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14-TF-0021

MAR 07 2014

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

SUBMITTAL OF THE REVISED 241-AY-102 PUMPING PLAN

Reference: Ecology letter J.A. Hedges to K.W. Smith, ORP and L.D. Olson, WRPS, "Removing Waste from Double-Shell Tank 241-AY-102 – Ecology's Comments on Letter 13-TF-0049, and the attached *241-AY-102 Pumping Plan*, RPP-PLAN-55220," 14-NWP-001, dated January 9, 2014.

The U.S. Department of Energy, Office of River Protection (ORP) is submitting the attached RPP-PLAN-55220, Rev. C, *241-AY-102 Pumping Plan* (Plan) to the Washington State Department of Ecology (Ecology) in response to Ecology's January 9, 2014, letter (Reference). This letter and the attached Plan have been formally coordinated with Washington River Protection Solutions LLC (WRPS) President L. Dave Olson.

ORP and WRPS are committed to working with Ecology to address the path forward for AY-102. We are executing Plan commitments and have been safely reducing the supernate level in AY-102, primarily through evaporation. The supernate level in AY-102 has already declined approximately 18 inches, or about 50,000 gallons, since August 2012.

This Plan implements the current risk-informed and risk-managed approach of acquiring the equipment for sludge removal and initiating supernate pumping when the waste retrieval and transfer system is ready to remove solids. This approach couples the risks of increased leak rate, increased waste temperature and increased flammable gas generation with the capability to remove both the supernate and the sludge from AY-102. The enclosed Plan has been revised to proceed with the planning, engineering and design, procurement, and installation of out-of-tank equipment. Following completion of the out-of-tank equipment installation, ORP will conduct a status readiness review to determine the timing of the in-tank equipment installation and waste removal.

ORP is requesting an opportunity to brief you and your staff on the Rev. C Plan during the week of March 10, 2014. Erik Olds, ORP Chief of Staff will contact you to arrange a briefing at your convenience.

Kevin W. Smith
Manager

TF:GDT

Attachment

cc w/attach:
M. Bellon, Ecology
R. Albright, EPA
K. Kelly, EPA
D. Faulk, EPA
K. Niles, ODOE
W.C. Clark, WRPS
L.D. Olson, WRPS
Environmental Portal, LMSI
Administrative Record, DST
WRPS Correspondence

ATTACHMENT

14-TF-0021

REVISED 241-AY-102 PUMPING PLAN

241-AY-102 Pumping Plan

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U.S. Department of Energy Contract DE-AC27-08RV14800

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Abstract: This Pumping Plan addresses the approach and planning schedule for removal of the AY-102 primary tank supernatant and solid waste on a timeline as soon as is practicable.

241-AY-102 Pumping Plan

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Washington River Protection Solutions

Date Published
(March 2014)

Prepared for the U.S. Department of Energy
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Abbreviations and Acronyms

AN-101	DST 241-AN-101
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AP-104	DST 241-AP-104
AW-102	DST 241-AW-102
AW-105	DST 241-AW-105
AY-101	DST 241-AY-101
AY-102	DST 241-AY-102
AZ-101	DST 241-AZ-101
AZ-102	DST 241-AZ-102
AY-02A pit	241-AY-02A pit
C-101	SST 241-C-101
C-106	SST 241-C-106
C-112	SST 241-C-112
CFR	Code of Federal Regulations
Cs^{137}	Cesium 137
DNFSB	Defense Nuclear Facilities Safety Board
DOE	United States Department of Energy
DST	Double-Shell Tank
ECN	Engineering Change Notice
EPG	Double Shell Tank Emergency Pumping Guide
ERSS	Extended Reach Sluicer System
HIHTL	Hose-In-Hose Transfer Line
HLW	High-Level Waste
IQRPE	Independent Qualified Registered Professional Engineer
LDP	Leak Detection Pit
NACE	National Association of Corrosion Engineers
ORP	Office of River Protection
OSD	Operating Specification Document
OUO	Official Use Only
Plan	241-AY-102 Pumping Plan [RPP-PLAN-55220]
RPP	River Protection Project
Sr^{90}	Strontium 90
SST	Single-Shell Tank
TWINS	Tank Waste Inventory Network System
WAC	Washington Administrative Code
WCA	Waste Compatibility Assessment
WFD	Waste Feed Delivery
WRPS	Washington River Protection Solutions
WRS	Waste Retrieval and Transfer System
WTP	Waste Treatment and Immobilization Plant

Units

Gal	Gallons
Kgal	Thousand Gallon
Mgal	Million Gallon

1.0 PURPOSE

The purpose of this Pumping Plan (Plan) is to provide the approach and planning schedule for removal of tank waste contained in double shell tank (DST) 241-AY-102 (AY-102), on a timeline as soon as is practicable. The AY-102 Recovery Project was commissioned in August 2013 to be prepared for pumping waste from AY-102. Based on evaluation of tank integrity studies, enhanced monitoring data, Leak Detection Pit (LDP) robotic inspection, and potential changes affecting safety basis assumptions, the strategy of the initial Pumping Plan has been revised to include all activities required for DOE to authorize waste removal from AY-102.

The AY-102 waste removal effort is interdependent with the actions necessary to retrieve the next nine tanks and the *Framework Initiative* at both a funding and operational level. This plan assumes that any simultaneous operational activities are successfully de-conflicted, and that no new risks are identified. The Department of Energy is committed to safely managing the Tank Farms to protect the safety of the public, the workers, and the environment.

1.1 241-AY-102 WASTE REMOVAL

The pumping plan execution strategy has been revised to proceed with the planning, engineering and design, procurement, and installation of out of tank equipment. This revision is based on input from the Washington Department of Ecology (Ecology) on January 9, 2014 (External letter 14-NWP-001, "Removing Waste from Double-Shell Tank 241-AY-102 – Ecology's comments on Letter 13-TF-0049, and the attached *241-AY-102 Pumping Plan*, RPP-PLAN-55220" [14-NWP-001 – Letter]), and the results of extent of condition evaluations of tank integrity and operational impacts and risks associated with AY-102 waste storage. Following completion of the out-of-tank equipment installation, DOE will conduct a status review to determine the timing of the in-tank equipment installation and authorization of AY-102 waste removal.

The rationale for delaying removal of waste supernatant until transfer of solid waste from AY-102 is based on Safety Basis requirements to control flammable gas levels and impacts to operational limits for waste storage (OSD-T-151-00007, *Operating Specifications for the Double-Shell Storage Tanks*).

1.2 BACKGROUND OF TANK CONDITIONS

Tank AY-102 is a one million gallon (Mgal) DST located in the 241-AY Tank Farm (AY Farm). It was the first DST constructed at Hanford, and was declared operational in 1971 with a service life of 40 years. The tank consists of a primary carbon steel tank, 75 ft. in diameter, inside of a secondary carbon steel liner, which is surrounded by a reinforced-concrete shell. The primary steel tank rests atop an 8 in. insulating concrete slab, separating it from the secondary steel liner, and providing for air circulation/leak detection channels under the primary tank bottom plate. An annular space of 2.5 ft. exists in between the secondary liner and primary tank, allowing for visual examination of the tank wall and secondary liner annular surfaces, and ultrasonic volumetric inspections of the primary tank walls and secondary liners. Tank AY-102 has risers penetrating the dome that provide access for video cameras, ultrasonic inspection devices, waste sampling devices, mixer pumps, and other equipment requiring access to either the primary tank

interior or annular space. Above AY-102 are six pits extending from grade to varying depths, which house valves and pumps.

Between 1977 and 2007, the tank received a variety of solid and supernatant wastes. In 1998-99, the tank received high-heat sludge from single-shell tank (SST) 241-C-106, using the supernatant in Tank AY-102 as the sluicing medium (RPP-19919, *Campaign Report for the Retrieval of Waste Heel from Tank 241-C-106*). From July 2002 until October 2005, Tank AY-102 received dilute non-complexed condensate transfers from Catch Tank AZ-151. In April 2003, waste from the Tank C-106 retrieval decant operation was added to Tank AY-102 (RPP-19919). In December 2006, supernatant was pumped out of Tank AY-102 to Tanks 241-AW-102 and 241-AN-106. The last transfer of waste occurred in January 2007, when supernatant from Tank 241-AP-101 was added to Tank AY-102. The waste in Tank AY-102 was subsequently selected to be used as the high-level waste (HLW) hot commissioning feed for the initial hot runs of the Waste Treatment and Immobilization Plant (WTP). In May 2012, the tank contained 702 Kgal of supernatant, 119 Kgal of sludge solids, and 32 Kgal of sludge interstitial liquid (TWINS).

In August 2012, visual inspections of the annulus between the primary and secondary tank walls identified suspect waste material from the primary containment tank. A formal leak assessment team confirmed that the material discovered on the annulus floor was the result of a leak from a breach in the bottom of the primary tank. The probable cause was identified as accelerated corrosion due to high temperatures, and reduced containment margins resulting from fabrication challenges during tank construction. The conclusions are documented in RPP-ASMT-53793, *Tank 241-AY-102 Leak Assessment Report*, and RPP-RPT-54817, *241-AY-101 Tank Construction Extent of Condition Review for Tank Integrity*. Based on the results of the leak assessment, and recommendations of the leak assessment team, AY-102 was declared an Assumed Leaker - Primary Tank in October 2012. At that time, there was no evidence of a leak outside of the secondary containment of AY-102. As of August 2012, the liquid level in Tank AY-102 was approximately 308 in. and slowly declining due to evaporation. In October 2013, the tank liquid level was 294 inches, and the tank contained 658 Kgal of supernatant and 151 Kgal of sludge waste (HNF-EP-0182, Rev. 307, *Waste Tank Summary Report For Month Ending October 31, 2013*).

Following issuance of the Pumping Plan in June 2013, elevated radiation readings were detected in the transfer hose and around the transfer pump used to pump water from the Tank AY-102 Leak Detection Pit (LDP). As a result, a detailed engineering evaluation was performed to determine the cause for the elevated readings and to identify whether the AY-102 secondary tank liner was compromised. Sample analysis of LDP water and forensic evaluations of tank integrity concluded that tank waste from the annulus had not entered the LDP. The results are documented in report RPP-RPT-55939, *Tank 241-AY-102 Secondary Liner Integrity Investigation Results*. As a measure of due diligence, robotic technology was selected to perform inspections of the tank annulus and the LDP drain lines to confirm AY-102 secondary liner integrity.

The additional scope for robotic inspections and enhanced monitoring was subsequently added to the 241-AY-102 Pumping Plan and 241-AY-102 Recovery Project activities. Details of

completed project activities supporting waste transfer operations are provided in Attachment A, Completed AY-102 Project Activities.

2.0 241-AY-102 WASTE REMOVAL

This section provides a summary of the waste conditions, equipment performance, and waste management operations required for removal of AY-102 waste, including a summary of preparations for removal of supernatant from the primary tank, isolation of the 241-AY-02A pit (AY-02A pit) drain line from the DST system, removal of solid material from the primary tank, and removal of waste from the AY-102 annulus. The risks affecting project execution to meet schedule milestones are summarized in Section 4.0.

The substantial inventory of Cesium 137 (Cs^{137}) and Strontium 90 (Sr^{90}) contained in the AY-102 waste requires additional controls to maintain the safety basis and licensing requirements of RPP-13033, Rev. 5-C, *Tank Farms Documented Safety Analysis*. Specifically, the heat load and temperature of the waste has been identified as key attributes affecting the generation rates of flammable gas. Controls required to protect the Safety Basis assumptions (e.g., tank ventilation [LCO 3.1] and flammable gas monitoring [LCO 3.7]) will be considered in the retrieval and transfer system design, the tank modifications, and process flow sheet studies for safe transfer and storage of the waste.

2.1 REMOVAL OF SUPERNATANT FROM 241-AY-102

2.1.1 Preparation for Transfer of Supernatant

The following actions supporting transfer of supernate from the primary tank and emergency transfer of supernatant from the tank annulus have been completed:

- A supernate transfer pump is installed in the primary tank and is available to transfer supernate when required.
- An emergency annulus supernate transfer pump has been selected and staged for installation in the annulus, if required. The waste transfer specific procedures, associated transfer specific training, and Waste Compatibility Assessment (WCA) documentation have been completed to ensure that the annulus supernate waste transfer will comply with specific administrative control, safety, regulatory, programmatic, and operational decision rules related to waste chemistry and waste properties.
- DST 241-AP-104 (AP-104) has been selected as the supernate receiver tank, and existing and available transfer equipment (pump, jumpers, transfer line, etc.) required to support transfer have been identified. Selection of this receiver tank included identification of a compliant waste transfer route.
- An additional tank and alternative transfer route from AY-102 to DST 241-AW-105 (AW-105) is in the process of being authorized to provide waste storage space if required.

2.1.2 Management of Supernate Levels

During normal tank waste storage operations, tank waste levels are maintained within limits documented in approved operating specifications (OSD-T-151-00007). Waste operating specifications provide limits that protect the function of tank systems, structures and components (SSCs) and protect assumptions supporting the Safety Basis.

In consideration for the risks associated with primary tank leak, an evaluation was performed to establish a range of supernate levels that would maintain approved operating specifications. The evaluation resulted in a minimum height of 48 inches of supernatant above the maximum solids level. The recommended supernate level is consistent with the approved operating specifications for DST waste storage (OSD-T-151-00007). The results of the evaluation are documented in RPP-RPT-53901, *Management of Supernatant Level in Tank 241-AY-102*.

Although pumping of supernate prior to being ready to remove the solid waste is technically feasible, it is not yet recommended for a number of reasons, to include:

- To date, the leaked tank waste material is assessed to be contained within the inner annulus (see Attachment B).
- Potential causes for the failure of the AY-102 primary tank have been identified, but the actual cause remains indeterminate. Therefore, any action to remove supernate could affect the condition of the leak mechanism, with some risk of increasing the leak rate.
- Lowering supernate levels reduces the available heat transfer volume (or mass) from the sludge, resulting in a potential increase in the supernate temperature. The reaction kinetics for corrosion and gas generation increase exponentially with temperature, resulting in accelerated corrosion and generation of flammable gas. These mechanisms could have a negative impact on leak rate of waste into the annulus.

To understand the potential impacts of a supernate level adjustment, and to address questions raised by the DNFSB about the risk of a consequent higher leak rate (external letter ["Safety and Integrity Implications of Decanting Liquid from Hanford Tank 241-AY-102"] from Peter S. Winokur to Ernest Moniz, November 1, 2013), Washington River Protection Solutions (WRPS) commissioned a multi-dimensional, transient Thermal Analysis of AY-102 waste storage, as recommended by the DNFSB. The analysis will investigate the relationship between supernate height, heat transfer mechanics, and transient effects from primary and secondary ventilation outages. The results of the analysis, scheduled for completion in May 2014, will provide input to the waste retrieval system design and safety analysis evaluations.

In summary, unless conditions significantly worsen, the recommendation is to not pump supernate at this time, and to start supernate transfer when the waste retrieval and transfer system is ready to remove solids.

2.2 ISOLATION OF AY-02A PIT DRAIN LINE

The existing configuration of the AY-02A pit drain lines provides a path for liquids entering the pits to be routed/drained into the AY-102 primary tank. The drain lines are an essential element of the secondary containment associated with the AY-02 pits. They are intended to remain operational until completion of the waste removal from AY-102, to support equipment flushing and rinsing operations needed to decontaminate equipment being removed from the tank or pits. During these operations, liquids may be introduced back into AY-102 through these drains.

Currently, the only path that would allow the introduction of liquids external to AY-102 is liquid transferred to and from 241-AY-101, transiting through the AY-02A pit, and connected to the AZ valve pit and the DST transfer system.

To prevent any external waste addition to AY-102, administrative and engineered controls will be implemented for the purpose of isolating liquid entries into the AY-02A pit:

- Prior to an AY-101 waste transfer, the drain blocker in the AY-02A pit will be functionally tested for operability, and a camera will be inserted into the AY-02A pit to provide continuous monitoring of the transfer route. The jumper used for this transfer has been certified by an Independent Qualified Registered Professional Engineer (IQRPE). The protective coatings in the AY-02A pit are maintained per National Association of Corrosion Engineers (NACE) requirements. A drip-wise leak during the AY-101 waste transfer will be a shutdown criterion for these waste transfers in the near-term, and will prevent the potential for additional waste liquids entering the primary tank of AY-102 until the situation is investigated and resolved. An additional physical parameter that provides a hydraulic advantage for preventing additional liquids entering AY-102 is that the AY-02A pit is the high point in the transfer from AY-101 to the AZ valve pit. Hence, free liquid in the lines will drain away from the AY-02A pit if a transfer was shut down.

- Engineered controls have been planned and will be implemented through modifications of the AY-02A pit and drain line, executed when the AY-102 retrieval and transfer system equipment is being installed. Modifications to the pit will include removing all excess equipment, sealing penetrations, and adding a new sump pump and jumper that will allow liquids to be removed from AY-02A and sent back to AY-101, should a leak have occurred. The new pit and jumper configuration would still allow supernate transfers to occur out of AY-102, and would not preclude removal of solid materials via sluicing.

2.3 REMOVAL OF SOLID WASTE FROM 241-AY-102

The Plan acknowledges that transfer of AY-102 waste to another DST will impact the current System Plan (ORP 11242, *River Protection Project System Plan*, 2011), which identifies waste currently stored in AY-102 as the first Low-Activity and High-Level waste feeds for Waste Treatment Plant (WTP) hot commissioning. Because the waste from AY-102 will be transferred prior to serving the Waste Feed Delivery (WFD) activities, it is understood that additional characterization and conditioning of the new/different hot commissioning waste will be required prior to feeding the waste to the WTP. While it is desirable to maintain the AY-102 characterization data, it is not practical to prevent commingling with the current DST volume status, and thus it was not a consideration in the development of this plan.

The project will proceed with planning and the activities necessary for removal of the solid waste and supernate in AY-102. Planning and associated activities include:

- design
- procurement
- field work package preparation and approval for all work packages required to remove equipment
- modify existing tank infrastructure
- installation of the entire retrieval system
- installation of the retrieval system control trailer and electrical equipment
- installation of the valve box(s) and associated jumpers
- excavation and installation of the Hose-In-Hose Transfer Lines (HIHTLs)
- installation of electrical conduit and associated wiring
- installation of the sluicers in AY-102
- supernatant/slurry pumps in AY-102 and the receiver tanks
- slurry distributors in the receiver tanks
- final HIHTL and wire terminations
- testing and readiness activities to commence pumping operations and transfer waste from AY-102.

In consideration of ending volumes, heat load, and future DST space considerations, the current process strategy is to split the sludge contents of AY-102 between DSTs 241-AZ-101 (AZ-101) and 241-AZ-102 (AZ-102). The preparations required to support removal of waste from AY-102 include multiple DST to DST transfers and evaporator campaigns. For example, the conditioning/dilution of AZ-101 supernate for use as the sluicing medium in AY-102 will require approximately thirteen DST decants/transfers between AZ, AW, and AP Tank Farms prior to retrieval operations. These AZ-101 conditioning/dilution activities/transfers require evaporator campaigns to maintain DST storage space. Also, the AY-102 retrieval process is modeled to require DST transfers to provide the proper initial conditions in AY-102, AZ-101, and AZ-102, to enable the modified sluicing retrieval operations with appropriate initial supernate levels in

both the feed tank and the receiver tank. These waste transfers and evaporator campaigns will need to be sequenced to support the ongoing planned tank retrievals. As a result, the process strategy may be revised based on further process flow studies and thermal analyses to confirm the current process strategy or identify other appropriate tanks.

HIHTLs used to transfer waste will be installed to be consistent with RPP-12711, *Temporary Waste Transfer Line Management Program Plan*. HIHTLs will be routed to/from AY-102 and the receiving tanks through valve boxes, to allow transfer routes to be established to the designated DST receiver tanks. Primary equipment in the receiving tanks will include a supernatant pump, slurry distributor, valve box(s), and the requisite jumpers, monitoring systems, and other ancillary equipment required for retrieval operations. Valve box preparation will include cleaning and inspections by a qualified NACE inspector to ensure the condition of the pit coatings are compliant with applicable NACE standards. If required, pit coatings will be repaired and re-inspected by a qualified NACE inspector for acceptance of repaired work.

The Extended Reach Sluicer System (ERSS) selected for removal of AY-102 solid waste was evaluated in October, 2013, against the following criteria:

- Technological maturity and ability to effectively mobilize solids within Tank AY-102 while maneuvering around obstacles.
- Risks involving the reliability of the system, system maintainability including in-tank components, and the availability of system components.
- The time required to design, fabricate, test, and deliver a field deployable system, including field construction/preparation work required for installation of the system (e.g., pump removal, excavation, power supply installation)
- Total cost of the project including installation design, system design, fabrication and testing, and field construction and preparation.

ERSSs have been successfully deployed for bulk retrieval of tanks 241-C-112 and 241-C-101, as well as hard heel retrieval of 241-C-112. The ERSS includes a boom that extends and retracts from the support mast to increase the effectiveness of breaking up solid waste in a tank. The sluicer is a remote-controlled, high-volume jetting system equipped with an articulating nozzle that provides for elevation and transverse coverage to remove waste. The combination of the boom extension and the nozzle functions of the ERSS provide capability for sluicing behind objects within the reach of the boom. The selection process and conclusions are documented in RPP-RPT-56094, *Alternatives Evaluation for Tank 241-AY-102 Modified Sluicing System*.

Major steps during the retrieval process will include:

1. Pump AY-102 supernate to minimum level above sludge. This is the starting point for sluicing operations.
2. Transfer half of the AY-102 sludge content to the first receiver tank.
3. Adjust transfer route to the second receiver tank.
4. Complete transfer of solid material waste from AY-102 to the second receiver tank.
5. Determine quantity of residual sludge in the tank and whether additional removal is required in order to evaluate AY-102 for repair or closure.

2.4 CORROSION TESTING OF ANNULUS WASTE, AND REMOVAL OF WASTE FROM 241-AY-102 ANNULUS

Removal of residual waste from the annulus is planned to occur after waste is removed from the primary AY-102 tank, to allow the *repair or close* decision to be made in accordance with Title 10, *Code of Federal Regulations*, Part 265.196(e), "Hazardous Waste Spill Reports" (10 CFR 265.196(e)). Removal of waste from the annulus at this time may increase the leak rate from the primary tank, and may compromise or damage the refractory underneath the primary tank. Therefore, it is not advisable to remove annulus waste until the waste has been removed from the primary tank. Plans for cleaning the waste from the annulus will be deferred until completion of waste transfer from the primary tank. An evaluation and determination of cleaning alternatives for both a *repair and return to service* approach and a *closure* approach will be developed following completion of annulus liner corrosion testing and refractory testing.

The following provides a summary of testing performed to date and challenges for removing existing waste from the annulus. Two key technical challenges requiring resolution prior to initiating waste removal from the annulus under current conditions include:

- Corrosion Testing: Testing of the waste in contact with the annulus liner to estimate the rate of corrosion and thus available waste removal options. The ongoing annulus corrosion testing will assist in estimating the susceptibility of the secondary liner to corrosion, and assist in selecting the best waste removal technology.
    - Testing will confirm the thermodynamic waste evaporation model used to determine the expected pH shift in the waste during drying, due to carbon dioxide absorbance. Understanding the pH shift of the waste, during and after drying is one critical factor in determining the waste's propensity to corrode the annulus liner.
    - Testing (Cyclic Potentiodynamic Polarization and Slow Strain Rate) will directly measure the corrosion propensity of the liner in contact with the waste. This testing conducted on steel coupons of similar vintage as the annulus liner will provide a specific corrosion rate for the analysis.

- Waste Removal Method: As noted in the AY-102 Leak Assessment Report (RPP-ASMT-53793), some of the radioactive constituents were absorbed into the thermal refractory below the primary tank liner. Testing will be required to determine the most effective methods to remove (e.g., flushing or chemical leaching) waste from the refractory, while ensuring that the overall structural integrity of the tank is protected (i.e., removal of the radioactive material does not significantly damage the thermal refractory).

As noted previously, removal of the waste from the AY-102 annulus under current conditions is not recommended until after completion of waste removal from the primary tank. The following rationale presents the potential consequence of annulus waste removal:

- The waste currently contained within the AY-102 annulus consists of wet salts created during the drying of the supernate and interstitial liquids in the presence of air. This material, in its current state, restricts waste flow into the annulus as observed in the annulus along the perimeter of the tank. Liquid additions to the annulus, to facilitate waste removal from the annulus, would dissolve the wet salts and potentially increase leakage into the annulus from the primary tank. In addition, there is no pumpable liquid in the annulus at this time to prime the annulus pump for removal of the annulus material.

The appropriate removal method cannot be determined until waste in the primary tank has been removed. Should repair of tank AY-102 prove to be impractical and closure is selected, then more aggressive waste removal actions (e.g., caustic or dilute acids) may be required to clean the tank to a point to allow its closure in accordance with WAC 173-303-610 (*Washington Administrative Code* [WAC] 173-303, "Dangerous Waste Regulations," Section 173-303-610, "Closure and post-closure"), as required by the Hanford Federal Facility Agreement and Consent Order, Action Plan, Section 5.3.

2.5 SECONDARY TANK SHELL INTEGRITY

In October, 2012, The WRPS Executive Safety Review Board determined that waste had leaked into the annulus of Tank AY-102 based on information documented in RPP-ASMT-53793. Although an extensive review of Tank AY-102 was conducted and increased inspection and monitoring of the tank was implemented, the precise cause and location of the leak could not be determined.

In parallel with the leak in the primary tank, the AY-102 leak detection pit (LDP) was accumulating water through the drain system outside the secondary liner. The liquid collecting in the LDP was suspected to be from water intrusion. The rate of water accumulating in the LDP at 2 to 3 gal per day required the LDP to be pumped routinely to comply with operating specifications (OSD-T-151-00007).

On June 20, 2013, during routine pumping of the Tank AY-102 LDP, an abnormal radiation dose rate was noted on the transfer hose and elevated surface contamination readings were found on the transfer pump once it was removed from the LDP. These two field readings caused concern that tank waste from a secondary liner breach might be leaking into the LDP. As a result, WRPS

investigated the integrity of the liner and concluded that a leak from the liner into the LDP had not occurred (RPP-RPT-55939). The investigation results recommended inspection of the LDP drain lines as a confirmatory action.

On November 20, 2013, the AY-102 Recovery Project inspected the 6 inch diameter drain line that collects liquid outside AY-102 secondary containment and discharges to the leak detection pit sump. To perform the inspection, a custom robotic inspection crawler was designed, built, and deployed down the LDP and into the 6 inch leak detection pit drain line to within two feet of the tank center. Examination of the robotic inspection video identified sediment and debris believed to originate from construction activities and corrosion products. No material was identified in the inspection video that looked like the tank waste material seen in previous Tank AY-102 annulus video inspections (no greenish or yellowish deposits or dark fluids, dried salt deposits or crystalline material). Upon removal from the LDP, field measurements of contamination levels on the crawler were consistent with past values seen on LDP pumping equipment. Laboratory analysis of contamination residues obtained from the crawlers did not find material consistent with tank waste. In summary, the inspection results provided no indication that the secondary liner of the tank had been breached, and along with previous evaluations and analyses, confirmed the integrity of the secondary tank liner.

3.0 PROJECT SCHEDULE SUMMARY

The schedule summarized in Table 4-1 provides an updated estimate of start and finish dates for the activities planned to enable removal of waste from AY-102, as soon as practicably achievable.

Table 3-1. AY-102 Retrieval Schedule Activities

Non-Intrusive Activities	Start Date	Finish Date
Critical Decision DOE Authorize Restart of AY-102 Recovery Project	2/18/2014 (completed)	
Waste Retrieval and Transfer System Engineering and Design	4/15/2014	5/12/2015
Initiate Long Lead Procurements	8/28/2014	
AY-102 Waste Retrieval and Transfer System (WRS) Equipment Procurement	8/28/2014	9/11/2015
AY-102 and Receiver Tanks Pits and Risers Examinations and Equipment Removal	4/29/2014	9/11/2015
Installation of Out-of-Tank Equipment	8/26/2015	11/6/2015
Intrusive Activities	**Start Date**	**Finish Date**
DOE Status Review to Authorize In-Tank Equipment Installation	NET 3/11/2015	
AY-02A pit Drain Line Isolation	NET 6/25/2015	NET 10/15/2015
WRS Construction Complete		NET 2/4/2016
Authorize Initiation of Pumping of AY-102 Waste		NET 3/4/2016

* NET : Not Earlier Than

4.0 PROJECT RISK

Technical challenges, funding, or other uncertainties could have a negative influence on project execution, schedule durations, and end dates indicated in the previous section. However, project uncertainties and related risks are identified early in the project, and mitigation strategies are developed and managed to reduce probability of occurrence, and impacts to cost and schedule.

The major risks that have been identified to potentially result in project delays are summarized in the following list (non-inclusive):

- Funding required to support project execution schedule
- Staff and subcontracted support remobilization causes delays
- Concurrent tank retrieval projects interferences, with conflicting regulatory milestones, and staff and subcontracted support limitations, resulting in competing priorities
- Unplanned impacts or unanticipated issues with other DSTs introduce competing priorities
- Pre-selected retrieval and transfer equipment is incompatible with higher waste temperatures, resulting in additional engineering work, and delays in early procurements
- Equipment vendor issues delay procurement activities
- Pre-selected receiver tank(s) changes, resulting in re-design and re-planning
- DST to DST transfers, and evaporator campaigns needed to free up DST tank space, not executed on time
- External review and approval of permit modifications are not completed on time, delaying start of construction and operations
- Changes in AY-102 leak rates

5.0 REFERENCES

1. "Safety and Integrity Implications of Decanting Liquid from Hanford Tank 241-AY-102" (external letter from Peter S. Winokur, Ph.D., Defense Nuclear Facilities Safety Board [DNFSB], to Ernest J. Moniz, Secretary of Energy–U. S. Department of Energy, November 1, 2013).

2. 14-NWP-001. "Removing Waste from Double-Shell Tank 241-AY-102 – Ecology's comments on Letter 13-TF-0049, and the attached *241-AY-102 Pumping Plan*, RPP-PLAN-55220" (external Letter from Jane A. Hedges, Ecology, to Kevin W. Smith, ORP, and L. David Olson, WRPS, January 9, 2014).

3. 10 CFR 265.196(e), "Hazardous Waste Spill Reports" [incorporated by reference at Washington Administrative Code (WAC) 173 303-400(3) (a), "Interim status facility standards"], *Code of Federal Regulations*.

4. HNF-EP-0182, January 8, 2014, *Waste Tank Summary Report For Month Ending October 31, 2013*, Rev. 307, Washington River Protection Solutions, Richland, Washington.

5. ORP-11242, Rev 6, *River Protection Project System Plan,* October 2011, U. S. Department of Energy, Office of River Protection, Richland Washington.

6. OSD-T-151-00007, Rev. 12, *Operating Specifications for the Double-Shell Storage Tanks,* July 23, 2013, Washington River Protection Solutions, Richland, Washington.

7. RPP-12711, September 2, 2008, *Temporary Waste Transfer Line Management Program Plan*, Rev. 5, CH2M Hill Hanford Group, Richland, Washington.

8. RPP-13033, January 30, 2014, *Tank Farms Documented Safety Analysis*, Rev. 5-C, Washington River Protection Solutions, Richland, Washington.

9. RPP-19919, February 12, 2004, *Campaign Report for the Retrieval of Waste Heel from Tank 241-C-106*, Rev. 0, CH2M Hill Hanford Group, Richland, Washington.

10. RPP-ASMT-53793, November 7, 2012, *Tank 241-AY-102 Leak Assessment Report*, Rev. 0, Washington River Protection Solutions, Richland, Washington.

11. RPP-RPT-53901, September 30, 2013, *Management of Supernatant Level in Tank 241-AY-102*, Rev. 2, Washington River Protection Solutions, Richland, Washington.

REFERENCES (cont.)

12. RPP-RPT-54817, August 26, 2013, *241-AY-101 Tank Construction Extent of Condition Review for Tank Integrity*, Rev. 0, Washington River Protection Solutions, Richland, Washington.

13. RPP-RPT-55939, September 10, 2013, *Tank 241-AY-102 Secondary Liner Integrity Investigation Results*, Rev. 0, Washington River Protection Solutions, Richland, Washington.

14. RPP-RPT-56094, November 25, 2013, *Alternatives Evaluation for Tank 241-AY-102 Modified Sluicing System*, Rev. 0, Washington River Protection Solutions, Richland, Washington.

15. WAC 173-303, "Dangerous Waste Regulations" *Washington Administrative Code*, Section 173-303-610, "Closure and post-closure," as amended.

Attachment A. Summary of Completed AY-102 Recovery Project Activities

Principal Deliverables

(Sheet 1 of 3)

Reference	Document title
AY-102 Recovery - Project Management	
RPP-PLAN-56413	AY-102 Recovery Project Execution Plan
Activity 1: AY-102 Enhanced Tank Monitoring	
	AY-102 Video of Riser 83 Annulus Weekly Working Log
	DST AY-102 Monthly Status Report
	Weekly Video Analysis of Riser 83
Activity 2: AY-102 Annulus and Leak Detection Pit Drain Line Inspection	
RPP- ASTM-55798	Alternatives Evaluation for Tank 241-AY-102 Robotic Inspection
RPP-PLAN-56400	Environmental Analysis associated with the Leak Detection Pit inspection
RPP-RPT-56464	LDP drain Line Inspection report
Activity 3: DST Structural and Leak Integrity Program Review	
RPP-AMST-56329	September 2013 Workshop 1 Leak Assessment
RPP-RPT-55981	241-AW Tank Farm Construction Extent of Condition Review for Tank Integrity
RPP-RPT-55982	241-AN Tank Farm Construction Extent of Condition Review for Tank Integrity
RPP-RPT-55983	241-AP Tank Farm Construction Extent of Condition Review for Tank Integrity
Activity 4: Annulus Corrosion Monitoring and Testing	
RPP-ASMT-54634	Propensity for Corrosion in the 241-AY-102 Annulus
RPP-ASMT-55871	Propensity for Corrosion in the 241-AY-102 Annulus
RPP-RPT-56141	FY2013 DNV DST and SST Corrosion and Stress Corrosion Cracking Testing Report

Attachment A - Summary of Completed AY-102 Recovery Project Activities (cont.)

Principal Deliverables

(Sheet 2 of 3)

Reference	Document title
Activity 5: AY-102 Waste Retrieval and Transfer System Engineering and Design	
RPP-ENV-56398	AY-102 Retrieval Project Non-Radioactive Air Permitting Strategy (DRAFT)
REQ 261792 R0	STATEMENT OF WORK, AY-102 Recovery Project Design Support, Phase 1
SOLICITATION NO. 261792	AY-102 RECOVERY PROJECT DESIGN SUPPORT - Draft Work Plan
REQ 261792 R1	STATEMENT OF WORK, AY-102 Recovery Project Design Support, Phase 1 FY14
SOLICITATION NO. 261792	AY-102 RECOVERY PROJECT DESIGN SUPPORT - Draft Work Plan Rev B
RPP-RPT-56094	Alternatives Evaluation for Tank 241-AY-102 Modified Sluicing System
IOM-11272013A	AY-102 WASTE RETRIEVAL - PRELIMINARY DESIGN VERIFICATION PLAN
IOM-11192013	AY-102 WASTE RETRIEVAL SYSTEM – PROCUREMENT PLAN - OUO
IOM-11272013	AY-102 WASTE RETRIEVAL – PRELIMINARY PROCESS PARAMETERS
IOM-11252013	AY-102 WASTE RETRIEVAL – PRELIMINARY PUMP AND SLURRY DISTRIBUTOR DESIGN DATA

Attachment A - Summary of Completed AY-102 Recovery Project Activities (cont.)

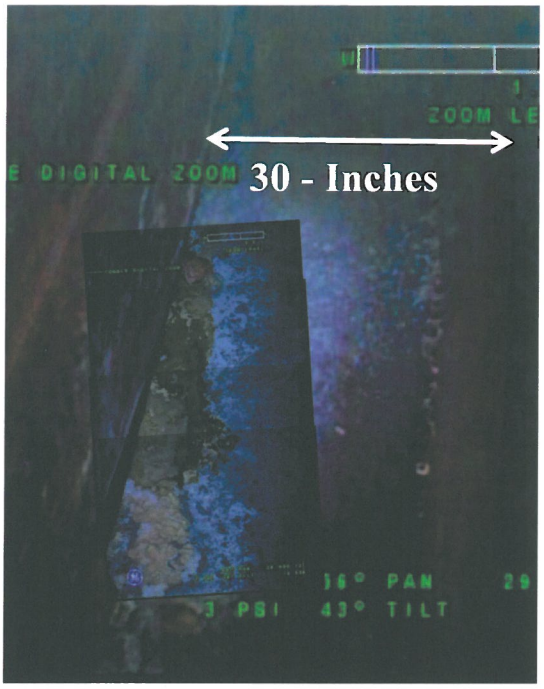
Principal Deliverables

(Sheet 3 of 3)

Reference	Document title
Activity 6: SN-265 Line Readiness for Supernatant Transfer from AY-102 to AW-105	
RPP-TE-56207	Overpressure protection technical evaluation (AY-102 to AW-105)
TFC-WO-12-5092	Pneumatic test on the SN-265 secondary encasement line
TFC-WO-12-5408	AW-05A pit coating inspection according to NACE standards
RPP-RPT-56412	SN-265 in-service IQRPE assessment
ECN-13-001197	SN-265 ECN for routing board
RPP-TE-56093	Thermocouple placement technical evaluation (AW-B-A-102 to AW-105)
TO-040-790	AW Farm waste transfer system temperature surveillance procedure
RPP-TE-56280	Leak path technical evaluation (AY-102 to AW-105
RPP-RPT-52823	Buried Piping Report
RPP-RPT-53847	Waste Compatibility Assessment
RPP-CALC-56185 **RPP-CALC-56186** **RPP-TE-56207**	Overpressure protection technical analysis
RPP-CALC-56520	High Point Column Separation Engineering Report
TO-232-001	Leak Check Procedure Preparation and Leak Path Screen
TO-230-370	AY-102 to AW-105 Transfer Procedure

Attachment B. Evolution of the visual observations of the waste leaked in the annulus

Video inspection from Riser 83



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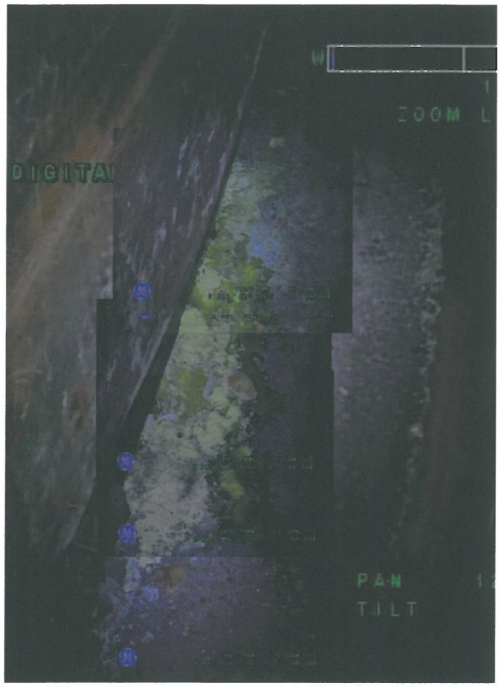
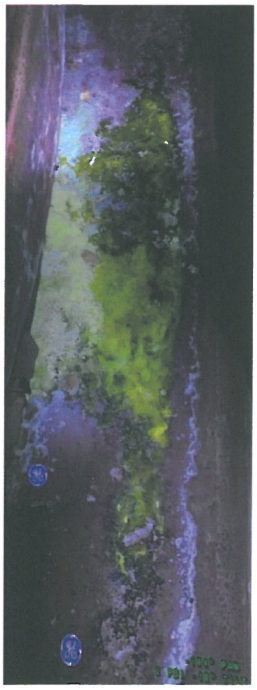


6/12/2013

12/23/2013



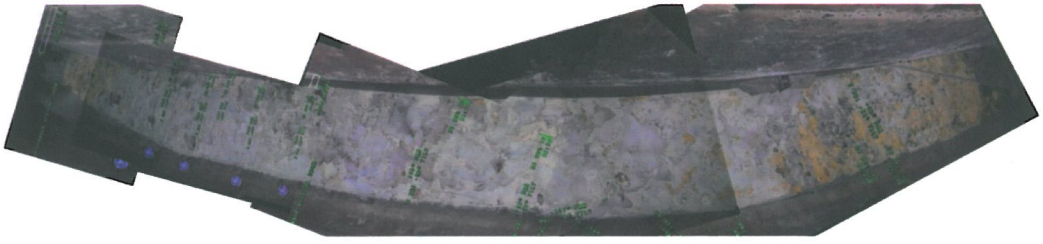
2/7/2014

Attachment B. Evolution of the visual observations of the waste leaked in the annulus (cont.)

Video inspection from Riser 87

8/30/2012

8/21/2013



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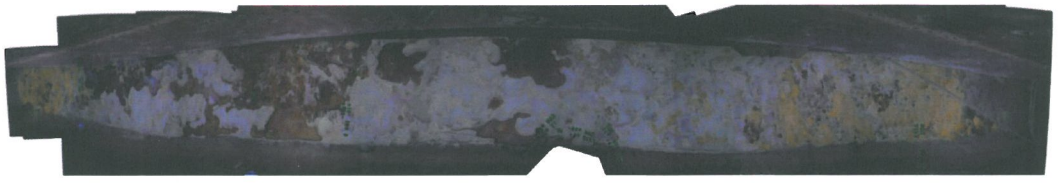
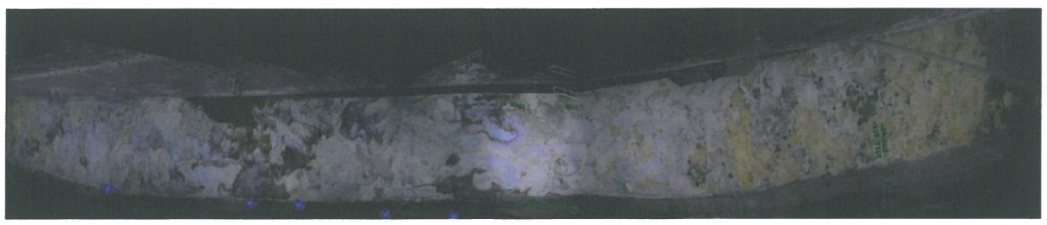


1/13/2014



1/29/2014

Attachment B. Evolution of the visual observations of the waste leaked in the annulus (cont.)

Video inspection from Riser 77

9/07/2012

3/03/2014