



STATE OF WASHINGTON  
**DEPARTMENT OF ECOLOGY**

Richland Field Office

3100 Port of Benton Blvd., Richland, WA 99354 • 509-372-7950

June 20, 2025

25-NWP-094

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

Re: Transmittal of the Department of Ecology's Comments for the *Single-Shell Tank Leak Detection and Monitoring Technologies Evaluation*, RPP-RPT-64595, Revision 1

Reference: See page 2

Dear Anders J. Wiborg:

The Department of Ecology (Ecology) is transmitting comments for the *Single-Shell Tank Leak Detection and Monitoring Technologies Evaluation*, RPP-RPT-64595, Revision 1 (Reference). Ecology reviewed RPP-RPT-64595 in accordance with the requirements of Agreed Order 21304 V.F.1.iii.

We appreciate your review of these comments and look forward to meeting with you to resolve comment responses.

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

Sincerely,

Digitally signed by Rochette,  
Beth (ECY)  
Date: 2025.06.20 11:03:51  
-07'00'

Elizabeth A. Rochette  
Cleanup Section Manager  
Nuclear Waste Program

lj/bp  
Enclosure

cc: See page 2

Reference: Letter 25-TWO-0069, dated May 21, 2025, "The U.S. Department of Energy, Hanford Field Office Response to 24-NWP-224 from the Washington State Department of Ecology and Transmittal of RPP-RPT-64595, 'Single-Shell Tank Leak Detection and Monitoring Technologies Evaluation,' Rev 1"

cc electronic w/enc:

Laura Buelow, EPA  
Ricky Bang, USDOE  
Laura O'Mara, CPCCo  
Dan Baide, H2C  
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Beth 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

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**Document Title(s)/Number(s):** RPP-RPT-64595, "Single-Shell Tank Leak Detection and Monitoring Technologies Evaluation," Rev 1

Document Manager		Telephone Number	Project Manager		Telephone Number	Facility Site ID	Cleanup Site ID	
Eric Pierce		(509)-410-5273	TBD					
Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/Close	Reviewer Initials
1	General	<p>Document cites "A recent Agreed Order (AO 21304) between the US DOE and the Washington State Department of Ecology states that, "the installation of new leak detection and monitoring technology could be beneficial in identifying fate and transport of liquid waste released from SSTs with active leaks if the instrumentation is sensitive enough to monitor the tank leakage rate."</p> <p>Document further emphasizes that "Any in-tank or ex-tank LDM technology can be improved by using more detectors at more locations with more frequent data collection and data evaluations and integrating in-tank and ex-tank data." Although ex-tank technology including (1) Dry Well logging with neutron probe and Gamma detector and (2) Electrical Resistivity (ER) are promoted as best for ex-tank leak detection particularly performed on a frequent basis, the report does not recommend implementing these on a frequent/regular basis for leak detection.</p> <p>Bay West Report states that the use of improved deployment technologies that facilitate monitoring for leaks closer to the SST base (i.e., volume of interest) were identified that may detect marginally smaller leak volumes or rates and provide improved LDM of SSTs.</p> <p>Given the age of the SSTs and their continued use for the foreseeable future beyond their 25-year design life, implementing a proven and viable ex-tank leak detection monitoring technology is an improved method of leak detection compared to not performing the monitoring until a suspected leak is confirmed by in-tank volume assessments (which is current practice when not in retrieval process).</p>	<p>Technologies addressed in the report for ex-tank leak detection are only good if applied and routinely/frequently implemented. Although routine ex-tank leak detection monitoring using dry well logging and electrical resistivity surveys were initially implemented their use has been decreasing in frequency and ultimately stopped except for tank recovery operation monitoring. Without continued routine monitoring it is impossible to determine if there are any changes in the subsurface soils that would suggest/indicate releases from the SSTs.</p> <p>Report needs to include ex-tank monitoring (neutron probe logging of dry wells and high-resolution resistivity surveys) at each tank farm as a proven and viable method for leak detection monitoring or provide clear justification (cost estimates and technology implementation constraints prohibiting deployment) why renewed routine ex-tank leak detection monitoring using dry well logging and electrical resistivity surveys is not practicable or implementable as part of the "leak detection and monitoring technology" assessment.</p>	AO 21304 V.F.1.iii	<p>05/22/25: Partial accept. The report will be revised to update the practicability assessment in Section 5 of Rev. 1 (Section 6.2 in Rev. 0) to show estimated costs for applying routine (retrieval based) LDM ER and logging systems to all SSTs and to provide clearer justification why ex-tank leak detection monitoring using dry well logging and electrical resistivity surveys is not practicable.</p> <p>In workshops* participants agreed ex-tank measurements are not proven or viable for low volume leak detection, only to determine nature and extent of an active SST leak in the vadose zone. An alternative implementation approach using lower frequency (snapshots once every 8 to 10 years) ER was proposed by WA Ecology. While this approach is less costly than more frequent ER measurement of all SST farms, improved ex-tank vadose monitoring of nature and extent would not affect tank waste disposition and retrieval activities. Text was added to Section 5 to explain why this is not practicable.</p> <p>*Workshops included participants from USDOE, WA Ecology and H2C.</p>	(wkh) Do not agree with comment: "In workshops* participants agreed ex-tank measurements are not proven or viable for low volume leak detection" which hinges on definition for <i>low volume</i> .	Open	CDG WKH

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Item No.	Pg. # Sec. # Para./Sent.	Comment or Question	Modification Needed	Basis/Justification	Permittee Response	Ecology Response	Open/Close	Reviewer Initials
2	General	<p>Report and Attachment 1 - Bay West Report BWJ221104 refer to RPP-9937, Rev 05D SST System Leak Detection and Monitoring Functions and Requirements Document for prior and current leak detection monitoring technologies and processes; however, procedures specified in RPP-9937 are to document the leak detection, monitoring, and initial actions required applicable during the SST pre-retrieval and post-retrieval of SST's and not regular routine ex-tank monitoring.</p> <p>There is no current routine ex-tank leak detection monitoring except during retrieval processes, as such making considerations and/or recommendations for technology improvements for leak monitoring without actual implementation of monitoring does not meet the intent of the required study. Simple technology source identification is not sufficient if even the historic dry well logging and electrical resistivity surveys which have proven successful are not even implemented anymore.</p> <p>Implementing a technology is an improved method of leak detection compared to not performing the monitoring.</p>	Report needs to enhance the assessment of ex-tank monitoring (neutron probe logging of dry wells and high-resolution resistivity surveys) and include as a proven and viable method for leak detection monitoring.	AO 21304 V.F.1.iii	05/22/25: Partial accept. See response to Comment 1.	See response to RCR #1.	Open	CDG
3	General Comment.	<p>The DOE should consider the use of resistivity around the tank farms as a monitoring procedure, by including an analysis of drywell locations to monitor an entire tank farm.</p> <p>Routine monitoring for potential leaks in the tank farms would have the benefit of a baseline comparison during tank retrieval processes (for which the drainable liquid level is constantly changing).</p>	Provide a justification for why routine monitoring using resistivity would not be considered an enhancement to the current tank farm leak detection and monitoring systems.	AO 21304 V.F.1.iii	05/22/25: Not accepted. The report already identifies routine monitoring using ER as an enhancement. Section 6.1 of Rev. 0 was moved to Section 1 in Rev. 1) states "Potential marginal enhancements and/or improvements to past electrical resistivity surveys at Hanford were: <input type="checkbox"/> Increase number of ER sensors and electrodes, <input type="checkbox"/> More sensors, sensor locations closer to tanks, and frequent monitoring improve the sensitivity of leak detection."	Accepted.	Closed	JAR

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4	Page xi Scientific Nomenclature	Scientific Nomenclature provides term identifiers and their definitions as well as correspondence to "L" however "L" by itself is not defined. "L <sub>e</sub> " and L <sub>s</sub> " are defined but not "L".	Provide definition for "L".	Clarification of term.	05/22/25: Not accepted. There is no "page xi" or "L" acronym.			CDG
5	Sec. 1.0, Pg. 4, Para 4	Text uses terms "incremental (or marginal)" and "order of magnitude". Nowhere in the agreed order are these given as standards for use in determining practicability.	Remove references to "order of magnitude improvement" as a standard measure in determining practicability.	AO 21304 V.F.1.iii	05/22/25: Accept. Order-of-magnitude will be removed for determining practicability.	accept	Closed	WKH
6	Sec. 1.0, Pg. 4, Para 4	In a paragraph describing results from the subcontractor is a sentence that includes "it is not technically or economically practicable to enhance current LDM technologies used at Hanford or to deploy new technologies." No where does the subcontractor make this claim. To the contrary, in Section 6.1, page 80 it is stated: "economic practicability was not evaluated as part of this evaluation" and ER is inferred as practicable with enhancements (Sec. 2.6, pg. 33, Table 2-8 Attachment 1, Page ES-4, Table ES-2).	Remove references to practicability without performing a true evaluation.	AO 21304 V.F.1.iii	05/22/25: Not accepted. An adequate evaluation was performed. See response to Comment 1 for enhancement.	accept	Closed	WKH
7	Sec. 2.0, Pg 5, Para i.	The purpose of the technology evaluation includes applications "to determine conditions, nature, location, and extent of any leakage". Determining nature and extent of the leaks seems to have fallen out of consideration of the technologies. ER is cited as capable of providing such information (pg. 33, Table 2-8).	Include a discussion of potential to monitor active leaks using ER and improvements possible with additional sensors/electrodes and software in the system.	AO 21304 V.F.1.iii	05/22/25: Partial accept. See response to Comment 1.	Accept	Closed	WKH
8	Section 3.3, Pg. 8, 3 <sup>rd</sup> paragraph, 2 <sup>nd</sup> sentence.	The text reads: "However, it was determined that adding more detectors at more locations would result in marginal improvements as compared to the performance of LDM technologies and methods currently used at Hanford."  The technologies used at the Hanford Single-Shell Tanks are majority used during tank retrievals. There is a need for more routine monitoring to be conducted, and this could be done with the addition of more detectors at more locations.	Please explain why the implementation of marginal improvements to current LDM (and leak rate and fate transport) are not being considered or are excluded from the report.	AO 21304 V.F.1.iii	05/22/25: Partial accept. See response to Comment 1.	Accept.	Closed	JAR

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9	Section 3.3, Pg. 9, Table 3-1 "Potential Methods to Enhance Current Hanford Technologies"	The table describes enhancement methods for dry well logging with neutron probes and gamma detectors.  Routine monitoring using dry well logging (with neutron probes and gamma detectors) could serve a use as a baseline comparison when used for retrievals – would it not be considered an enhancement to use this technique routinely as opposed to only during active retrievals, as is current practice?	Please explain why the enhancement method marked in Table 3-1 for dry well logging is not used outside of active retrieval.	AO 21304 V.F.1.iii	05/22/25: Accept. Text added in Section 1 to further explain why drywell logging is not used or recommended for use outside of active retrieval.	Accept.	Closed	JAR
10	Section 3.3, Pg. 9, Table 3-1 "Potential Methods to Enhance Current Hanford Technologies"	The table describes enhancement methods for electrical resistivity (ER).  Modeling to design a system for enhancing ER surveys and data acquisition would be beneficial to monitoring tank leaks – is the DOE or contractor considering any modeling efforts to design an improved system for ER?	Please explain why the enhancement method marked in Table 3-1 for ER is not being implemented universally in the SST system.	AO 21304 V.F.1.iii	05/22/25: Accept. Text added in Section 1 to further explain why ER is not used or recommended for use outside of active retrieval.	Accept.	Closed	JAR
11	Section 6.1.2, Page 15, 2 <sup>nd</sup> Paragraph	Text reads "Dry well logging potential enhancements and/or improvements identified were: <ul style="list-style-type: none"> <li>Automate and/or increase monitoring frequency and,</li> <li>Add monitoring locations (direct push wells and sensors)."</li> </ul> However, implementation of the technology at routine/frequent intervals for leak detection is not recommended in the report. Technologies addressed in the report for ex-tank leak detection are only good if applied and routinely/frequently implemented.	This is a very important aspect of ex-tank leak detection monitoring not currently implemented on a routine basis for leak detection.  Report needs to include ex-tank monitoring (neutron probe logging of dry wells and high-resolution resistivity surveys) at each tank farm as a proven and viable method for leak detection monitoring or provide clear justification (cost estimates and technology implementation constraints prohibiting deployment) why renewed routine ex-tank leak detection monitoring using dry well logging and electrical resistivity surveys is not is not practicable or implementable as part of the "leak detection and monitoring technology" assessment.	AO 21304 V.F.1.iii	05/22/25: Partial accept. See response to Comment 1. (Note: Portions of Section 6.1.2 in Rev. 0 were moved to Section 1 in Rev. 1).	See response to RCR #1.	Open	CDG
12	Section 6.1.2, Page 15, 3 <sup>rd</sup> Paragraph	Text reads "Potential enhancements and/or improvements to past electrical resistivity surveys at Hanford were:	Report needs to include ex-tank monitoring (neutron probe logging of dry wells and high-resolution resistivity surveys) at each	AO 21304 V.F.1.iii	05/22/25: Partial accept. See response to Comment 1. (Note: Portions of Section 6.1.2 in Rev. 0 were	See response to RCR #1.	Open	CDG

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		<ul style="list-style-type: none"> <li>Increase number of ER sensors and electrodes,</li> <li>More sensors, sensor locations closer to tanks, and frequent monitoring</li> <li>improve the sensitivity of leak detection; and,</li> <li>Perform ER/Surface Geophysical Exploration (SGE) across an entire tank farm."</li> </ul> <p>Again, implementation of the technology at routine/frequent intervals for leak detection is not recommended in the report. This is a very important aspect of ex-tank leak detection monitoring not currently implemented on a routine basis for leak detection. Technologies addressed in the report for ex-tank leak detection are only good if applied and routinely/frequently implemented.</p>	tank farm as a proven and viable method for leak detection monitoring or provide clear justification (cost estimates and technology implementation constraints prohibiting deployment) why renewed routine ex-tank leak detection monitoring using dry well logging and electrical resistivity surveys is not practicable or implementable as part of the "leak detection and monitoring technology" assessment.		moved to Section 1 in Rev. 1).			
13	Sec. 6.2, Pg. 16, Para 2 & 4	<p>Para 2: "A detailed cost/benefit analysis is not realistic unless further refinement and selection has been made to..."</p> <p>Para 4: "Therefore, it is not technically or economically practicable to enhance current LDM technologies used at Hanford or to deploy new technologies, and no additional LDM studies or improvements are identified." These two statements are incongruous.</p>	Remove references to economic and technical practicability that are made without adequate, or any, support elsewhere in the text.	AO 21304 V.F.1.iii	05/22/25: Partial accept. See response to Comment 1.	Accept	Closed	WKH
14	Section 6.2, Pg. 16, 4 <sup>th</sup> paragraph.	<p>The text says "therefore, it is not technically or economically practicable to enhance current LDM technologies used at Hanford or to deploy new technologies, and no additional LDM studies or improvements are identified."</p> <p>However, in the previous paragraph (Pg. 15, Section 6.2, second paragraph), the text states "[it] is apparent that reliable cost estimates and potential incremental improvements could not be quantified without further development and design specific to the Hanford Tank Farms."</p>	Please explain why permittees will not conduct a design specific to this type of work in the SSTs.	AO 21304 V.F.1.iii	05/22/25: Partial accept. See response to Comment 1.	Not accepted. See response to RCR #1.	Open	JAR

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		It would seem that this suggests that a study can be identified to improve the potential for technology enhancement/implementation of new technology...by conducting a study specifically around the Hanford Site SSTs.						
15	Page 16 Section 6.2 Last Paragraph	Text reads "Therefore, it is not technically or economically practicable to enhance current LDM technologies used at Hanford or to deploy new technologies, and no additional LDM studies or improvements are identified."  This is a very important aspect of ex-tank leak detection monitoring not currently implemented on a routine basis for leak detection. Without continued routine monitoring it is impossible to determine if there are any changes in the subsurface soils that would suggest/indicate releases from the SSTs.	Report needs to include ex-tank monitoring (neutron probe logging of dry wells and high-resolution resistivity surveys) at each tank farm as a proven and viable method for leak detection monitoring or provide clear justification, such as cost estimates and technology implementation constraints prohibiting deployment, why renewed routine ex-tank leak detection monitoring using dry well logging and/or electrical resistivity surveys is not practicable or implementable as part of the "leak detection and monitoring technology" assessment.	AO 21304 V.F.1.iii	05/22/25: Partial accept. See response to Comment 1.	See response to RCR #1.	Open	CDG
16	Page 68 Section 5.4 First Paragraph	The text reads: "As noted previously, none of the new technologies or methods reviewed appear to be capable of providing an order of magnitude improvement to current LDM and characterization methods, while the amount of incremental improvement possible will vary depending on how the technologies are installed and operated and how the data is evaluated."	Ecology recommends additional testing and review of methodology as necessary before determining the magnitude of improvement.	AO 21304 V.F.1.iii	05/22/25: Not accepted, additional testing for potential marginal improvements to current Hanford LDM technologies is not practicable. See response to Comment 1.	Partially agree but willing to close out discussion in this comment pending review of comment #1.	Closed	MM
17	Page 73 Section 5.5.3 Last Paragraph	The text reads: "Ex-tank monitoring is not currently required for SSTs in storage mode."	Ecology recommends ex-tank monitoring as a routine task to ensure there is no chance of a release from tanks in storage.	AO 21304 V.F.1.iii	05/22/25: Not accepted. Leak detection monitoring is not a tool to ensure suitable confinement of waste and does not pertain to the AO scope or requirements.	Partially accepted provided that resistivity and moisture content measurements are continued pursuant to AO 21304 V.F.1.i and V.F.1.iii.	Open	MM
18	Attachment 1 - Bay West Report BWJ221104 Page ES-1 Executive Summary	Text reads "However, the use of improved deployment technologies that facilitate monitoring for leaks closer to the SST base (i.e., volume of interest) were identified that may detect marginally smaller leak volumes or rates and provide improved LDM of SSTs."	Ecology has two items:  1) Report needs to include ex-tank monitoring (neutron probe logging of dry wells and high-resolution resistivity surveys) at each tank farm as a proven and viable method for leak detection monitoring or	AO 21304 V.F.1.iii	05/22/25: Not accepted. 1) ex-tank monitoring is not a proven and viable method of leak detection capable of meeting the AO requirements, and 2) the report already evaluates incremental/marginal improvements.	(2) not accepted, but agree to disagree whether marginal and incremental improvements are required by AO.	Closed	CDG WKH

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	3 <sup>rd</sup> Paragraph	Document addresses "improved deployment techniques" which includes performing routine vadose zone monitoring, which has not been performed since around 2005. Implementing a technology is an improved method of leak detection compared to not performing the monitoring (which is current practice).	provide clear justification, such as cost estimates and technology implementation constraints prohibiting deployment, why renewed routine ex-tank leak detection monitoring using dry well logging and electrical resistivity surveys is not practicable or implementable as part of the "leak detection and monitoring technology" assessment.  2) Discuss incremental/marginal improvements as legitimate goals to meet requirements of AO.					
19	Attachment 1, Page ES-4, Table ES-2, & Page ES-7, Para 2	The report can be read as a down-selection of electrical resistivity for additional evaluation. ER is cited throughout as existing and effective for leak detection and confirmation. Enhancements in LDM using ER can be made with more electrodes (Table ES-2). "Modeling, testing and/or cost/benefit studies would be needed to confirm and quantify the incremental improvements and further refine the estimated costs." (ES-7, para 2)	Perform a thorough and defensible technical and economic practicability evaluation for enhancing the ER network throughout the tank farms.	AO 21304 V.F.1.iii	05/22/25: Not accepted. An adequate evaluation was performed. See response to Comment 1 for enhancement.	accepted	Closed	WKH
20	Attachment 1 - Bay West Report BWJ221104 Page 5-6 Last paragraph Page 5 continuing number items on Page 6	Technologies evaluated must address one or more of three basic functions: 1. <b>Leak Detection:</b> A technology that allows continuous or frequent measurement of some parameter and can detect changes which may be indicative of a tank leak. 2. <b>Leak Monitoring:</b> A technology that can evaluate the anomaly detected by the leak detection method, confirm that it is in fact a tank leak, and/or provide some indication of the leak volume and changes in the leak rate. 3. <b>Leak Tracking:</b> A technology that can provide detailed data, which can be used to determine the extent of an active tank leak, and track migration of the leak in the vadose zone.	Report should emphasis the actual implementation of ex-tank monitoring (neutron probe logging of dry wells and high-resolution resistivity surveys) at each tank farm as a proven and viable method for leak detection monitoring or provide clear justification (cost estimates and technology implementation constraints prohibiting deployment) why renewed routine ex-tank leak detection monitoring using dry well logging and electrical resistivity surveys is not is not practicable or implementable as part of the "leak detection and monitoring technology" assessment.	AO 21304 V.F.1.iii	05/22/25: Partial accept. Ex-tank monitoring is not a proven and viable method of leak detection capable of meeting the AO requirements. See response to Comment 1.	See response to RCR #1.	Open	CDG

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		Document promotes "leak monitoring" and "leak tracking" which can only occur if routine vadose zone monitoring is actually performed. Routine monitoring has not been performed since around 2005. Recommending/Implementing a technology is an improved method of leak detection compared to not performing the monitoring (which is current practice).						
21	Attachment 1 - Bay West Report BWJ221104 Section 2.6 Table 2-8	Table is titled "Potential Methods to Enhance Current Ex-Tank Hanford Technologies" and promotes "enhanced deployment" of dry well logging and electrical resistivity surveys. However, although the summary identifies "expansion of devices" it fails to promote reestablishing routine/frequent implementation of these technologies for leak detection.  Document addresses "potential methods to enhance current monitoring techniques" but does not clearly recommend reactivation/performing routine vadose zone monitoring, which has not been performed since around 2005. Implementing a technology is an improved/enhanced method of leak detection compared to not performing the monitoring (which is current practice).	Report needs to include ex-tank monitoring (neutron probe logging of dry wells and high-resolution resistivity surveys) at each tank farm as a proven and viable method for leak detection monitoring or provide clear justification (cost estimates and technology implementation constraints prohibiting deployment) why renewed routine ex-tank leak detection monitoring using dry well logging and electrical resistivity surveys is not is not practicable or implementable as part of the "leak detection and monitoring technology" assessment.	AO 21304 V.F.1.iii	05/22/25: Partial accept. Ex-tank monitoring is not a proven and viable method of leak detection capable of meeting the AO requirements. See response to Comment 1.	See response to RCR #1.	Open	CDG
22	Attachment 1 - Bay West Report BWJ221104 Page D-13 & D-14	Report references that HGI has been involved in application of HRR to SST leak detection at Hanford for about 20 years. Over that time, they have been involved in ex-tank monitoring for 15 tanks during retrieval operations. The current HRR-LDM system has shown the ability to detect a leak of 2100 gallons within 24 hours at a 95% confidence level, and a leak of 1000 gallons with a 50% confidence level.  Report further states resistivity measurements represent the best chance of detecting highly	Include ex-tank monitoring (neutron probe logging of dry wells and high-resolution resistivity surveys) as a recommendation for each tank farm or provide clear justification (cost estimates and technology implementation constraints prohibiting deployment) why implementation of routine ex-tank leak detection monitoring is not practicable.	AO 21304 V.F.1.iii	05/22/25: Not accepted. See response to Comment 1.	See response to RCR #1.	Open	CDG

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		<p>alkaline conductive liquid associated with a tank leak. Other methods such as drywell gamma or neutron moisture logging can only detect leaks when the liquid is close to the drywell.</p> <p>HRR and drywell gamma or neutron moisture logging has been a proven effective method for subsurface soil investigations for assessment of contaminants from tank releases and must be addressed as a viable leak detection monitoring technique to be implemented at all tank farms.</p>						