nitrite, actinides)	Clarification				GP

Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/ Close	Reviewer Initials
6	Executive Summary, Pages i-iv	**Note: This comment involves a comment from Ecology reminiscent of a previous Request to Forego a Third Retrieval Technology (AX-103).** The Executive Summary describes rationale to forego a third retrieval, based on several claims, including impact on DST space, tank integrity, time, cost, worker safety, a relatively small reduction in residual waste volume (assumed 646 ft^3 [Section 5.4]), and a small reduction in modeled risk for both nonrads and rads. Regarding these latter risk impacts, after the second retrieval technology, estimated groundwater concentrations or rad doses are reported to be well below the following: MCLs and groundwater dose limit (4 mrem/y) for selected rads (Tc-99, Se-79, I-129), various MCLs, MTCA CULs, and HQ limit (1) for selected nonrads (total Cr, Cr(III), Cr(VI), nitrate, nitrite), and intruder rad dose limits at 500 yr post-closure (500 mrem for acute well driller, 100 mrem/yr for chronic suburban gardener).	Add that these risk reductions need to be weighed against broader risk-related uncertainties (e.g., several identified in WMA A/AX PA reports [RPP-ENV-62206, Rev. 00 and RPP-ENV-61497, Rev. 00]), associated with Cr(VI) (its fraction of total Cr, as well as its potency as both an oral and inhalation carcinogen), potential presence of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) in residual tank waste (based on several groundwater detects), and omission of assessing ecological risk, specifically for tank AX-101 (e.g., ecological receptors could be exposed to contaminated soil)	Addressing these broader risk-related uncertainties, associated with WMA A/AX, would enhance the transparency of the risk analysis component for tank AX-101.				GP
7	Executive Summary, 2nd paragraph and Pg. 3-1, Section 3.0, 1st paragraph and Pg. 4-1, Section 4.1, 1st paragraph and Pg. 5-9, Section 5.3, 3rd paragraph	The Executive Summary describes the total residual volume consisting of 687 ft^3 on the tank floor, and 327 ft^3 on the walls, stiffener rings, air lift circulators, risers, and instruments. Pg. 4-1 also lists the remaining volume as 327 ft^3 on the walls, stiffener rings, and equipment. Pg. 5-9 also lists the remaining volume as 327 ft^3 on the walls, stiffener rings, and equipment. However, on Pg. 3-1, the final residual volume is described as 687 ft^3 on the tank floor, and 264 ft^3 on the walls, stiffener rings, and equipment.	Residual volumes for the amount of waste remaining on the walls, stiffening rings, ALCs, risers, instruments, and equipment are not reported the same in these sections of the report.	Clarification of the volume of waste remaining.				JR

Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/ Close	Reviewer Initials
8	Executive Summary, Page ii & iii, 8th bullet, sub-bullet 2 Identical wording on Page 7-2, Section 7.0, Conclusions, Bullet 8, sub-bullet 2	**Note: This comment is reminiscent of a previous Request to Forego a Third Retrieval Technology RCR comment (AX-103).** Regarding sub-bullet 2 that focuses on chromium and includes total Cr, Cr(III), Cr(VI), clarify that only total Cr has an MCL (100 ug/L; Ground Water, Maximum Contaminant Level, 40 CFR 141 and WAC 246-290, Group A Public Water Supplies and CLARC [Feb 2025 update]). Also, note that the 2024 updated IRIS oral CSF for Cr(VI) is 0.16 [mg/kg-d] $^{-1}$ (a factor of 3 larger [and 3-times less protective] than the previous CLARC value from Cal-EPA 2023 of 0.5 [mg/kg-d]$^{-1}$). Further, note that the Cr(VI) groundwater concentration (2.06E-03 ug/L, Table 6-3, page 6-6, pdf pg 62) remains below the updated (Feb 2025 for the CLARC table) MTCA Groundwater Method B (cancer) CUL for Cr(VI) (0.14 ug/L, 1E-6 risk) or EPA Tap Water RSLs for Cr(VI) of 0.11 ug/L Tap Water, presenting a cancer risk of 1E-06 risk	Specify that total Cr has an MCL (100 ug/L), whereas Cr(III) and Cr(VI) do not. Regarding Cr(VI) and its updated oral CSF, bring subsequent related text (i.e., second sentence, first paragraph, p. 6-7 and 6-8) into the Executive Summary.	Among Cr species, only total Cr has an MCL. Cr(VI) has an EPA Tier 3 oral CSF (0.16 [mg/kg-day]$^{-1}$) and a mutagenic mode of action, lowering previous soil and groundwater CULs and RSLs. The oral cancer slope factor 0.16 (mg/kg-day)$^{-1}$ is the updated IRIS (2024) and CLARC (2025) value. Previous values (July 2021 to July 2024) was 0.50 (mg/kg-day)$^{-1}$				GP
9	Executive Summary, Pages ii & iii, 8th bullet and sub-bullets Also Section 6.1.3, paragraph 4 and Section 7.0, page 7-2, 8th bullet and sub-bullets	**Note: This comment involves a clarification request from Ecology reminiscent of a previous AX tank's Request to Forego a Third Retrieval Technology (AX-103).** For each sub-bullet describing comparisons to target values (i.e., dose, MCL, HQ), please clarify the timeframe to which each evaluation applies. It is important to readily discern current post-retrieval conditions versus calculations of a future (postremedy) condition. It is not clear, as presented at a summary level, if reported values reflect present-day inventory/risk estimates following second retrieval or modeled future values (i.e., at 500 years).	Include a statement to each bullet that notes the timeframe of the measurement or observation: e.g., "… impacts from residual waste left in tank AX-101 after the second retrieval technology are a factor of 14 to 322 below the federal maximum contaminant levels *at the period of peak estimated concentration/dose in XXXX years*."	Clarification				GP
10	Executive Summary, Page ii and iii, ES, 8th bullet, first, second and third sub-bullets, last sentence in each sub-bullet Also Page 7-2, bullet 8, sub-bullet 1 and 2	Significance is used quite often in scientific and statistical discussions with actual quantitation. For example, "The treatment mean was significantly lower than the control mean with a *p*-value of 0.03." Or "The modeled concentrations of the 2nd retrieval technology were not significantly lower than the modeled concentrations of the 3rd retrieval technology ($p = 0.02$, t – test, n-1 = 4 degrees of freedom)." Referring to the sentence: "Deployment of a third technology is not estimated to drive these numbers significantly lower." How much is not enough to be significant? In traditional statistics, when something is or is not **quantitatively**	Provide an exact numerical quantitative discussion about why adding a third technology would or would not produce lower estimates of modeled soil Cr concentration at the WMA fenceline and how the statistically insignificant difference between the 2nd and 3rd technologies and the estimates in soil Cr concentrations, are, statistically speaking, essentially zero. Further, explain how a very small difference would have very little effect on the human health parameter estimates (such as any change in modeled soil concentrations of Cr at fence line, hazard quotients, etc.).	Language that implies precision when no precise analysis exists or the document lacks a robust and transparent statistical explanation supporting the statement.				GP

Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/ Close	Reviewer Initials
		significantly different (higher or lower) than something else, the means are reported with their associated 95% confidence intervals, along with the results of a statistical test, like the *t*-test above.	Otherwise remove the word "significant" since it implies thoughtful numerical and statistical analysis.					
11	Executive Summary, Page iii, first paragraph for 8th bullet, second sub-bullet. Also for Page 6-7, Table 6-3, Footnote b and last paragraph, Page 6-9, 2nd Paragraph	"…the risk equation from section H.4.1 of RPP-ENV-58813, *Updated Exposure Scenarios for Risk and Performance Assessments in Tank Farms at the Hanford Site, Washington*, …" RPP-ENV-58813 is cited in the references section, Page 8-3 as Rev. 2.	Rev. 2 of RPP-ENV-58813 does not have a section titled "H.4.1". [cf. Rev. 2 with Rev. 0 or 1 for H.4.1] Please correct this since Rev. 2 cited. Add hyphens for each occurrence (ES occurrence missing hyphens in RPP-ENV-58813)	Rev. 2 of RPP-ENV-58813 supercedes previous revisions.				GP
12	Pg. 2-4, Figure 2-3	There is no caption or figure key describing what information the plan view of the tank diagram is showing.	Description of the plan view of Tank 241-AX-101.	For more information to be provided in order to be able to better understand the figure.				JR
13	Section 2.3 Page 2-5	In reference to: "Retrieval operations were performed over 37 batches and 140 operating days from January 13, 2023, to June 12, 2024. Retrieval was performed in batches. Each batch consisted of sluicing with the water addition followed by recirculation to continue sluicing. Several batches included additional sluicing while transferring to Tank AZ-102 to entrain solids, known as a "recirc transfer" sequence. In addition, HPW was used on the tank walls during Batches 29 and 30 and on tank bottom solids in Batches 35 to 37." I didn't realize these technologies were deployed simultaneously from the same platform, or that they would switch back and forth from reading the TWRWP. Based off of the description that was the best way to deploy the ERSS. I have some other questions, but I do understand that under the consent decree the division of technologies is based on the TWRWP, and therefore H2C certainly has deployed 2 technologies in AX-101.	What is the metric H2C uses for distinguishing between technologies? Is high pressure spraying and washing a feature or setting of the Extended Reach Sluicer System, or is it a second piece of equipment that was deployed separately? Is the ERSS single use, or will it be retrieved and deployed in a different tank when this campaign is complete? How many operable ERSSs are there and is this specific ERSS needed to apply either (or both) technologies in the next tank. How long does it take to fabricate or replace an ERSS should it fail, or get stuck in a tank? If you deployed Chemical Dissolution Using Acid with ERSS and Slurry Pump would high pressure spraying be involved, or just sluicing?	Questions				JHD

Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/ Close	Reviewer Initials
14	Section 2.3 Page 2-5	In reference to: “Retrieval operations were performed over 37 batches and 140 operating days from January 13, 2023, to June 12, 2024. Retrieval was performed in batches. Each batch consisted of sluicing with the water addition followed by recirculation to continue sluicing. Several batches included additional sluicing while transferring to Tank AZ-102 to entrain solids, known as a “recirc transfer” sequence. In addition, HPW was used on the tank walls during Batches 29 and 30 and on tank bottom solids in Batches 35 to 37.” Technology 2 doesn’t appear to have been deployed to nearly the same extent as Technology 1.	Please clarify when exactly the first technology ended and how you knew you were done with that technology, and when the second technology started.	2010 Consent Decree				JHD
15	Section 2.3.3 Page 2-9 Table 2-2	Document states: Due to the low density in Batch 34, HPW was used in Batches 35 to 37 to break down and attempt to remove additional waste. Like Batches 29 and 30, HPW was started and stopped, as needed, due to fogging. The HPW was applied to elevated solids above the liquid surface using Sluicer #2 for a total of 2 hours for Batch 35, 1.50 hours using Sluicer #3 for Batch 36, and 0.97 hours using Sluicer #1 for Batch 37. After applying HPW in Batch 35 the density remained at or below 1.05 g/mL for 36 hours of recirculation, then increased to 1.07 g/mL during the last few hours of recirculation before the transfer. This indicates HPW had minimal affect but may have removed additional solids initially. However, in Batches 36 and 37 the density decreased to 1.02 g/mL and 1.01 g/mL respectively, indicating minimal waste removal.	The value of table 2-2 for evaluating practicality of 3rd treatment would be increased if columns were added identifying the Riser number and retrieval technology, transfer volume to AZ-102, and final volume in AX-101..					JHD
16	Pg. 3-1, Section 3.0, 1st paragraph	The paragraph references the document *RPP-RPT-64880*, “Retrieval Completion Report for Extended Reach Sluicing and High Pressure Water for Single-Shell Tank 241-AX-101". However, the document is not in the Administrative Record (AR).	Add the document to the AR.	Availability on the AR.				JR

Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/ Close	Reviewer Initials
17	Section 3-1 Page 3-1	The authoritative definition of limits of technology is in the consent decree and whether or not they have been met is what this review and subsequent agreement or resolution will determine.	Please delete paragraph 1 of this section and the numbered paragraphs below it. You may choose to include the Consent decree definition of limits of technology if you wish for a preamble. The "limits of technology" means that the recovery rate of that retrieval technology for that tank is, or has become, limited to such an extent that it extends the retrieval duration to the point at which continued operation of the retrieval technology is not practicable, with the consideration of practicability to include matters such as risk reduction, facilitating tank closures, costs, the potential for exacerbating leaks, worker safety, and the overall impact on the tank waste retrieval and treatment mission.	Consent Decree's criteria.				JHD/EP
18	Pg. 3-2, Table 3-1	The table includes a footnote ([1] *Volume Displacement Adjustments*).	Explain the meaning of the footnote.	Footnotes should be explained so that the reader can understand them.				JR
19	Section 3.1 Page 3-2	In reference to: "A specific quantitative definition for LOT was not established for HPW due to the unknowns and variability of tank bottom hard-heels. However, the system operation requirements for sluicing apply in this case as well."	Please explain, are the system operation requirements of sluicing and spraying the same because they are parts of the same system?	Question				JHD
20	Section 3.1 Page 3-2	In reference to: "It should be noted that the first technology does not have to be operated to its LOT before technology two is applied."	Please footnote this statement with a reference to the section and page of the TWRWP where this notion was planned and approved?					JHD

Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/ Close	Reviewer Initials
21	Section 3.3 Page 3-8 and Section 3.2.4 Page 3-6	In reference to: Once pooling occurred, HPW could no longer make direct contact with the waste and lost its effectiveness. As shown in Table 3-3, all three sluicers were utilized over the course of the retrieval to deploy HPW on tank bottom solids and the density decreased to 1.02 g/mL in Batch 36 and 1.01 in Batch 37, indicating it had reached the LOT. And: "Video evidence indicates that waste throughout the tank was movable using either sluicing or HPW. The low-density measurements (1.07, 1.02 and 1.01) for Batches 35, 36 and 37 respectively, indicate that although waste moved into the slurry pool, little waste was transferred. Figure 3-3 show the final waste locations after Batch 37." It is my understanding that the rapid drop off in dissolved solids was more from the inability to obtain representative tank liquid samples than from the pumping location, and not from an absence of waste or a change in the effectiveness of the ERSS platform. It appears that although there is more waste to remove and technologies 1 and 2 are still effective at moving waste, ripples in the tank floor complicate the pumping operation for the remaining waste, and the reach of the ERSS may limit ability to remove more waste from the tank walls. The justification for why dissolved solid's are a meaningful indicator for LOT on a physical removal process is also lacking.	Please explain in more detail the physical limitations for the (physical) removal process of high pressure spraying and washing the conclusion of the limit of technology in section 3.3 and 3.4.	Requested edit				JHD
22	Section 4.1 Page 4-1	In reference to: The residual volume consists of 687 ft3 (5,137 gal) on the tank floor based on laser scan measurements and 327 ft3 (2,446 gal) on walls, stiffener rings, and equipment based on the laser scan and estimated waste thicknesses from video observations. 327 ft3 makes it hard to the target by pumping just the floor.	How much of the non-floor residual waste is on the walls and rings? Why hasn't the waste from the walls and rings been removed?	Question				JHD

Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/ Close	Reviewer Initials
23	Pg. 5-1, Section 5.1.2, 1st paragraph	The text reads "Section 3.3 describes the waste remaining in Tank AX-101 after sluicing and HPW completion". Section 3.3, while it does describe some of the waste remaining after the first two technologies, is focused on describing the LOT for HPW. It doesn't describe in detail the remaining waste.	Editorial clarification and correction of text in Section 5.1.2. Include a more detailed description of the remaining waste in Section 3.3.	Editorial clarification and more details needing to be added.				JR
24	Table 5-1 page 5-3	If tank ripple diking is preventing pumping of waste that has already been removed from the tank walls and instruments, then the potential for pumping from another location should also be considered.	How does the practicability of continuing with the first two technologies, but installing a new pump, or moving the existing pump to one of the risers directly above the pooled waste, and pumping it out compare to what is presented in this document?					JHD
25	Table 5-1 page 5-3	The mobile arm retrieval system is one system with the capability of reaching locations where waste remain on walls and instruments and pumping waste from behind ripples yet the table states "similar to ERSS sluicing and HPW technologies used, not likely to remove additional waste" and "capability to meet the Consent Decree residual waste volume goal very low.	If the remaining tank waste on walls and instruments is inaccessible to ERSS and the remaining 687 ft3 waste on the tank floor are inaccessible due to ripples, what is the conclusion that the MARS is not likely to remove additional waste based on? It seem extremely likely that the MARS could either meet or nearly meet the consent decree goal. Has any calculation or estimate of adequate quality been made for how much waste on the tank walls and floor could be removed with a MARS system? If chemical dissolution is not an effective technology outside the lab the success at C-105 must be at least a partial success of the MARS system, although limited apparently by failure of the vacuum pump, and design scale. Why is there not a MARS system available or in fabrication for deployment? What is the plan for retrieval of the remaining flat bottom tanks if Ecology doesn't continue approving retrieval plans with chemical dissolution as a third technology knowing H2C does not believe the technology worthwhile even when residuals are double or triple the target volume?	Questions				JHD
26	Page 6-1, Section 6.1.1 Basis for Inventory Reduction Estimate, second paragraph and 9 other instances in this document	"RPP-CALC-66709, *Potential Groundwater Impacts and Inadvertent Intruder Doses from Tank 241-AX-101 Residuals Under Various Retrieval Scenarios,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington." is not in the Hanford Administrative Record (Searched 5-27-2025).	This document is essential for evaluating the analysis for potential impacts to a variety of performance metrics to human health from residual waste in Tank AX-101. For example estimated Tc-99 concentration at fence line of ~ 64 picoCi/L (a very very small amount of Curies)	Cited document missing from Hanford AR.				GP

Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/ Close	Reviewer Initials
27	Page 6-1, 6-3, and 6-10 Section 6.0; Page 8-3, Section 8.0	RPP-ENV-61497, 2020, *Preliminary Performance of Waste Management Area A-AX, Hanford Site, Washington,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington. RPP-ENV-62206, 2020, *Analysis of Post-Closure Groundwater Impacts from Hazardous Chemicals in Residual Wastes in Tanks and Ancillary Equipment at Waste Management Area A-AX at the Hanford Site, Southeast Washington,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.	These two documents are archived as a single pdf in the Hanford AR. Create a footnote to aid the reader if documents are accessed in the Hanford AR.	Reduction in confusion when accessing cited documents in the Hanford AR				GP
28	Table 6-1, Page 6-2, rows for Sr-90, Cs-137, and Actinides	Assuming Sr-90 was the intended radionuclide, "90" is a typographical error. The Sr-90 activity in the AX-101 tank after two retrieval technologies (23,000 Ci in 1,013 cubic feet of waste) appears to be below the 7,000 Ci/m^3 Class C activity given by the NRC. [1,013 cubic ft x (1 cubic meter / 35.3 cubic feet) = 28.7 cubic meters, thus 23,000 Ci / 28.7 cubic meters = 801.4 Ci/cubic meter]. Using the NRC classification this waste concentration would generally be acceptable for near-surface disposal (per rule (5)(ii) in NRC 61.55 Waste Classification. Assuming this row holds data for Sr-90, the removal after two retrieval technologies is ~46%. The same argument can be applied to row 11 in Table 6-1: Actinides. There is great differences observed when comparing the same table and Sr-90, Cs-137, and Actinide before/after ratios (inventory at start divided by inventory after two retrieval technologies) for AX-102, -103, and -104 (RPP-RPT-62918 Rev.0, RPP-RPT-63929 Rev.0, and RPP-RPT-63380 Rev.0).	"Sr-90" is the most likely COC appropriate for this omission. Please correct. Explain why only ~2% of the original tank inventory remains (~ 98% of the tank inventory was removed) but ~ 46% of the Sr-90 Ci inventory remains. Explain the variation observed when comparing AX-101 Table 6-2 values with the same table in Request to Forego 3rd Ret. Tech. documents for tanks AX-102, AX-103, and AX-104 for Sr-90, Cs-137, and Actinide before/after ratios (inventory at start divided by inventory after two retrieval technologies).	Clarification of computational process and mathematical modeling methods used to compute and Sr-90, Cs-137, and Actinide radioactivity (Ci) under the assumption that COCs were evenly distributed (assumption of homogeneity) in the tank inventory removed and tank inventory remaining.				GP

29	Section 6.1.3, Page 6-3, Paragraph 2	**Note: This comment is reminiscent of a comment made by Ecology for a previous AX tank's Request to Forego a Third Retrieval Technology (AX-103).** The assumptions in RPP-ENV-61497 for source term release, especially grout filling of the retrieved tank and emplacement of an infiltration barrier, now appear to be postponed for several decades (or more). In the meantime, infiltration rates through the graveled surface of the tank farm are in the range of (roughly) 100 mm/y (rather than 0.5 mm/y assumed with a barrier), and the water that will access the ungrouted retrieved tank during the interim period will result in advective (rather than the assumed very slow diffusive) release of waste.	Please calculate the migration of contaminants (the contaminant depth and inventories in the vadose zone) that would occur over the interim period before closure. The conditions requested are: 1. Infiltration: 100 mm/y 2. Flow equations: Advection/dispersion for water in the vadose zone and through the tank. 3. Tank top permeability: Based on tank history of water intrusion (if intrusion is occurring), or estimated values for weathered/rusted steel. 4. Tank bottom permeability: Based on estimates for weathered concrete. Tank inventory: Estimated based on current tank residual volume and process history information.	The document states "The potential impacts to human health posed by the residual waste in tank AX-101 were evaluated using the methodology documented in RPP-ENV-61497." RPP-ENV- 61497 Rev. 00 (page 3-13) states: "For the purpose of developing a source release model for the SSTs, the residual waste volume is conceptualized to be present as a thin layer on the floor of each tank, based on the observed distribution of most residual waste in previously retrieved tanks in WMA C, and based on the expected waste characteristics, the tank features, and the waste retrieval process. In any case, the assumption that all residuals in SSTs will reside on the tank floors has the effect of minimizing the distance contaminants must be transported to enter the environment in groundwater pathway calculations (Section 3.2.1.2)." RPP-ENV-61497 Rev. 00 (page 3-13) also states: "The engineered features that are considered in the source term calculations are the emplaced surface cover at closure, the SST structure, the infill grout material, and the ancillary equipment area. The Modified RCRA Subtitle C Barrier reduces the net infiltration that will eventually percolate to the buried tank structures and ancillary equipment. The infill grout material provides not only structural stability to the tank configuration, but also (as				GP

Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/ Close	Reviewer Initials
				long as the grout is not physically degraded) provides a relatively impermeable barrier to flow leading to flow diversion around the tank and a substantial barrier to a complete biotic pathway or inadvertent human intrusion. The infill grout material also controls the chemical conditions of the pore water that contacts the residual waste through mineral phase dissolution and precipitation (e.g., dissolution of portlandite and precipitation of calcite). The tank structure and infill grout, including the chemical conditions that are altered by the grout, are not considered for the ancillary equipment source terms."				
30	Page 6-3, Section 6.1.3, Page 6-3, Paragraph 3	"EPA determined is equivalent to the 4 mrem/yr drinking water standard is 900 pCi/L…" See RPP-ENV-61497_-62206, page 2-97 (pdf page 198/1,555), Table 2-41, that gives the DWS for Tc-99 as 900 pCi/L. See also in -61497 pages 9-3 Section 9.1.4 Groundwater Resource Protection.	Add an EPA citation for this drinking water standard.	Document should be fully referenced with correct citations for source of information.				GP
31	Page 6-3 through 6.13, Sections 6.1.3 and 6.1.4	**Note: This comment involves a clarification request from Ecology reminiscent of a previous Request to Forego a Third Retrieval Technology (AX-104).** When retrieval is considered complete, where are these risk estimation results routinely reported or considered in future documents (e.g., tank retrieval reports, calculation briefs, inputs for performance assessment)? This section provides good information on a tank-by-tank basis that should be compiled and accessible for ongoing work. Knowing where to find the "sum of the parts" helps Ecology to understand and communicate the types and concentrations of residual contaminants, inform cumulative or integrative risk assessment, and track ongoing remedy performance through the performance assessment and monitoring.	Denote in the Practicability Evaluation where the inventory and risk information are maintained for future reference and use.	Clarification and improved integration with other projects.				GP

Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/ Close	Reviewer Initials
32	Section 6.1.3, Page 6-4, Paragrah 2, second sentence	For the sentence: "…with fence line groundwater concentrations greater than 1×10^{-8} pCi/L…" Where did the 1×10^{-8} pCi/L value come from?	Give a reference or explanation where the 1×10^{-8} pCi/L value came from.	Logical flow of argument.				GP
33	Section 6.1.3, Page 6-4, Paragraph 2	"Table 6-3 shows estimated inventory and related fence line concentrations, federal MCLs, Cleanup Levels and Risk Calculation (CLARC) *Revised Code of Washington* (RCW) 70A.305, "Hazardous Waste Cleanup−Model Toxics Control Act). Method A or B groundwater cleanup levels, and hazard quotients (HQs) associated with key chemicals in residual waste left after the use of the second retrieval technology and the hypothetical third technology."	The sentence starting with "Method A or B groundwater cleanup levels, and hazard quotients (HQs) associated…" should be joined with a comma rather that a period since it refers to one of many categories in the headers of Table 6-3. The current paragraph is confusing because of incorrect grammar.	Punctuation correction / coherent expression of ideas				GP
34	Section 6.1.3, Page 6-4, Paragraph 3	**Note: This comment is reminiscent of a comment made by Ecology for a previous AX tank's Request to Forego a Third Retrieval Technology (AX-103).** "Owing to its affinity to be sorbed on Hanford sediments, uranium from Tank AX-101 residual waste left after the use of the second retrieval technology does not arrive in groundwater at the WMA A-AX fence line until the end of the period of analysis, only reaching ~2×10-15 μg/L at 10,000 years after closure." Given the Hanford K_d value for uranium (0.6 mL/g in sand and silt, p. 5-23 (pg 1,271/1,555 in pdf) in RPP-ENV-62206, Rev 0), it is not clear why uranium appears relatively immobile (*cf.* "owing to its affinity to be sorbed on Hanford sediments . . .").	Please clarify why uranium appears to have low mobility (and low concentration in groundwater), despite a low K_d (10th percentile [P10]=0.2 mL/g).	PNNL-13895 (Rev 1, Table 16) lists a uranium K_d data set (mL/g, n=172) with the following percentiles (Px): P5=0.05, P10=0.2, P25=0.55, P50=1.46 mL/g. This report states: "Uranium migration under natural Hanford conditions will be high to moderate with greater migration occurring at high and low pH values."				GP
35	Page 6-6, Paragraph 1, Section 6.1.3 Potential Future Impacts of Residual Waste: Ground Water Impacts	"The chromium groundwater concentration at the WMA fence line…is 2.1E-03 microg/L." This statement is confusing. Both the total Chromium and the Hexavalent Chromium from Table 6-3 have the same estimated concentration value for WMA A-AX fence line: 2.06 E-03 (that equals 2.1E-03 when rounded).	Add an explanation telling what species of chromium is being discussed.	Clarity.				GP

Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/ Close	Reviewer Initials
36	Page 6-6, Paragraph 1, Section 6.1.3	"This is over three orders of magnitude below…[MTCA Method B CUL] of 14 microg/L…" gives incomplete information. The 14 microg/L refers to the hexavalent chromium Ground Water Method B non-cancer value (CLARC Feb 2025). Because of previous language in the paragraph, it is not clear that the text is referring to hexavalent chromium here.	Suggested revision: This is over three orders of magnitude below…[MTCA Method B CUL] of 14 microg/L for hexavalent chromium.	Reduction in reader confusion.				GP
37	Page 6-6, Paragraph 1, Section 6.1.3	The 14 microg/L value from CLARC for hexavalent chromium is for the non-cancer category. Hexavalent chromium is a carcinogen and has a MTCA Method B Ground Water cancer value of 0.14 microg/L, only one order of magnitude larger than the estimated hexavalent chromium groundwater concentration at the WMA fence line of 2.1E-03 microg/L.	ECY requests that this important information about the MTCA Method B Ground Water cancer value of 0.14 microg/L, being only one order of magnitude larger than the estimated hexavalent chromium groundwater concentration at the WMA fence line of 2.1E-03 microg/L, be included in the paragraph under consideration in this comment.	Complete and relevant transparency for cancer risk assessment.				GP
38	Page 6-6, Paragraph 1, Section 6.1.3	"…WAC 173-201A-240, Water Quality Standards for Surface Waters of the State of Washington, Toxic Substances,…" deals with Water Quality Standards for ***Surface Waters*** of Washington. Referring to the actual statue, there is no entry at all in Table 240 for Cr (total), and an entry (row) with no data for Cr(III) in Table 240 of WAC 173-201A-240 (accessed 7-1-2025). Further, there is no entry matching 10 microg/L for Cr(VI) in Table 240 of WAC 173-201A-240.	Refer to the cited statue and correct the current entry of 10 microg/L, including checking and verifying what table/source it came from. Make it clear that hexavalent chromium is being discussed, not total chromium or trivalent chromium. WAC 173-201A-240 is not the ARAR most appropriate to Section 6.1.3 Potential Future Impacts of Residual Waste: Ground Water Impacts. Recommend replacing with CLARC (Feb 2025) Ground Water Method B Potable Groundwater Cleanup Level (Target for Soil to Groundwater Pathway) of 1.4E+00 microg/L	Inappropriate ARAR				GP
39	Page 6-6 and 6-7, Table 6-3, Chromium analysis	Regarding Table 6-3, add MTCA Method B (cancer) Groundwater CUL for hexavalent chromium (1.40E-01 or 0.14 ug/L) and associated risk for the residential tap water scenario.	Add a column in Table 6-3 with header 'CLARC Method B (cancer) Groundwater CUL' for hexavalent chromium	Effective risk assessments consider both non-cancer and cancer effects.				GP
40	Page 6-7, Table 6-3, Chromium analysis and footnote f	Comparing Cr and Cr(VI), how can the inventories be 23-fold different (223/9.61 ~ 23) yet have the same modeled concentration at the fence line of 2.06E-03. Previous documents (e.g, RPP-RPT-63929 Rev. 0) had a footnote for hexavalent chromium stating this important note: "Assumes all chromium is hexavalent chromium."	Add important note (see comment).	Clarity and reduction in confusion in assumed natural occurrences of chromium species.				GP

Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/ Close	Reviewer Initials
41	Page 6-7, Table 6-3, footnote b Page 6-7, bottom of page, sentence referring to RPP-ENV-58813 Page 6-9, Paragraph 2, last sentence Page 8-3, Reference Section	"All exposure scenarios are described in RPP-ENV-58813, *Updated Exposure Scenarios for Risk and Performance Assessments in Tank Farms at the Hanford Site, Washington*." RPP-ENV-58813 has gone through three revisions. "…the risk equation from section H.4.1 of RPP-ENV-58813, *Updated Exposure Scenarios for Risk and Performance Assessments in Tank Farms at the Hanford Site, Washington*, …" This cited document is in the references section, Page 8-3 as Rev. 2. H.4.1 exists only in Rev. 0 of RPP-ENV-58813. "This exposure scenario is described in RPP-ENV-58813." Citation: "RPP-ENV-58813, 2024, *Exposure Scenarios for Risk and Performance Assessments in Tank Farms at the Hanford Site,Washington,* Rev. 2, Washington River Protection Solutions, LLC, Richland, Washington." Conflicts with other citations of RPP-ENV-58813 such as the reference to H.4.1 on page 6-7.	ECY NWP assumes all references to RPP-ENV-58813 are to Revision 2 (Hanford Release date of Jul, 03, 2024). Per language in RPP-ENV-58813, Rev. 2, information in previous revisions is superseded. Rev. 2 states (page 1-1) "The information presented in this data package will supersede the information presented in the exposure scenario data package, RPP-ENV-58813, Rev. 1, *Exposure Scenarios for Risk and Performance Assessments in Tank Farms at the Hanford Site, Washington*." Rev. 2 of RPP-ENV-58813 does not have a section titled "H.4.1". Rev. 2 has Section 8.3 Unit Risk Factors Based on Tap Water Exposure Scenario (pg 213/296), and this section refers to Section 5.3 RCRA Ground Water Risk Evaluation for Hazardous Chemicals (pg 163/296) and refers also to the Exposure Assumptions in Section 4.3 Exposure Assumptions for RCRA Groundwater Risk Evaluation (page75/296)	Confusion among revisions of RPP-ENV-58813				GP
42	Page 6-1, 6-3, and 6-10 Section 6.0; Page 8-3, Section 8.0	RPP-ENV-61497, 2020, *Preliminary Performance of Waste Management Area A-AX, Hanford Site, Washington,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington. RPP-ENV-62206, 2020, *Analysis of Post-Closure Groundwater Impacts from Hazardous Chemicals in Residual Wastes in Tanks and Ancillary Equipment at Waste Management Area A-AX at the Hanford Site, Southeast Washington,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.	These two documents are archived as a single pdf in the Hanford AR. Add a note clarifying this in text.	Clarification of status of archived documents				GP

Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/ Close	Reviewer Initials
43	Page 6-7, paragraph directly following Table 6-3	Text states: "Peak cancer risks from hazardous carcinogens are not discussed because carcinogenic chemicals have an affinity to be sorbed onto Hanford sediments and do not arrive at groundwater during the 0- to 10,000-year period of analysis." However, statements following (in text, same paragraph) specify the peak cancer risk for hexavalent chromium at the WMA fence line would be 5.98E-09, assuming ingestion of groundwater and assuming all total chromium is hexavalent chromium.	Therefore, given hexavalent chromium mobility (K_d = 0) and carcinogenicity (oral CSF= 1/(0.16 [kg-d/mg]), IUR = 0.010 [ug/m3]$^{-1}$), delete the statement, "Peak cancer risks from hazardous carcinogens are not discussed because carcinogenic chemicals have an affinity to be sorbed onto Hanford sediments and do not arrive at groundwater during the 0- to 10,000-year period of analysis."	Hexavalent chromium is highly mobile with Hanford Kd=0 (PNNL-13895, Rev 1) and would readily leach to groundwater. See comment above starting with "The assumptions in RPP-ENV-61497 for source term release…"				GP
44	Page 6-8, last part of paragraph directly following Table 6-3	Text states: "…the peak cancer risk from hexavalent chromium at the fence line would be 5.98×10^{-9}, which is about 160 times below the regulatory standard, which is to be below 1×10^{-6}."	Add to text (and confirm) that this risk is estimated with the updated (Feb 2025 in CLARC) oral CSF for Cr(VI) (0.16 [mg/kg/d]$^{-1}$) and revise text after evaluating how including reference to the risk equation in Section H.4.1 of RPP-ENV-58813, Rev 1, is not valid since Rev. 2 of RPP-ENV-58813 super cedes Rev. 1.	Checking numerical values of peak cancer risk for Cr(VI) and how evaluation of numerical values must use RPP-ENV-58813 Rev. 2.				GP
45	Page 6-8, Section 6.1.4 , first paragraph	**Note: This comment is reminiscent of a comment made by Ecology for a previous AX tank's Request to Forego a Third Retrieval Technology (AX-104).** Text states: "The Suburban Garden scenario was selected from the three chronic scenarios because it provides the highest dose rate of the three chronic scenarios."	Although the Suburban Gardener scenario produced the highest chronic dose rate (mrem/y), add that the well driller scenario produced the highest acute dose (mrem) and required the least amount of modeling (e.g., no crop nor fodder uptake factors).	Inclusion of important details to aid in overall evaluation of the Potential Future Impact analysis.				GP
46	RPP-RPT-65531, Rev 1 Section 6.1.4 Pages 6-9 Table 6-4	Table 6-4 show the inventory increasing after two retrievals for commercial farm, rural, pasture suburban, garden and in all timelines in table 6-6. This increased risk does not indicate a third technology should be foregone. This appears to be a data quality, we may need to briefly discuss.	Please present exposure scenarios with calculations derived from sample data of adequate quality to support this decision.	2010 consent decree				JHD
47	Page 6-13, Section 6.1.5, Conclusions on Potential Future Impacts	**Note: This comment is reminiscent of a comment made by Ecology for a previous AX tank's Request to Forego a Third Retrieval Technology (AX-103).** Please clarify that the calculated impacts of residual waste to groundwater and future impacts from hypothetical inadvertent intrusion are *estimates* representing *contributions* to risk *only* from Tank AX-101 residuals *for the modeled scenarios*. These estimates are limited in that they do not consider additive or cumulative impacts from other tank residual constituents or from other potential contaminant sources within WMA A/AX or the SST System, nor do they consider conditions between present day and the time at which the presumed remedy is implemented.	State the limitations of the assessment, including but not limited to: • Estimated concentrations, hazard quotients, and dose represent *specific* COC contributions *only* from Tank AX-101 at a particular point in time for a given scenario. • Calculated concentrations, hazard quotients, and dose represent post-remedy assumptions (grouting and barrier placement). • Hazard quotients and dose representing preremedy conditions (no grout, no barrier) were not evaluated. Cumulative impacts from other potential contaminant sources within WMA A/AX or the ST System were not evaluated.	Clarification and evaluation of quality and veracity of risk assessment.				GP

Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/ Close	Reviewer Initials
48	Page 6-13, Section 6.1.5, Conclusions on Potential Future Impacts, first paragraph	As mentioned earlier in the comments (Comment 8, ES, page ii and iii, bullet 8 above), significance should be used in scientific and statistical discussions with actual quantitation. For example, "The treatment mean was significantly lower than the control mean with a *p*- value of 0.03." Or "The modeled concentrations of the 2nd retrieval technology were not significantly lower than the modeled concentrations of the 3rd retrieval technology ($p = 0.02$, *t* – test, n – 1 = 4 degrees of freedom)." Referring to the sentence: "While additional retrieval could further reduce the future impact assuming successful deployment, the additional risk reduction may not be significant." How much is not enough to be significant? In traditional statistics, when something is or is not **quantitatively significantly different** (higher or lower) than something else, the means are reported with their associated 95% confidence intervals, along with the results of a statistical test, like the *t*-test above.	Provide an exact numerical quantitative discussion about why adding a third technology would or would not produce lower estimates of modeled soil Cr concentration at the WMA fenceline and how the statistically insignificant difference between the 2nd and 3rd technologies and the estimates in soil Cr concentrations, are, statistically speaking, essentially zero. Further, explain how a very small difference would have very little effect on the human health parameter estimates (such as any change in modeled soil concentrations of Cr at fence line, hazard quotients, etc.). Otherwise remove the word "significant" since it implies thoughtful numerical and statistical analysis.	Language that implies precision when no precise analysis exists or the document lacks a robust and transparent statistical explanation supporting the statement.				GP
49	Page 7-2 Risk reduction second and third sub-bullets	Please state that results are *modeled* and represent *contributions* from Tank AX-101. Also state that concentration and dose contributions from AX-101 have not been assessed with respect cumulative potential risk within WMA A/AX or the SST System.	Suggest language "After two technologies, the *modeled* groundwater concentration *contribution of [COC] from Tank AX-101 at* [spatial boundary (e.g., WMA fenceline, 100m downgradient from WMA fenceline, directly beneath tank) *in* [number of years] is…" The suggested language describes meaningful characteristics of the calculated values.	Clarification				GP
50	Page 7-2, Risk reduction, fourth and fifth sub-bullets	Please state that the estimated intrusion doses correspond specifically to intrusion into Tank AX-101 residuals by adding "…into Tank AX-101…"	Suggest language "A maximum exposure dose of [DOSE] from a [SCENARIO] inadvertent intrusion scenario ***into Tank AX-101*** is estimated at…"	Clarification				GP
51	RPP-CALC-66224 Section 5.0 Page 3	RPP-CALC-66224 states: The AX-101 retrieval tracking spreadsheet is attached with this report in the configuration Database.	Provide the AX-101 retrieval tracking spreadsheet and AX-101 Dissolution Curve.xlsx	Please				JHD