1219222

Office of River Protection, State of Washington Department of Ecology
Tank Waste Retrieval Work Plan/Functions and Requirements Change Notice
(Per Hanford Federal Facility Agreement and Consent Order Section 9.3)

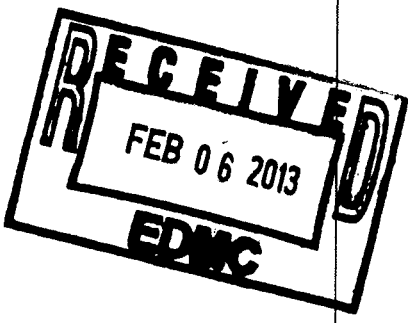
1. Document Title and Number: RPP-33116, Rev. 2, 241-C-110 Tanks Waste Retrieval Work Plan		
2. Minor Field Change: (Section 12.4 HFFACO Action Plan) ☐ Yes: (WRPS Signature Only – Attach signed form to Primary Document for record purposes) x No: Proceed to Box 3	**3.** Document Issue Date: 06/10/08 **4.** Document Modification Notice Date: 12/18/12	**5.** Notice Number: 2012-13
6. Do proposed changes require schedule changes? (Would this extend completion of retrieval beyond 12 months from date of initiation?) ☐ Yes x No	**7.** Do proposed changes include specific additions, deletions, or modification to scope and/or requirements which affect the overall intent of the plan? ☐ Yes x No	**8.** (Check only one box) ☐ Significant Modification (Check if the answer to question in either section 6 or 7 is "yes". Significant modifications require revision of the primary document.) Minor Modification x Requires modification of the document x Can be accomplished with Modification Notice.

9. Description and Justification of Change:

Change Description: A change is needed to identify the second and third retrieval technologies that will be used in tank C-110. A change is included to require ORP, as requested by Ecology, to provide a basis and rationale for continuing retrieval operation when equipment is degraded. General updates are also included. Changes are also included to align this TWRWP with other recently modified TWRWPs.

Justifications:

- Section 3.1 pg 3-1—Added second and third technologies and consent decree direction.
- Section 3.1.1, pg 3-2—Added equipment description.
- Section 3.1.1, pg 3-3—Identified riser for deploying the in-tank vehicle.
- Section 3.1.2, pg 3-4—Clarified that dissolution/softening will occur.
- Section 3.1.2, pg 3-5---Added in-tank vehicle operating description.
- Section 3.1.2, pg 3-6 to 3-7—Added limit of technology discussion and challenge language.
- Section 3.2, pg 3-10—Added estimated water use information associated with an in-tank vehicle.
- Section 3.3, pg 3-14 to 3-15—Updated rational for technology selection.
- Section 3.6, pg 3-16—Corrected Table number.
- Section 3.6, pg 3-18—Updated Figure 3-2 for an in-tank vehicle.
- Section 3.6, pg 3-21—Added Consent Decree reference to Table 3-4.
- Section 3.8, pg 3-24—Updated IQRPE requirement reference.
- Section 5, pg 5-1 to 5-2---Updated air permit reference.
- Section 9—Updated references



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See the attached redline strikeout
10. Impact of Change: Authorizes retrieval technologies and actions for C-110 hard heel.
11.

Approvals

Washington River Protection Solutions, LLC.	Office of River Protection	State of Wash., Dept. of Ecology
☐ Provisional Approval[2] Date	☐ Provisional Approval[2] Date	☒ Provisional Approval[2] Date
☒ Final Approval Date 1/24/13	☒ Final Approval Date 1/24/13	☒ Final Approval Date 1/31/13

Notes

1 - For use by Ecology to identify any additional information needed to make a decision regarding the request for modifications. In addition, Ecology will identify actions, if any, regarding the modification request that DOE may take pending Ecology's final decision

2 – Provisional approval allows DOE and it's contractors to take specific actions identified in section 11, prior to final approval of this modification.

3 PLANNED RETRIEVAL TECHNOLOGY

3.1 SYSTEM DESCRIPTION

System description (physical and operating)

This section provides a description of the primary and secondary waste retrieval system (WRS) and how it will be operated. The rationale for selection of primary and secondary technologies is provided in Section 3.3. However, in accordance with Appendix C, Part 1 of the Decree:

> "If 360 cubic feet is reached with the first retrieval technology, the first retrieval technology shall be used to the "limits of technology" and a second retrieval technology shall not be required."

The primary technology is the first technology deployed for waste retrieval. The primary waste retrieval system or first technology for C-110 is modified sluicing. The second and third technologies for C-110 are mechanical conditioning with an in-tank vehicle (2) and high pressure water with the in-tank vehicle (3) to break apart large agglomerates. Modified sluicing will be used to mobilize the solids for pumping. These three technologies will be deployed in an effort to obtain the Consent Decree residual waste goal of 360 cubic feet.

In accordance with the Decree, Appendix C, Part 1:

> "If the waste residual goal of 360 cubic feet is not achieved using the established two technologies, an additional retrieval technology established in a revised TWRWP shall be deployed to the "limits of technology;" provided that DOE may request that the State agree that DOE may forego implementing a third retrieval technology if DOE believes implementing such technology is not practicable under the criteria set forth above [in Appendix C, Part 1 of the Decree]. If DOE and Ecology are unable to reach agreement, the resolution of the issue of whether a third retrieval technology shall be deployed shall be resolved through the dispute resolution process set forth in Section IX of this Decree."

For efficiency, DOE will use the third technology, high pressure water, as needed during the mechanical conditioning with the in-tank vehicle.

Continued design development and incorporation of lessons learned may lead to changes in the design and/or operating strategy.

3.1.1 Physical Description

The physical equipment will consist of a modified sludge sluicing system to mobilize and retrieve waste from tank C-110. The sluicing system will include two (or more) sluice nozzles and a slurry pump in the tank. The sluice nozzles will be controlled from a control trailer located outside the tank farm fence. The sluice nozzles can be installed in existing tank risers located around the perimeter of the tank. The sluice nozzles will have the capability to direct liquid at various locations in the tank. Double-shell tank supernate will be used as the primary sluicing

liquid. The WRS will also have the capacity to use raw water for sluicing with minor modifications.

The new slurry pump will be installed in a riser located in the center pit. The slurry pump design for C-110 will allow the pump installation height to be adjusted to facilitate maximum waste removal. The C-110 pump will be installed using a crane so that the inlet will be just under the waste surface to start, as determined by the in-tank camera. Little or no water should be required for this pump installation. This same installation method would be used for replacement pumps. The C-110 pump will be mounted on a system that will allow the pump to be lowered to the bottom of the tank as waste retrieval progresses. Other designs or arrangements may be used to optimize the pump installation or operation.

Double-shell tank 241-AN-106 (AN-106) is planned to be used for both waste receipt and as the source tank for supernate recycle. Tank AN-106 was selected based on its location, available space, and existing equipment.

An in-tank vehicle in combination with the existing modified sluicers will be used to mechanically condition the waste for pumping. This in-tank vehicle will have high pressure water spray nozzles and a movable blade. The high pressure water can be supplied up to 5,000 psig and a nominal 12 gpm. The blade will have a polymer "squeegee" on the bottom when installed in the tank. The hydraulically powered vehicle will move about on polymer tracks and will push the solids towards the slurry pump. The in-tank vehicle will be designed to access the tank via a 12 in. diameter riser. The in-tank vehicle support system will include an above ground water supply skid and hydraulic power pack.

Camera(s) will be installed in tank C-110 to provide the capability to visually monitor and aid in control of waste retrieval operations. Instrumentation will also be provided to monitor process control data (e.g., pressures and flow rates). This information will be used to support material balance calculations. The existing ENRAF[1] level gauge in tank C-110 will be retracted during waste retrieval operations and will be used periodically to monitor waste levels. The AN-106 ENRAF will be used to monitor the waste level in that tank.

During waste retrieval operations, tank C-110 will be actively ventilated. The ventilation system will consist of skid-mounted high-efficiency particulate air filtered portable exhauster(s).

Condensate drainage from the exhauster(s) will be routed back to an SST being retrieved or an SST undergoing equipment installation in preparation for retrieval. Any change to this drainage routing will be covered by a change to this TWRWP.

The configuration of tank C-110 includes no concrete pits and only a single central corrugated metal caisson. The drain in this caisson will be closed off and a sump pump used to pump leakage into the tank. The WRS for tank C-110 may require design and construction of riser extensions to support the installation of the sluice nozzles and a slurry pump. Table 3-1 provides the planned riser use for tank C-110. This riser use may change.

[1] ENRAF is a trademark of Enraf, Inc., Enraf B.V., Delft, The Netherlands.

Table 3-1. Planned Riser Use for Tank C-110 Waste Retrieval System.

Riser Number	Tank C-110
1	Spare, camera, or as required if need arises during detailed design
2	Sluicer
3	Ventilation exhaust duct/camera
4	ENRAF[1] level gauge
5	Spare, camera, or as required if need arises during detailed design
6	~~Vacuum relief/camera/breather filter~~In-Tank Vehicle
7	Sluicer
8	Spare, camera, or as required if need arises during detailed design
13	Slurry pump

[1]ENRAF is a trademark of Enraf, Inc., Enraf B.V., Delft,, The Netherlands

~~*The riser for an in-tank vehicle will be selected during detailed design~~.

A portable valve box serves to control the routing and flow of liquid to the sluice nozzles and to control water additions to the waste retrieval process. The valve box provides secondary containment and the collection/detection of any leakage in a sump. The portable valve box has a leak detector that is connected to the pump shutdown system in the control trailer. In the event that a leak is detected in the portable valve box, the transfer pumps in tank C-110 and in the receiver DST would be shut down. The portable valve box has a sump and a sump pump that can be configured to transfer any leakage to the SST being retrieved.

A valve/transfer line diversion box may be needed to permit routing of solutions to and from tank C-110 and other tanks which may be undergoing retrieval concurrently. If a suitable pump cannot be obtained that will provide adequate capacity, a booster pump may also be required. Any booster pump will be located within a separate steel pit. Any new pits required will be inspected, will have a leak detector, and will either drain to a tank or have a sump pump. Leak detectors may be a conductivity probe, a thermal leak detector, or another type of leak detector as appropriate.

Should a transfer leak from the primary hose occur the leak detection system is designed to shut the pump off when liquid covers the leak detection element contacts. Secondary containment structures will not overflow as a result of the transfer line leakage, including any transfer line drainback, because either the free volume of the structure exceeds the volume of leaked waste plus drainback, or there are openings in the structure which allow free-drain to the tank.

Transfer of waste from tank C-110 to AN-106 and the transfer of supernate from DST back to tank C-110 will be performed using transfer lines that provide secondary containment. The waste retrieval project currently plans to use overground hose-in-hose transfer lines (HIHTL) and the *Resource Conservation and Recovery Act of 1976* (RCRA)-compliant DST transfer system.

The receiver DST will have a supernate pump that will be used to pump liquid back to tank C-110. The receiver DST will also have a slurry distributor to distribute the sludge received from tank C-110.

Because the elevation of the AN tank farm is approximately 22 ft higher than the C tank farm, the slurry distributor and the supernate pump incorporate anti-siphon devices to prevent unintentional flow from the DST to the SST.

The transfer lines and DSTs are RCRA compliant.

3.1.2 Operating Description

The retrieval process will be monitored using closed-circuit television to facilitate waste retrieval and aid in minimizing any liquid in the tanks. Supernate will be used as the primary retrieval liquid to minimize DST storage space. Raw water will be used in limited quantities as necessary for waste mobilization and conveyance, transfer line flushing, equipment flushing, heel flushing, dissolution/softening, or as required for miscellaneous use. During all retrieval activities the tank liquid level will be maintained below the maximum waste level designated in the process control plan.

During routine operations, waste retrieval will be initiated by starting the supernate pump in the DST source tank and using the pumped supernate to provide sluicing fluid to the selected sluice nozzle. Initial sluicing will be focused in the center portion of the tank to minimize the time required to get liquid to the slurry pump to allow it to be started. The in-tank camera will be used to provide visual input for directing the sluice nozzle. The slurry pump in tank C-110 will be started when liquid from the sluicer operation reaches the area of the pump inlet and there is enough liquid present to prime and operate the pump. As the sluice liquid contacts the tank waste, the sludge will be mobilized and retrieved via the slurry pump. Typically, one sluicer will

be operated at a time at a flow rate of approximately 60 to 120 gal/min. If the pump suction is too shallow when waste retrieval is started, the sluice nozzle discharges can be aimed at the pump inlet to enable to the pump to be inserted a little deeper. The flow rate through the sluice nozzles will be adjusted based on the pump-out rate so that the rate of liquid introduction will approximately equal the rate of solution removal with the objective of minimizing the liquid waste volume in the retrieval tank while maximizing waste retrieval efficiency. The slurry removed will consist of the mobilized tank waste and the DST supernate or water. Maintaining a balanced pumping rate into and out of the tank is integral to minimizing the liquid volume in tank C-110 and reducing the potential for leakage.

If initial sluicing efforts show the tank C-110 sludge is not readily mobilized it may be necessary to add sufficient liquid to the tank to cover the sludge and allow it to sit for a period of time to soften the solid waste before sluicing is resumed. Liquid can break down bonds in dried waste or dissolve salt crystals holding the waste together. The DST supernate used will not be saturated and thus will be expected to dissolve such salts or break the crystal structure down sufficiently to permit retrieval. The volume of free liquid added to soften any waste would be minimized by keeping the free liquid height above the waste to as small as practical. The time needed to soften the waste is unknown, it is expected to be a few days or longer.

The in-tank vehicle will be lowered through a riser to the tank bottom or waste surface. It will be moved about the tank with the blade employed as needed to push waste towards the pump inlet. The high pressure water nozzles will be used as needed to break up the waste. The vehicle tracks may also break up some of the waste agglomerations.

A probable sequence of operational activities could be as follows:

- Use the in-tank vehicle and sluicers to move waste to the slurry pump.
- Sluice out the smaller solids.
- Use the in-tank vehicle for mechanical size reduction of large agglomerations.
- Position the in-tank vehicle blade so that it is a backstop and size reduce solids with sluice nozzles.
- Use high pressure water nozzles on the in-tank vehicle to size reduce large agglomerations.

The sequence of activities may be performed in any order depending on the conditions in the tank or based on available resources. Each operational period may not include all of the steps above. It is likely that several cycles of these activities will be used during the retrieval.

During all field activities, standard operating procedures and safety precautions will be implemented to protect worker health and safety, the public, and the environment. In accordance with standard operating procedures, health physics and industrial health technicians will monitor conditions within the tank farm in accordance with approved monitoring plans.

Before initiating waste retrieval, a formal waste compatibility assessment will be performed in accordance with HNF-SD-WM-OCD-015, *Tank Farm Waste Transfer Compatibility Program.* HNF-SD-WM-OCD-015 provides a formal process for determining waste compatibility through the preparation of documented waste compatibility assessments for waste transfers. The primary

purpose of the program is to ensure that sufficient controls are in place to prevent the formation of incompatible mixtures during waste transfer operations. Waste compatibility assessments are prepared before all waste transfers into the DST system to ensure that the waste transfer will comply with specific administrative control, safety, regulatory, programmatic, and operational decision rules related to waste chemistry and waste properties. Waste compatibility assessments require the preparation of calculations to determine source tank and/or receiver tank compositions and to assess those compositions against specified decision rules that are provided in HNF-SD-WM-OCD-015.

Formal issuance of the compatibility assessment will not be completed until just before waste retrieval operations begin to ensure that current conditions are captured in the assessment.

Meeting the informational requirements for waste transfers meets the requirements of *Washington Administrative Code* (WAC) 173-303-300, "General Waste Analysis." Compliance with the following documents is required before initiating a waste transfer:

a. RPP-29002, *Double-Shell Tank Waste Analysis Plan*. Single-shell tanks transfers into the DSTs for any reason must meet the waste acceptance criteria presented in this plan. This plan is written pursuant to WAC 173-303-300(5) and EPA guidance document OSWER 9938.4-03, *Waste Analysis at Facilities that Generate, Treat, Store, and Dispose of Hazardous Waste.*

b. Waste Stream Profile Sheet (RPP-29002~~, Attachment A~~). The sheet addresses the applicable sections of WAC 173-303-300; Title 40, *Code of Federal Regulations*, Part 761, "Polychlorinated Biphenyls (PCB) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions" (40 CFR 761); 40 CFR 268, "Land Disposal Restrictions"; and WAC 173-303-140, "Land Disposal Restrictions," and also requires a waste compatibility assessment pursuant to HNF-SD-WM-DQO-001, *Data Quality Objectives for Tank Farms Waste Compatibility Program*, to meet WAC 173-303-395(1).

When the level of residual solids gets low in the tank, the volume of solids removed per unit volume of sluicing fluid removed from the tank or per unit of time or transfer will be tracked. The units used will be selected by engineering personnel. Waste retrieval operations will continue in an effort to obtain the goal of 360 ft^3 or less of residual waste remaining in the tank and/or until the limits of technology have been reached for this retrieval method. The project will determine when a tank retrieval is complete by following the Consent Decree requirements stating "that the recovery rate of that retrieval technology for that tank is, or has become, limited to such an extent that it extends the retrieval duration to the point at which continued operation of the retrieval technology is not practicable, with the consideration of practicability to include matters such as risk reduction, facilitating tank closures, cost, the potential for exacerbating leaks, worker safety and the overall impact on the tank waste retrieval and treatment mission."

Until a risk evaluation is available, the limit of technology for modified sluicing is defined in RPP-50910, *Single-Shell Tank Waste Retrieval Limit of Technology Definition for Modified Sluicing* as when the concentration of SST waste in the retrieved slurry sent to the DST is within, or bracketing, the range of 0 to 0.6 volume percent. There is no defined limit of technology for

an in-tank vehicle operation. When additional experience and data is accumulated with an in-tank vehicle it may be possible to develop a limit of technology.

Experience has shown that unexpected waste forms and tank conditions may be encountered and that equipment performance can degrade with time. The ORP will inform Ecology at least every 2 weeks, through normally scheduled meetings, about unexpected waste forms behavior and tank conditions along with retrieval equipment performance changes that would impact overall retrieval rates and retrieval volume. If a normally scheduled meeting does not occur, Ecology will initiate a meeting for this information exchange.

At these meetings, ORP will provide to Ecology the basis and rationale for continuing retrieval when it is suspected that waste form behavior, tank condition and/or equipment performance has diminished significantly or performance has impacted the ability of the deployed equipment to operate in order to meet the waste residual goal of 360 ft^3.

The following information will be used to evaluate termination of retrieval and will be shared with Ecology prior to a decision to terminate field retrieval activities:

a. System performance and efficiency data.

b. In-tank visual confirmation of tank condition and waste retrieval.

c. Preliminary volume estimates using tank geometry and in-tank structural features.

d. Presentation and discussion of alternate system configurations and process modifications to enhance retrieval performance.

e. Presentation and discussion of residual sample location.

TFC-ENG-CHEM-P-47, *Single-Shell Tank Retrieval Completion Evaluation*, provides the methodology to follow for determining when an SST undergoing waste retrieval has reached the end of the retrieval process. The following summary of this procedure does not take the place of TFC-ENG-CHEM-P-47, and for any differences between this summary and the latest version of the procedure, the procedure takes precedence. Refer to TFC-ENG-CHEM-P-47 for details of the summary steps.

a. When waste retrieval starts, engineering personnel will begin tracking retrieval performance (e.g., percent of waste retrieved) and provide a weekly status report. Weekly status information will be forwarded to Ecology to brief them on retrieval activities, including residual volume estimates and performance parameters. Ecology will be invited to view waste retrieval activities and video images of the in-tank operations.

b. Engineering shall recommend configuration or procedure changes to enhance recovery as warranted. Management is notified after performance efficiency or retrieval rate has reduced significantly.

c. An attachment to TFC-ENG-CHEM-P-47 provides guidance for retrieval performance and limit of technology evaluations. Establishment of when the limits of technology have been reached includes the following:

    1. Examination of in-tank images to observe/record waste contours and characteristics.

    2. Estimation of waste retrieval performance efficiency and remaining waste volume.

Table 3-2. Tank C-110 Waste Retrieval Summary Data.

Tank	Initial Tank Waste Volume prior to Retrieval (kgal)	Retrieval Flush Volume (kgal)	DST Supernate Recycle (kgal)	Estimated Operating Duration (days) [c]
C-110	178 [a]	105 [b]	6,450 [c]	94

[a] From Table 2-3.

[b] Standard flush volume assumed for past 100-Series tank modified sluicing waste retrievals (RPP-21895, *241-C-103, and 241-C-109 Tanks Waste Retrieval Work Plan*, Rev. 3A, and RPP-22393, *241-C-102, 241-C-104, 241-C-107, 241-C-108, and 241-C-112 Tanks Waste Retrieval Work Plan*, Rev. 3B) and assumed to be applied to the C-110 waste compatibility assessment.

[c] Duration and supernate volume estimates based on the general operating assumptions of three shifts operating 7 days/week with 60% operating efficiency. Sluicing durations assume 1 vol% solids loading in slurry first week, 6 vol% solids until 30 kgal left, 2 vol% solids until 15 kgal left, 0.5 vol% solids after that, and an average DST supernate transfer rate into the SST of 80 gal/min.

DST = double-shell tank.

The volume of water added to a tank via the high pressure water nozzles of the in-tank vehicle will be dependent upon how efficiently the in-tank vehicle can break up the waste and direct it to the retrieval pump. Experience with high pressure water usage for different in-tank vehicle deployed in S-112 showed roughly 1.5 to 2 gallon of high pressure water per gallon of waste removed. The water pressure used with the in-tank vehicle planned for deployment in C-Farm will be lower than that used in S-112, and the waste agglomerations will be different than the solidified salt in S-112, so the water usage rations may not be comparable. Assuming 1 to 3 gallons of high pressure water per gallon of waste removed, every 5,000 gallons of waste heel removed from a tank would add 5,000 to 15,000 of water to the DST system. For C-110 the hard heel volume is approximately 17,000 gallons so 17,000 to 52,000 gallons of water may be added to the DST system during the retrieval of the C-110 heel.

The use of supernatant will be limited by the following:

~~a.~~1. The waste compatibility assessment for supernatant recycle will be completed and reported to Ecology. This compatibility assessment shall be made to determine if the solution is acceptable for use in retrieving the tank C-110 solids. Ecology will be informed of the results of this assessment before initiation of retrieval operations and a copy of the assessment report shall be provided to Ecology.

~~b.~~2. Submittal of a retrieval data report, as described in M-045-86, 12 months following DOE's certification to Ecology that retrieval is complete. This report shall include a review of the efficiency and performance of the in-tank settling of the retrieved solids in the receiving DST, an estimate of the amount of solids that were recycled during waste retrieval, and the impacts these solids have on removing additional solids from the SSTs.

~~c.~~3. Ecology will be informed by email when the cumulative volume of supernatant liquid being recycled exceeds the estimated quantity of 1,000,000 gal, and for each incremental million gallon quantity recycled.

~~d.~~4. Following the use of supernatant, a minimum of three tank heel rinses using a minimum volume of raw water that is three times the estimated residual waste volume will be

Table 3-3. Advantages and Disadvantages of Using DST Supernate for Retrieval of Insoluble Waste Solids in Tank C-110. (2 Sheets)

	DST system would require about 15 days of WTP operating time.
Supernate Recycle Disadvantage	The design and equipment costs to recycle supernate are more than the design and equipment costs associated with water addition.
Supernate Recycle Disadvantage	The supernate recycle process is not as flexible due to the added difficulties of maintaining equipment that is contaminated vs. that which has only contacted water.
Supernate Recycle Disadvantage	The supernate recycle process is more complex due to the need for encased lines and leak detection equipment not needed for water only lines.
Supernate Recycle Disadvantage	A DST pump with an adjustable suction or a suction fixed in the supernate well above the sludge level is required for supernate recycle.

3.3 TECHNOLOGIES CONSIDERED AND RATIONALE FOR SELECTION

Technologies considered and rationale for selection

Waste retrieval technologies currently available for deployment at tank C-110 are (1) modified sluicing and (2) the mobile retrieval system (MRS is a vacuum system with an in-tank vehicle), (3) modified sluicing (modified sluicing is used to mobilize the waste solids for pumping) with an in-tank vehicle, and (4) high pressure water. Modified sluicing uses water or DST supernate to mobilize waste to a pump where it can be removed from a tank. The MRS consists of an articulated mast system, which is a vacuum-based system deployed in the center of the tank with a crawler deployed to move sludge from the perimeter of the tank to the center of the tank where it can be removed with the vacuum system. Water is used as needed to mobilize waste solids in the tank. Water or recycled supernate is added to the aboveground batch receiver vessel for the retrieved waste to aid in transferring the slurry to a DST. Modified sluicing with an in-tank vehicle and high pressure water for breaking apart agglomerates provides a retrieval process that improves the retrieval effectiveness when a hard-to-retrieve heel is reached.

When modified sluicing is performed using DST supernate, the overall volume of waste requiring management (storage and/or volume reduction) in the DST system is significantly reduced over that associated with the MRS. The retrieval duration is also significantly less with modified sluicing.

After considering both candidate waste retrieval technologies and evaluation of the tank as discussed in Section 2.1.3.2, modified sluicing using recycled DST supernate was selected as the preferred technology for deployment in tank C-110.

The second and third technology alternatives, following modified sluicing are an in-tank vehicle and high pressure water.

Generally, an in-tank vehicle is desirable for large or heavy or monolithic particles since it can move and break up these agglomerations for sluicing, while a chemical retrieval of larger aggregates may be slow or ineffective due to the small surface area for dissolution. An in-tank vehicle is preferred as the heel volume increases because a chemical retrieval process may take up too much DST space and, for caustic or acid dissolutions, will have proportionally more impact to the DST space. A chemical retrieval process is preferable for heels where the volume is relatively low so the impact on DST space and the WTP throughput volume is less. However, a low heel volume, depending on waste type, may require a large volume of dissolution material. A chemical retrieval process may also be preferable if the particles are small because the surface area for dissolution is greater and an in-tank vehicle may just push the fine particles around the tank.

An in-tank vehicle with high pressure water was selected as the second and third technology for C-110 since the volume required for complete dissolution of the heel would have large impact on the DST system preventing or significantly impacting the ability to retrieve other SSTs.

Modified sluicing followed by mechanical conditioning with an in-tank vehicle and high pressure water for size reduction used to their limits of technology is the appropriate deployment sequence in an effort to obtain the 360 cubic feet target volume goal specified in the Decree. The "limits of technology" as defined in the Decree is noted in section 3.1.3.

3.4 ANTICIPATED PERFORMANCE COMPARED TO AGREEMENT CRITERIA

Anticipated performance compared to agreement criteria

The WRS for tank C-110 will be designed deployed and operated to each of its limit of technology, as defined in this document, in an effort to obtain a waste residue goal of 360 ft^3 or less in accordance with the Decree.

3.5 WASTE RETRIEVAL SYSTEM DIAGRAM

A simplified diagram of the retrieval system (include flow path, elevation changes, and tank layout).

Figure 3-1 is a proposed installation of ventilation system(s) equipment to support waste retrieval operations. Alternate layouts may also be used. A sketch of the WRS installation planned for tank C-110 is provided in Figure 3-2. A potential HIHTL flow path routing and equipment layout in the tank farm is provided in Figure 3-3. As noted in Section 3.1.1, the elevation in the AN tank farm is approximately 22 ft higher than the elevation in the C tank farm.

3.6 FUNCTIONS AND REQUIREMENTS FOR WRS DESIGN

Functions and corresponding requirements necessary to support design of proposed waste retrieval system. Functions and requirements are to be provided at a level of detail

This section defines the upper-level functions and corresponding requirements to which the C-110 WRS must be designed and operated. This TWRWP is not a system specification that defines design criteria for the WRS. However, the system specification for the C-110 WRS will be consistent with this TWRWP. The functions and requirements are provided in Table 3-~~3~~4 and are focused on defining the upper-level requirements for the tanks.

Figure 3-2. Tank C-110 Waste Retrieval System In-Tank Components.

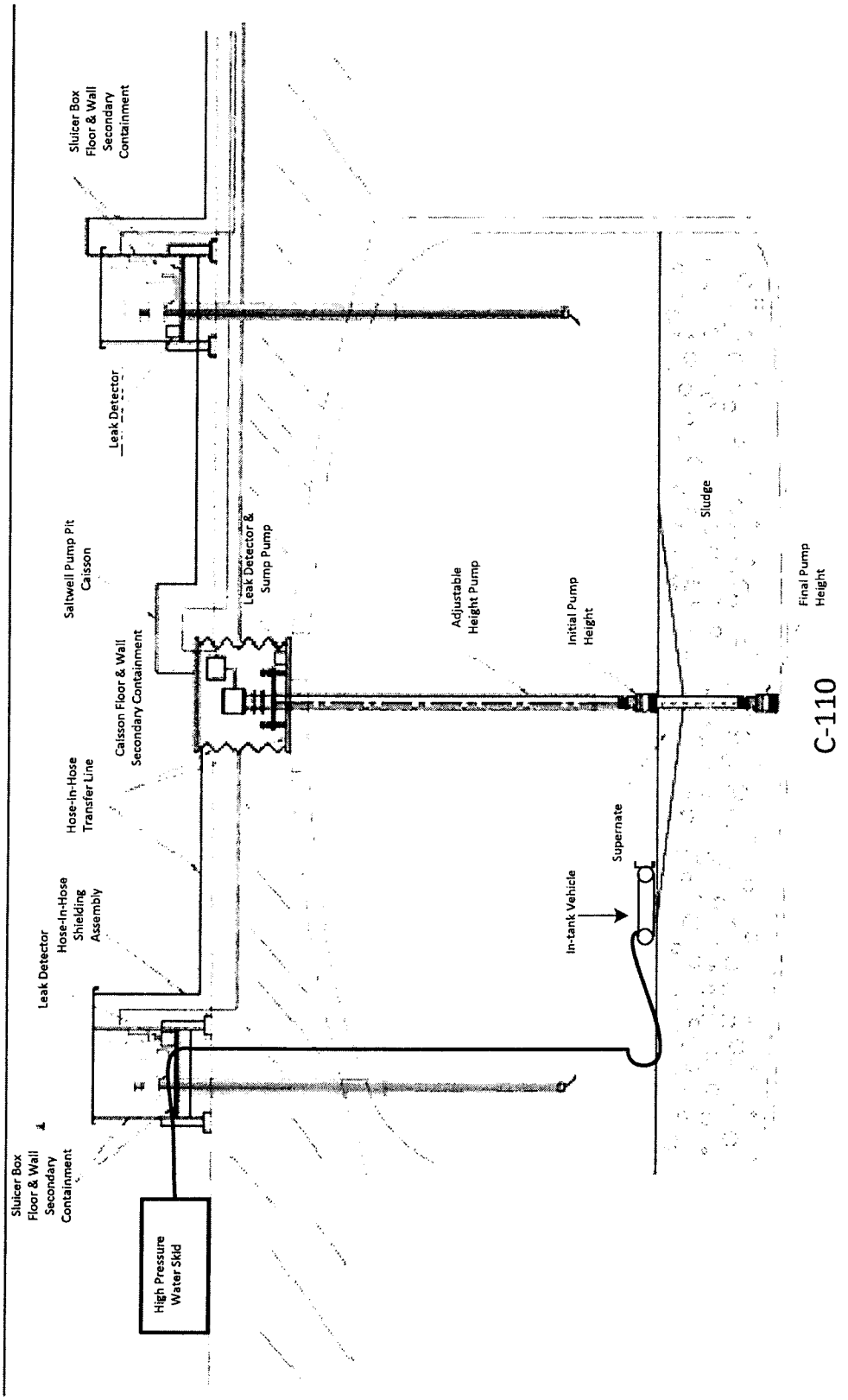

Table 3-4. Tank C-110 Waste Retrieval System Functions and Requirements. (2 Sheets)

Function	Requirement	Basis*	Key Elements
Control gaseous and particulate discharges	The ventilation system exhaust shall be filtered to restrict emissions to the environment.	WAC 173-303 WAC 173-400 WAC 173-460 WAC 246-247 TFC-ESHQ-ENV-STD-03 TFC-ESHQ-ENV-STD-04	Mitigate potential release to the public and the environment.
Mitigate potential for leaks to occur during waste retrieval	Prevent inadvertent release from tank C-110 to the environment.	RPP-13033, Section 3.3.2.3.4	Do not raise waste level above benchmark level. (Benchmark level is discussed in Section 4.6).
Control waste level in DST receiver tank	The WRS shall be operated to maintain waste level within specified allowable maximum and minimum values.	OSD-T-151-00007	Provide for safe waste storage in DSTs.
Remove waste from tank C-110	The retrieval technologies will be designed, deployed and operated to each of their "limits of technology" in an effort to achieve the waste residue goal of 360 ft^3 of waste or less. The limit of technology is defined in the Decree.	WAC 173-303 ~~HFFACO Milestone M-45-00~~Decree	The retrieval technologies shall have the potential to achieve a waste residue of 360 ft^3 or less.
Control and monitor the waste removal process in tank C-110	The WRS shall provide the monitor and control capability to control the waste retrieval and transfer process. This includes controlling and monitoring the following WRS process parameters: • Pressures • Flow rates • Differential pressures across exhaust ventilation filters • Leak detection systems.	RPP-13033 HNF-SD-WM-TSR-006 WAC 173-303 WAC 246-247 TFC-ENG-STD-26	Provide for safe and effective operation of the WRS.
Minimize waste generation	The WRS shall minimize waste generation to the greatest extent practical.	WAC 173-303 40 CFR 264.73(b)(9)	No numerical requirement.
Nuclear safety	The WRS shall be designed and operated to protect workers, public, the environment, and equipment from exposure to radioactive tank waste and emissions during the retrieval campaign.	WAC 246-247 10 CFR 830 RPP-13033 HNF-SD-WM-TSR-006 HNF-IP-1266	Ensure protection of workers and the public from routine operations and potential accident conditions.
Occupational safety and health	The WRS shall be designed for safe installation, operation and maintenance.	WAC 173-303-2 83(3)(i) 29 CFR 1910 10 CFR 835 29 CFR 1926	OSHA standards. Occupational Radiation Protection.

The requirements for an IQRPE assessment need and the permitting decision logic for new equipment or repairs/upgrades to equipment will be performed in compliance with TFC-ESHQ-ENV- PP-C-11, ~~*IQRPE*~~ *Independent Qualified Registered Professional Engineer Assessment Process*,~~(currently in draft) or successor document~~.

Risers were assessed as part of the original SST System Integrity Assessment (RPP-10435). SST system components (e.g., risers, pits, etc.) that were identified as part of the SST system for the original Integrity Assessment are not part of the retrieval system (unless specifically identified as such) and do not require a separate or additional integrity assessment if the function of the equipment doesn't change from its original purpose (e.g., the original purpose of risers is to provide tank access) and changes to the component are not outside the original component design basis and specifications.

3.9 DISPOSITION OF WASTE RETRIEVAL SYSTEM FOLLOWING WASTE RETRIEVAL

Describe the disposition of the system at the completion of waste retrieval.

3.9.1 Disposition of New Waste Retrieval System Components

Following completion of waste retrieval, the in-tank equipment will be left in place for disposition during component closure actions. The above-grade equipment (e.g., transfer lines, valve box, and related enclosures) will be reused to the extent possible for future waste retrieval activities. Transfer lines and related equipment will be flushed to reach acceptable exposure rates for disconnecting and relocating the equipment. Any above-grade equipment that needs to be removed and is not suitable for reuse will be packaged and disposed of as mixed waste onsite in accordance with the approved waste acceptance criteria for the Hanford Site burial grounds. If contaminated equipment is reused it will be controlled as specified in TFC-OPS-WM-C-10, *Contaminated Equipment Management Practices*. Where or if required and needed to support the retrieval of SSTs, the HIHTLs will be managed to ensure the availability and functionality of each as needed for future retrievals. At the conclusion of their mission, or on reaching the end of life for an HIHTL, the HIHTL will be managed in accordance with RPP-12711, *Temporary Waste Transfer Line Management Program Plan*.

3.9.2 Disposition of Existing Ancillary Equipment

Ancillary equipment associated with tank C-110 is limited to waste transfer lines and equipment installed in pits and above-grade risers. The current status of the ancillary equipment associated with tank C-110 is described in Section 2.2. Any existing contaminated ancillary equipment located within risers that needs to be removed following waste retrieval will be packaged and disposed of onsite in accordance with the approved waste acceptance criteria for the Hanford Site burial grounds or controlled as specified in TFC-OPS-WM-C-10.

In accordance with the SST System Closure Plan (RPP-13774), disposition of the ex-tank ancillary equipment, including pipelines, will be performed in accordance with a separate component closure activity plan. Closure plans will be incorporated into the SST permit.

5 REGULATORY REQUIREMENTS IN SUPPORT OF RETRIEVAL OPERATIONS

Summaries of documents (training plans, contingency plans, emergency response plans, reporting, record keeping, inspection summaries, etc.) as required for waste retrieval by WAC 173-303.

Retrieval of waste from the C-Farm SSTs will be performed under the requirements of the the Decree, the *Atomic Energy Act of 1954*, and RCRA, RCW 70.105, "Hazardous Waste Management Act" and their implementing regulations. The SSTs do not provide secondary containment and are not compliant with RCRA and RCW 70.105 interim facility standards of Subpart J of 40 CFR 265. The SSTs are currently authorized to continue operations under RCW 70.105 pending closure in accordance with WAC 173-303-610, "Closure and Post-Closure," under the authority of HFFACO Milestone M-45-00, "Complete Closure of all Single Shell Tanks Farms." Except as otherwise modified by HFFACO Milestone M-45-00, DOE conducts day-to-day operations of the SSTs in accordance with the interim facility standards established in WAC-173-303-400(3), "Interim Status Facility Standards." WAC 173-303-400(3) incorporates by reference the interim status performance standards set forth by the EPA in 40 CFR 265. Additionally, the SSTs are governed by federal regulations promulgated under the authority of the *Atomic Energy Act of 1954* and various DOE directives incorporated into the contract between ORP and the tank farm contractor (DE-AC27-0RV-14800). These requirements are implemented through operating plans and procedures by the tank farm contractor.

Interim status facility standards in WAC 173-303-400(3)(a) incorporate by reference the interim status standards set forth by EPA in 40 CFR 265 Subpart J for tank systems. Elements of the interim status standards relevant to the WRS along with the WRS features and/or operating plans and procedures are summarized in Table 5-1.

If required, approval to retrieve waste that could contain polychlorinated biphenyls (PCBs) from tank C-110 using supernate from the receiver DST and transfer the resulting slurry to the receiver DST will be obtained from EPA before initiating waste retrieval operations. The DST supernate is classified as PCB remediation waste in accordance with Ecology et al. (2000), *Framework Agreement for Management of Polychlorinated Biphenyls (PCBs) in Hanford Tank Waste*. Because the DST supernate is classified as PCB remediation waste, the retrieval of waste from SSTs when using DST supernate requires a Risk-Based Disposal Approval, approved by EPA, pursuant to the *Toxic Substances Control Act of 1976*.

Those components of the aboveground system using DST supernate to transfer SST waste to the receiving DST will be handled consistently with the current method of addressing polychlorinated biphenyl (PCB) waste in the DST system.

The ventilation system(s) used during waste retrieval operations are designed to pass air through the tank, thereby reducing condensation and fog within the tank. The ventilation systems required by Washington State Department of Health include a heater, prefilter, demister, two high-efficiency particulate air filters and test sections, exhaust fan, and stack. Details of the ventilation systems are provided in ~~AIR-09-704, *Categorical Tank Farm Facility Waste Retrieval and Closure: Phase II Waste Retrieval Operations (including as amended in updates)*~~

~~and DE05NWP-002R2, *Approval of Criteria and Toxics Air Emissions Notice of Construction (NOC) Application for Hanford Single-Shell Tank Waste Retrieval (as amended in updates)*~~00-05-006, *Hanford Site Air Operating Permit,* as amended and succeeded.

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