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Ms. Jane A. Hedges, Program Manager
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Ms. Hedges:

THE U.S. DEPARTMENT OF ENERGY, OFFICE OF RIVER PROTECTION SUBMITS THE RETRIEVAL COMPLETION CERTIFICATION AND REPORT FOR TANK 241-C-110

The U.S. Department of Energy (DOE), Office of River Protection (ORP) is transmitting RPP-56214, Revision 0, "Retrieval Completion Certification Report for Tank 241-C-110," to the Washington State Department of Ecology (Ecology) in accordance with Section IV-B-5 of the Consent Decree in *Washington v. DOE*, Case No. 08-5085-FVS (E.D. Wa. October 25, 2010) (Consent Decree), which states "When DOE completes retrieval of waste from a tank covered by this Decree, DOE will submit to Ecology a written certification that DOE has completed retrieval of that tank."

This letter certifies that ORP has completed retrieval of Tank 241-C-110 in accordance with Part 1 of Appendix C of the Consent Decree and with the retrieval technology/systems that were established by approval of Ecology on May 13, 2008, in Tank Waste Retrieval Work Plan RPP-33116, Revision 2.

If you have any questions, please contact Joanne F. Grindstaff, Federal Project Director, Retrieval and Closure, at (509) 376-6202.

Kevin W. Smith
Manager

TF:CJK

Attachment

Distribution see page 2

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Attached to:
0091889, 0077956

cc w/attach:
TPA Administrative Record
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ATTACHMENT

14-TF-0007

RETRIEVAL COMPLETION CERTIFICATION REPORT FOR TANK 241-C-110

DOCUMENT RELEASE FORM

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(b) Reviewer (Optional, Print/Sign): R. S. Wiegman *Beau Wiegman* Date: 1/7/14 Date: Date: Date: Date: Date: Date:

(c) Responsible Manager – (Print/Sign): S. J. Eberlein Date: 01/07/14

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Retrieval Completion Certification Report for Tank 241-C-110

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Abstract: This Retrieval Completion Certification Report documents the completion of retrieval operations on the single-shell tank 241-C-110 on October 16, 2013 using the modified sluicing and chemical dissolution (caustic cleaning) technologies as described in the Tank Waste Retrieval Work Plan approved by the State of Washington Department of Ecology on February 16, 2012. This report provides a summary of technical information upon which the decisions to cease tank retrieval operations in tank 241-C-110 were based for each of these technologies. In addition, this report is the mechanism by which the U.S. Department of Energy (DOE) asserts that the selected retrieval technologies have reached their respective limits of technology, in compliance with the requirements of Section IV, Paragraph B.5 of the Consent Decree in Washington v. DOE (Case No. CV-08-5085-FVS) (E.D.Wa. October 25, 2010).

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APPROVED
By G.E. Bratton at 7:06 am, Jan 08, 2014

Release Approval Date

DATE:
Jan 08, 2014
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RPP-56214
Revision 0

Retrieval Completion Certification Report for Tank 241-C-110

L. A. Fort
Washington River Protection Solutions, LLC

Date Published
January 2014

washington river protection solutions

Prepared for the U.S. Department of Energy
Office of River Protection

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RETRIEVAL COMPLETION CERTIFICATION REPORT FOR TANK 241-C-110

Pursuant to Consent Decree in Case No. CV-08-5085-FVS
(*State of Washington v. Department of Energy* [E.D. Wa. October 25, 2010])

1.0 INTRODUCTION

The U.S. Department of Energy (DOE), Office of River Protection (ORP) is hereby submitting this Certificate of Retrieval Completion Report (hereinafter "Retrieval Completion Certification") in accordance with Section IV-B-5 of the Consent Decree in *Washington v. DOE*, Case No. 08-5085-FVS (E.D. Wa. October 25, 2010) (hereinafter the "Decree" or "Consent Decree"), which provides as follows: "When DOE completes retrieval of waste from a tank covered by this Decree, DOE will submit to Ecology a written certification that DOE has completed retrieval of that tank."

This Retrieval Completion Certification provides a summary of completion of retrieval operations on the single-shell tank (SST) 241-C-110 (C-110) on October 16, 2013. Tank C-110 was retrieved using modified sluicing, the FoldTrack®[1] Mobile Retrieval Tool, and high pressure water technologies as described in the Tank Waste Retrieval Work Plan (RPP-33116, *241-C-110 Tank Waste Retrieval Work Plan*) as amended by *Tank Waste Retrieval Work Plan/Functions and Requirements Modification Notice 2012-13* (ORP and Ecology 2012), to a final waste volume of ~280 ft^3 (~2,100 gal). The final waste volume meets the Consent Decree goal of 360 ft^3 or less.

This Retrieval Completion Certification provides a summary of technical information on which the decisions to cease retrieval operations in tank C-110 were based for each of these technologies. The format and content of this Retrieval Completion Certification resulted from numerous discussions between the State of Washington Department of Ecology (Ecology) and DOE-ORP and its Tank Operations Contractor, Washington River Protection Solutions, LLC, and an agreed-upon outline that DOE-ORP followed in preparing this document. The DOE-ORP is hereby declaring that it has completed the retrieval of tank C-110 in full compliance with the requirements of Part 1 of Appendix C of the Consent Decree, and with the retrieval technologies/systems that were established by the Tank Waste Retrieval Work Plan, and is submitting this Retrieval Completion Certification accordingly.

[1] The FoldTrack® Mobile Retrieval Tool is manufactured by Non Entry Systems Ltd., UK Patent Application No: 0718573.9.

2.0 RETRIEVAL PROCESS DESCRIPTION AND CHRONOLOGY

2.1 PRE-RETRIEVAL CONDITION

Tank C-110 is a 530,000-gal (~70,850-ft^3) SST that was used to store radioactive waste beginning in 1946. Prior to retrieval, the initial waste volume in tank C-110 was estimated in the Best-Basis Inventory (BBI)[2] to contain ~178,000 gal (~23,800 ft^3) of waste that were deposited in this tank primarily during the 1940s, 1950s, and 1960s. HNF-EP-0182, *Waste Tank Summary Report of Month Ending July 31, 2013*, Revision 304 classifies tank C-110 as an assumed leaker. Waste releases from tank C-110 were attributed to an overfill of the tank and it was recommended that tank C-110 be reclassified as "sound" (i.e., evaluation of data indicates no loss of liquid attributed to a breach of integrity) in RPP-ASMT-38219, *Tank 241-C-110 Leak Assessment Report*.

The chemical and radionuclide composition and inventory of the waste was documented in the BBI estimate, and is based on the results of core samples obtained in 1992 and process knowledge of the types of waste that were received at tank C-110 (TWINS 2006). Samples were described as reddish brown sludge that was wet in appearance. The BBI sludge volume was based on a number of sludge measurements taken over time at a single location in the tank.

2.2 PROCESS DESCRIPTION

The DOE-ORP selected modified sluicing as the initial preferred technology for deployment in tank C-110 as documented in RPP-33116. In the modified sluicing deployment, supernate from tank 241-AN-106 (AN-106) was used as the sluicing media to mobilize the waste in tank C-110 and the resulting slurry was pumped to tank AN-106. The slurry from tank C-110 also contained insoluble solid material. The solids settled in tank AN-106 and the supernate was reused in the sluicing operations.

The modified sluicing operation was suspended on April 27, 2009 when DOE determined that the bulk of the remaining waste consisted of solids (hard heel) that were not mobilized by sluicing. At the cessation of modified sluicing, an estimated waste volume of ~17,200 gal (~2,300 ft^3) remained in tank C-110. In accordance with the general approach provided in RPP-33116 and Appendix C, Part 1 of the Consent Decree, DOE-ORP considered deploying a waste retrieval technology to recover the hard heel remaining. Nine grab samples of solids were obtained from tank C-110 Riser 6 in September 2010 using the Off-Riser Sampling System. Laboratory scale testing of tank C-110 heel samples was performed.

The laboratory results from the September 2010 samples showed that the solids in tank C-110 consist primarily of sodium fluoride phosphate [$Na_7F(PO_4)_2 \cdot 19H_2O$, also known as natrophosphate]. A combination of mechanical waste conditioning using an in-tank vehicle (FoldTrack® mobile retrieval tool [MRT]) with plow-blade, high pressure water (MRT water

[2] See Tank Waste Information Network System (TWINS), Queried 6/30/2006, (Best-basis Inventory, Calculation Detail, Tank 241-C-110, https://twins.pnl.gov/twinsdata/Forms/About.aspx?subject=TWINS).

cannon and scarifiers) and modified sluicing were selected to retrieve the remaining solids. The candidate hard heel waste retrieval technologies were identified by RPP-RPT-44139, *Nuclear Waste Tank Retrieval Technology Review and Roadmap*. The high pressure water and mechanical waste conditioning delivery system and rationale were described in documents RPP-PLAN-48868, *Single-Shell Tank 241-C-110 Hard Heel Retrieval Method Selection* and RPP-PLAN-53943, *Process Control Plan for Tank 241-C-110 Waste Heel Retrieval*. The mechanical waste conditioning and sluicing were performed to remove as much of the waste as possible; high pressure water and sluicing were applied as needed. No additional sampling of the waste was done during this process.

During this waste recovery operation, the solids were first pushed closer to the slurry pump and sluicers using the MRT plow-blade, and water was added through the MRT scarifier nozzles at a flow rate of ~6 gpm to prevent the nozzles from plugging (flow rates of 6 gpm or more were needed for flow meter measurements). As solids were moved toward the pump, the solids were sluiced (mobilized) using supernate from tank AN-106. The slurry pool was pumped down after each operating period and operations resumed. As needed, the flow rates and pressures of the scarifiers were increased to break up solids using high pressure water and to work with the plow-blade to move solids to the pump. A backstop to hold and suspend sluiced solids was created by mounding waste on the opposite side of the slurry pump from the sluice stream. High pressure water from the MRT nozzles also provided an effective backstop for sluicing by using the high pressure water nozzles to create a ridge of water on one side of the slurry pump, and sluicing material toward the pump from the other side.

During the last week of operations, hydraulic leaks were observed when moving the MRT. The MRT was parked near the slurry pump and used as a backstop during sluicing.

After the MRT use, hot water was sluiced into the tank to size-reduce solids and to move solids toward the pump. High pressure hot water was also applied through the MRT nozzles at flow rates of ~12 gpm to act as a backstop to wash sluiced solids into the pump and to suspend the solids. The slurry was then pumped from the tank. Plow-blade and high pressure water operations were conducted in accordance with the process control plan (RPP-PLAN-53943) and the tank waste retrieval work plan (RPP-33116).

2.3 RETRIEVAL CAMPAIGN CHRONOLOGY

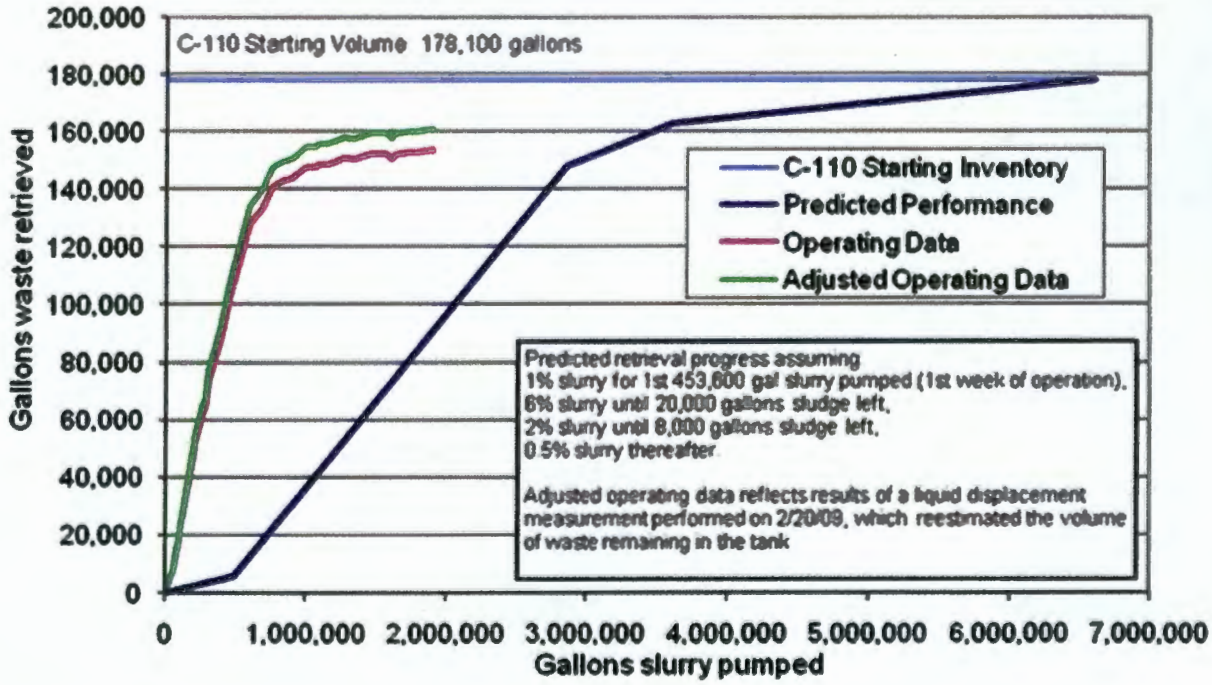
2.3.1 Modified Sluicing

Modified sluicing operations were performed during 31 operating days (61 shifts) starting on September 22, 2008 and ending on April 27, 2009. By March 6, 2009, the remaining solids were lighter in color, appeared to be like sand in consistency, and could be moved by the sluicers but were not easily pumped from the tank. Most of the waste in tank C-110 consisted of a soft brown sludge that was readily mobilized by the sluicers and pumped from the tank. The retrieval progressed quickly over the first few days of operation. Grainier, light-colored solids became more prevalent as the softer dark-colored sludge was washed out of the tank. A few larger chunks of material and some hard material on the tank bottom were observed, but the bulk of the

light-colored waste appeared sandy and mobile. Although mobilized by the sluicers, this waste settled rapidly and was not easily retrieved with the existing installed equipment.

Figure 1 shows retrieval system performance as a function of the volume of slurry (solids plus recycled tank AN-106 supernate) transferred from tank C-110 to tank AN-106. Retrieval system performance was tracked by trending the net waste volume increase in the receiver tank AN-106 after accounting for water additions; this is shown as the Operating Data line in Figure 1. This running volume balance does not distinguish between liquids and solids and does not account for solids dissolution or liquid evaporation. There are also uncertainties with the estimates of initial waste volume because of pore space in the waste. Near the end of retrieval, the operating data was adjusted to account for evaporation and pore space, as shown in the "Adjusted Operating Data" line in Figure 1.

Figure 1. Tank 241-C-110 Modified Sluicing System Performance.



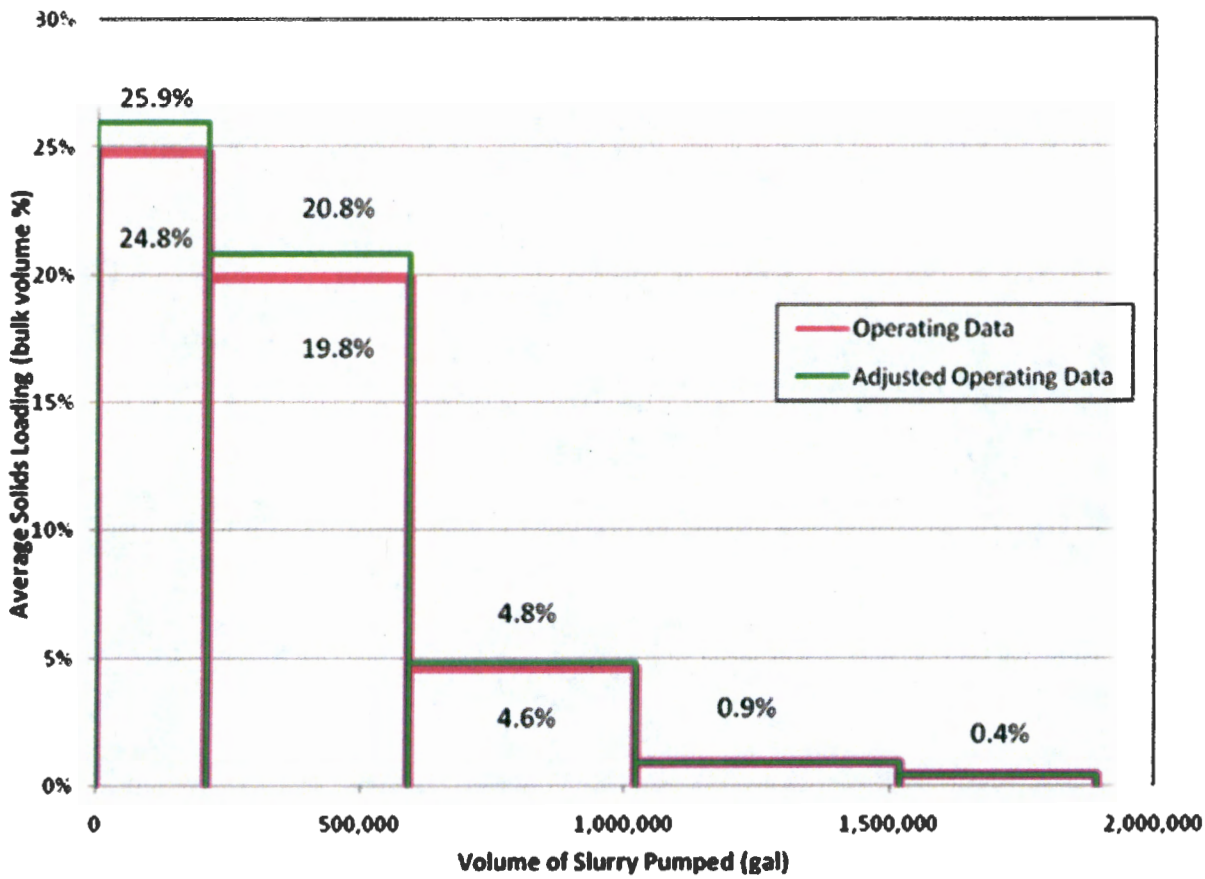
Volume displacement calculations and video evaluation performed during the February 20, 2009 addition of supernate to tank C-110 to soak the solids, estimated that ~23,000 gal (3,100 ft^3) of waste remained in tank C-110. Between the time of that estimate and the end of sluicing operations, limited waste retrieval was observed. Based on a material balance for that period, 17,200 gal (2,300 ft^3) of waste remained in tank C-110 as of April 27, 2009.

At the end of sluicing operations, solids still covered nearly the entire tank bottom and extended part way up the tank knuckle. A section of tank bottom was visible under the risers at the north side of the tank. A pool of liquid surrounded the slurry pump in the center of the tank and extended to the north and south sides of the tank where the sluicers were located. The solids were light in color and consisted primarily of sand-like solids with some coarser material

intermixed. Brown sludge was no longer observed in the tank. There was some waste on sections of the stiffener rings, but overall there did not appear to be much waste on the tank walls and stiffener rings. No estimate of the volume of waste on the tank walls and stiffener rings had been made. Other than some cables or wires, no debris or equipment was observed on the tank bottom.

Figure 2 shows the trend in retrieval system volumetric efficiency as measured by the average solids loading in the slurry as a function of the volume of slurry pumped from tank C-110. The high solids concentration in the slurry observed at the beginning of retrieval reflects the capability of the new slurry pump. By comparison, the retrieval of tanks 241-C-103, 241-C-108, and 241-C-109 by modified sluicing had solids concentrations that averaged only 7 to 11 bulk volume percent during the initial stages of retrieval. The decline in volumetric efficiency reflects a depletion of readily mobilized sludge in the tank and the difficulty of mobilizing lighter-colored sludge.

Figure 2. Solids Loading in Tank 241-C-110 Slurry.



The final days of operations show a slurry solids loading of about 0.4 bulk volume percent with less than 1,400 gal of waste retrieved over about 66 hours of pumping; this low retrieval rate was also supported by visual observations of the retrieval operations.

A summary of the amount of waste retrieved and waste remaining in tank C-110 after the modified sluicing is provided below in Sections 3.0 and 4.0.

2.3.2 FoldTrack® Mobile Retrieval Tool and High Pressure Water

The MRT was operated to move solids from the edge of the tank closer to the sluicers and pump. Initially, the FoldTrack® blade was used to move as much of the solids as possible, with minimal use of high pressure water or sluicing. Water, added through the high pressure scarifier and cannon nozzles, was used with the FoldTrack® blade to move and break up solids.

To ensure solids did not accumulate on the FoldTrack®, the waste was sprayed to wet the solids using either the sluicer supernate (at a low flow rate) or water from the FoldTrack® scarifier or cannon nozzles before the FoldTrack® moved across the waste. As a means to enable better visibility of operations, the sluicer was not aimed directly at the FoldTrack® during MRT operation.

During blading, the sluicer pool size was kept to a minimum to enable Operations to observe waste solids. This was done using a slow water stream (~6 gpm) directed through the scarifier nozzles to mitigate the possibility of the nozzles plugging. After blading, high pressure water was applied through the scarifier nozzles and cannon to further break up and move solids toward the pump. Once a pile of solids was pushed toward the pump, the sluicer was operated to spray the pile and pump solids. The MRT was used as a backstop during sluicing operations.

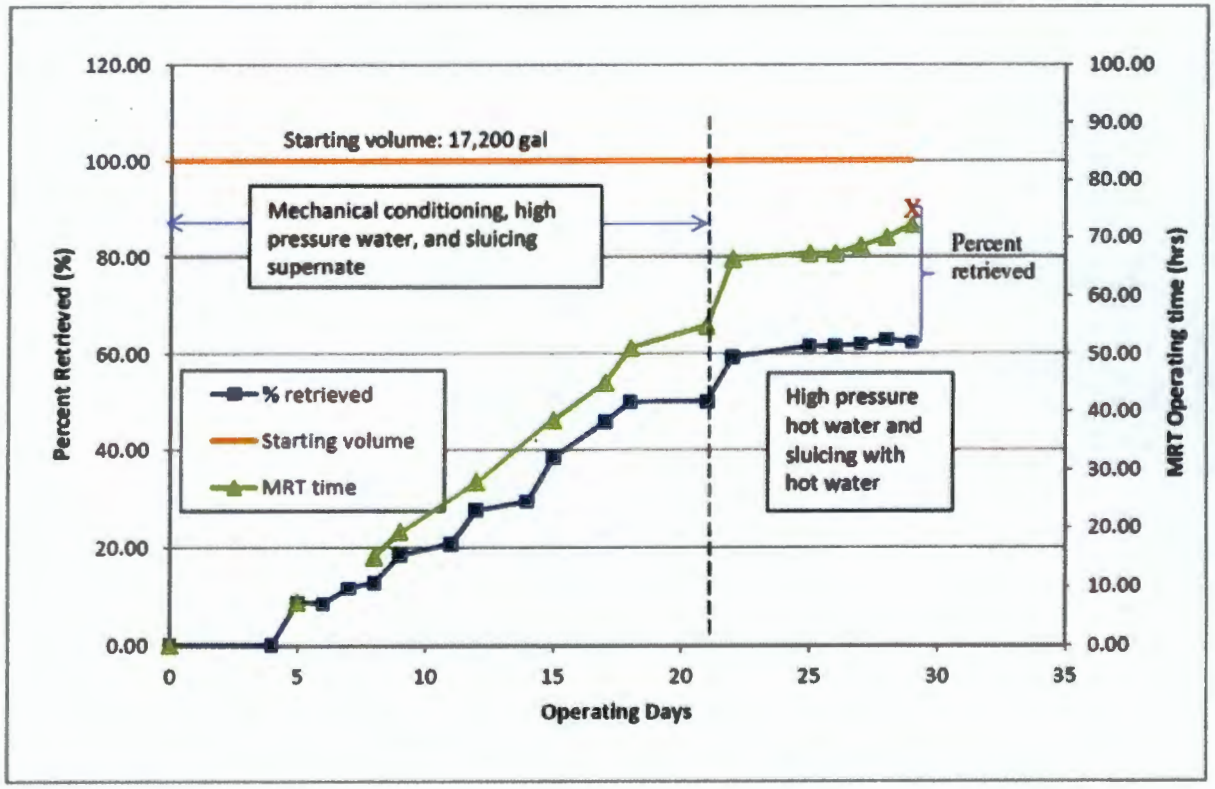
Sluicing and MRT operations (blading or high pressure water additions) were generally conducted simultaneously. The cycles of mechanical waste conditioning and mobilization using the FoldTrack® blade and high pressure water followed by sluicing were continued until retrieval was determined to be completed to the limit of technology as specified in RPP-33116.

After switching to focus on high pressure water, hydraulic fluid leaks were discovered in the MRT umbilical cord when moving the left track in forward and when moving the right track in reverse. No leaks were observed when the MRT was not being moved. As a result, the MRT was parked near the slurry pump and continued to be used to supply high pressure hot water as a backstop to solids sluiced to the pump and to help to suspend solids particles. After 2 to 3 days of combined hot water and sluicing operations, volume balance estimates and in-tank observations showed little progress. A final displacement using hot water was performed. Figure 3 shows volume balance retrieval results for high pressure water and sluicing removing 88% of the waste present at the start of MRT operations. The differences in the estimated and measured waste volume remaining were much lower than observed in the final liquid displacement and are described in RPP-RPT-55932, *Single-Shell Tank 241-C-110 Waste Heel Retrieval Completion Report*. These differences resulted from evaporation, tank configuration (bottom of the tank appears to be elevated ~0.5 in. in places), flow meter errors, and differences in particle volume estimates.

About 15,000 gal of hot water were sluiced into the tank for the displacement measurement. The water streams were aimed at the remaining piles in a final effort to reduce the height of the piles to below the liquid level. The MRT high pressure water was used during the final pump down.

Based on final displacement results and visual observations, the high pressure hot water combined with hot water sluicing appeared to be effective. It appears that few fine particles remain in the tank and no large particle agglomerates remain. Most of the solids remaining appear to be coarse sand to gravel-size particles.

Figure 3. Volume Balance Results for Tank 241-C-110 Retrieval.



It was found that hot water sluicing became effective during the latter part of the waste retrieval operations. The transfer of liquid from tank C-110 to tank AN-106 was completed on October 16, 2013. Volume displacement measurements and tank video scans were performed during the transfer out. Based on the video evidence, it appeared that the transfer out was successful, and large areas of the tank floor were visible.

A summary of the amount of waste retrieved and waste remaining in tank C-110 after the MRT process is provided below in Sections 3.0 and 4.0.

2.4 LIMIT OF TECHNOLOGY

2.4.1 Modified Sluicing

Modified sluicing of tank C-110 was assessed prior to establishing RPP-50910, *Single-Shell Tank Waste Retrieval Limit of Technology Definition for Modified Sluicing*, and therefore prior

to defining the following two criteria for reaching the "limit of technology" for retrieval of waste from a Hanford Site SST using modified sluicing with only double-shell tank (DST) supernate or water as the sluicing medium. However, the tank C-110 modified sluicing campaign was evaluated against these criteria and determined to meet them (see discussion below).

1) The concentration of SST waste in the retrieved slurry sent to the DST is within or bracketing a 0 to 0.6 vol. percent range for three operating periods. Bracketing refers to two successive data points, one of which is below 0 and the next near or above 0.6, which average less than 0.6 vol. percent. An operating period is a period over which retrieval performance is measured. An operating period is normally one operating day, but as a minimum must be greater than or equal to 8 hours in duration and consist of at least ~10,000 gal (~1,340 ft^3) of slurry transferred from the SST.

2) The DOE-ORP and the Tank Operations Contractor have provided documentation to Ecology that demonstrates that all reasonable efforts were attempted to enhance the effectiveness of the installed modified sluicing retrieval system in order to increase waste removal from all quadrants of the tank under consideration.

As indicated in Figure 2 above, DOE-ORP showed the trend in retrieval system volumetric efficiency as measured by the average solids loading in the slurry as a function of the volume of slurry pumped from tank C-110. The decline in volumetric efficiency reflects a depletion of readily mobilized sludge in the tank, the difficulty of mobilizing harder sludge, and the increasing distance of remaining solids from the sluicers. The 0.4% solids loading, shown in Figure 2, occurred in the final days of operations showing no net waste retrieval; this was also supported by visual observations of the wastes remaining during the retrieval operations. By April 27, 2009, most of the area under and between the two sluicers had been cleared of solids. In these areas, the tank bottom was either exposed or covered by only a thin layer of solids. The bulk of the remaining solids were near the tank knuckle on the east and west sides of the tank. During the period of April 23 to 27, 2009, five additional days (12 shifts) of sluicing operations occurred with no measureable waste retrieval during this period, meeting criterion 1.

The second criterion associated with the limit of technology definition for modified sluicing in RPP-50910 requires a demonstration that all reasonable attempts were made to enhance the effectiveness of the installed modified sluicing system in order to increase waste removal from all quadrants of the tank under consideration. At the end of modified sluicing in tank C-110, waste retrieval operations had been: (1) using each sluicer independently to sluice the two quadrants nearest each sluicer to ensure that the entire waste surface was sluiced, (2) back flushing the slurry pump with supernate to clear the pump of any solids prior to starting the pump, and (3) varying the slurry pump rate. The solids loading in the slurry averaged 0.4 bulk volume percent. These observations, coupled with the measured decrease in recovery with continued operation, demonstrate that all reasonable efforts were made to retrieve the waste from all quadrants of the tank.

In accordance with the Consent Decree, during evaluation of the limits of technology related to modified sluicing, DOE-ORP also examined the other factors specified in the Decree including

risk reduction, facilitating tank closures, worker safety, and the overall impact on mission and costs. These factors as they relate to use of modified sluicing are discussed below.

- The continued deployment of the modified sluicing system without the aid of another technology would require continued use of work crews, resources, and equipment that DOE-ORP needs to use to retrieve other tanks within Waste Management Area (WMA) C. The small incremental amount of residual wastes that would be removed by continuing modified sluicing would result in a minimal reduction in risk from residual wastes left in tank C-110 and would result in little or no benefit to facilitating closure of tank C-110 and other tanks and facilities in WMA C.

- Continued modified sluicing would result in continued exposure to workers that is not justified by the minimal amount of waste that could be removed by continuing with modified sluicing efforts. Although sluicing operations are controlled from a control trailer, multiple field activities (valve line-ups, field measurements and monitoring, etc.) are required to support the sluicing operations, resulting in continued exposure.

- Continued deployment of modified sluicing would delay the completion of retrieval activities at tank C-110 with limited benefits. At this point in time, any delay in completion would have the potential to adversely affect schedules of other retrieval activities and therefore impact the ability of the overall retrieval and treatment mission to meet current Consent Decree milestones and commitments.

- Continued use of work crews, resources, and equipment during modified sluicing would incur additional costs with little or no incremental benefit to decreasing risks from residual wastes in tank C-110. These efforts would divert resources from other more pressing retrieval activities associated with tanks that have not been retrieved, and would likely result in an overall increase in costs associated with the retrieval and closure mission.

Based on the performance metrics evaluated with the implementation of this technology and consideration of the factors specified in the Consent Decree, DOE-ORP has concluded that the modified sluicing retrieval technology has been deployed to the limit of technology at tank C-110.

2.4.2 Modified Sluicing with Mechanical Conditioning and High Pressure Water (FoldTrack® plow-blade, and FoldTrack® scarifier and cannon)

Specific criteria by which to measure the limit of technology for MRT system processes have not been defined to this point. The information used to evaluate termination of retrieval is provided in RPP-33116.

The DOE-ORP's evaluation of the limits of technology also considered Consent Decree factors related to risk reduction, facilitating tank closures, worker safety, and the overall impact on mission and costs. A brief discussion of these factors as they relate to use of MRT systems follows.

- All steps in the MRT process for tank C-110 were performed as described in the process control plan (RPP-PLAN-53943). Systematic efforts were made to contact all areas of the waste with water. Observation of the operations, discussion with operators, and observance of the waste itself (e.g., reduction of waste piles) confirm that the efforts to remove as much of the residual wastes as practicable were successful. Continued deployment of this MRT process would not result in appreciably reducing the amount of waste remaining in tank C-110 and therefore the risk from the residual wastes in tank C-110.

- A redeployment of the MRT process would not make efficient use of work crews, resources, and equipment being used in other areas of WMA C and would interfere with other retrieval efforts. The incremental decrease in amount of residual wastes by redeployment would be very small, would not significantly reduce the associated risk from residual wastes left in tank C-110, and would result in little or no benefit to facilitating closure of tank C-110 and other tanks and facilities in WMA C.

- A redeployment of the MRT equipment and process would result in continued exposure to workers. Although retrieval operations are controlled from a control trailer, multiple field activities (valve line-ups, field measurements and monitoring, etc.) are required to support the sluicing operations, resulting in continued exposure.

- A redeployment of the MRT process would delay the completion of retrieval activities at tank C-110 with no benefit. This delay in completion would have the potential to adversely affect schedules of other retrieval activities and therefore impact the ability of the overall retrieval and treatment mission to meet current Consent Decree milestones and commitments.

- Continued use of work crews, resources, and equipment with a redeployment of the MRT process would continue to incur costs with little or no incremental benefit to decreasing risks from residual wastes in tank C-110. These efforts would divert resources from other, more pressing retrieval activities associated with un-retrieved tanks and would likely result in an overall increase in costs associated with the retrieval and closure mission.

Based on the performance metrics examined with the implementation of these technologies and consideration of the factors specified in the Consent Decree, DOE-ORP has concluded that the MRT process retrieval technologies of mechanical and high pressure water dissolution have been deployed to the limit of technology at tank C-110.

3.0 POST-RETRIEVAL CONDITIONS

Three methods (volume displacement, video observations, and engineering judgment) were used to estimate the waste volume removed and the residual waste volume left after bulk retrieval using modified sluicing and after heel retrieval using an in-tank vehicle for mechanical conditioning and high pressure water. A complete discussion of these methods and associated calculations of the estimated waste volume removed from tank C-110 during modified sluicing was based on the volume displacement and video evaluation as discussed in RPP-CALC-34573, *Estimate of Waste Volume and Percent Retrieved for Tank 241-C-109*. Methods and calculation for heel retrieval are documented in RPP-RPT-55932 and RPP-CALC-55938, *Estimated Waste Volume Remaining in Single-Shell Tank 241-C-110 after Hard Heel Retrieval*. Figure 4 shows tank C-110 after waste retrieval operations.

Figure 4. Tank 241-C-110 Photo Mosaic Looking North from Riser 3.

The BBI volume for tank C-110 was estimated at ~178,000 gal (~23,800 ft^3) of waste at the start of retrieval. The amount of waste remaining in tank C-110 after the first retrieval technology was completed was estimated at ~17,200 gal (2,300 ft^3). The amount of waste remaining after deployment of the FoldTrack® MRT and high pressure water process technologies in combination with sluicing was estimated to be ~2,100 gal (~280 ft^3) (RPP-CALC-55938). This final waste volume is below the 2,690 gal (360 ft^3) requirement specified in the Consent Decree.

4.0 RETRIEVAL COMPLETION SUMMARY AND CONCLUSIONS

At the conclusion of modified sluicing, tank C-110 contained ~17,200 gal (~2,300 ft^3) of waste based on the volume displacement and video evaluation. At the conclusion of FoldTrack® MRT mechanical conditioning, high pressure water, and final sluicing retrieval operations, tank C-110 is estimated to contain ~2,100 gal (~280 ft^3) of remaining waste (see RPP-CALC-55938), meeting the waste residual goal provided in the Consent Decree (*Washington v. DOE*, Case No. 08-5085-FVS [E.D.Wa. October 25, 2010]).

5.0 CONCLUSION

This summary report supports DOE's written certification that DOE has completed retrieval of tank C-110 in accordance with Part 1 of Appendix C of the Consent Decree (*Washington v. DOE*, Case No. 08-5085-FVS [E.D.Wa. October 25, 2010]) and with the retrieval technology/systems that were established in Tank Waste Retrieval Work Plan RPP-33116, as amended by *Tank Waste Retrieval Work Plan/Functions and Requirements Modification Notice 2012-13* (ORP and Ecology 2012).

The format and content of this Retrieval Completion Certification summary follows a general outline that was developed collaboratively by Ecology and DOE-ORP in a series of meetings held between December 19, 2011 and March 6, 2012. A working version of this outline was accepted in a February 9, 2012 meeting between DOE-ORP and Ecology.

6.0 REFERENCES

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