DEPARTMENT OF ECOLOGY
State of Washington

Hanford Tanks *status update*

Ecology's report on Hanford tank waste retrieval and closure - Winter 2019

Ecology's goal for cleaning up tank farms is to make sure that we close them as safely as practicable. In addition, while we are doing clean up and closure, we are taking some preventative measures to minimize any environmental effects from the waste that is already in the soil or that may be getting out of a tank.

To make closure decisions we need information about the soil contamination, possible remedies, and the effects of waste that remains in the soil and tanks after we finish cleaning up as much as possible. Closing the SST's gets very complicated with all of the regulations and work activities needed. This publication provides you with a summary of the work we are doing for the SST's and for the C-farm.

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A single-shell tank milestone: Waste retrieval completed at Hanford's C-Farm

Work has been completed to retrieve waste from the 16 SSTs that make up the C-Farm. Environmental regulations require DOE to remove as much waste as possible and close the SSTs.

C-Farm is the first tank farm for which waste has been retrieved from every tank. Overall, 96 percent of the waste was removed from C-Farm and transferred to safer double-shell tanks. Since the waste in each tank is different, varying amounts of waste remain in the individual tanks.

All SSTs are past their design life and are at risk of leaking waste to the environment; many have already leaked. The A and AX farms are next in line for retrieval.

Definitions

DOE - United States Department of Energy
SSTs - Single-shell tanks
DSTs - Double shell tanks
TPA - Tri-Party Agreement

If you follow single-shell tank retrieval at Hanford, you'll see a lot of different names for the C tank farm.

- 241-C Tank Farm
- C tank farm
- C-Farm
- Waste Management Area C
- WMA-C

These terms, which tend to be used interchangeably, all refer to the same place. To reduce confusion, we'll call it C-Farm throughout this publication.

To request materials in a format for the visually impaired, visit https://ecology.wa.gov/accessibility, call Ecology at 509-372-7950, Relay Service 711, or TTY 877-833-6341.

Single-shell tank Tier 1, 2, and 3 closure plans

Closure plans for the single-shell tanks are explained in the Tri-Party Agreement, Appendix I. The Tier 1 Closure Plan for the SST System is a "framework plan" that explains how DOE intends to meet regulatory requirements pertaining to closure of all tank farms (WAC 173-303-610).

Tier 2 closure plans will be developed for each of the waste management areas (WMAs) to document how closure requirements specific to each WMA will be met. DOE has submitted the WMA-C Tier 2 closure plan.

The Tier 3 closure plans, or "component closure activity plans," will be developed for ancillary equipment or other components at each WMA. DOE has submitted the Tier 3 plans for the four smaller C-Farm "200-Series" tanks. All three tiers will be part of the Hanford Sitewide Permit.

DOE is reviewing our comments on: RPP-RPT-58858, Tier 1 Closure Plan Single-Shell Tank System; RPP-RPT-59389, Tier 2 Resource Conservation and Recovery Act (RCRA) Closure Action Plan for Waste Management Area C; and RPP-RPT-59390, Tier 3 Resource Conservation and Recovery Act (RCRA) Component Closure Action Plan for 241-C-200 Series Tanks.

Surface infrastructure that was in place while workers were retrieving waste from the C-Farm tanks.

Now that retrieval is complete, much of the support infrastructure has been removed. (Courtesy DOE)

Corrective Measures Study for C-Farm

We have finished reviewing, Waste Management Area C Phase 2 Corrective Measures Study Report (CMS) (RPP-RPT-59379). In the report, DOE considered a range of technologies for both shallow and deep soil contamination. They concluded that no practicable or effective technologies were readily available to mitigate impacts to groundwater from mobile contaminants at C-Farm.

In the CMS, DOE evaluated options for corrective measures for shallow vadose zone soils only. Therefore, the CMS did not evaluate corrective measures for waste deep in the vadose zone or remaining in the SSTs and ancillary equipment. Nor did they evaluate corrective measures for groundwater contaminated by the C-Farm.

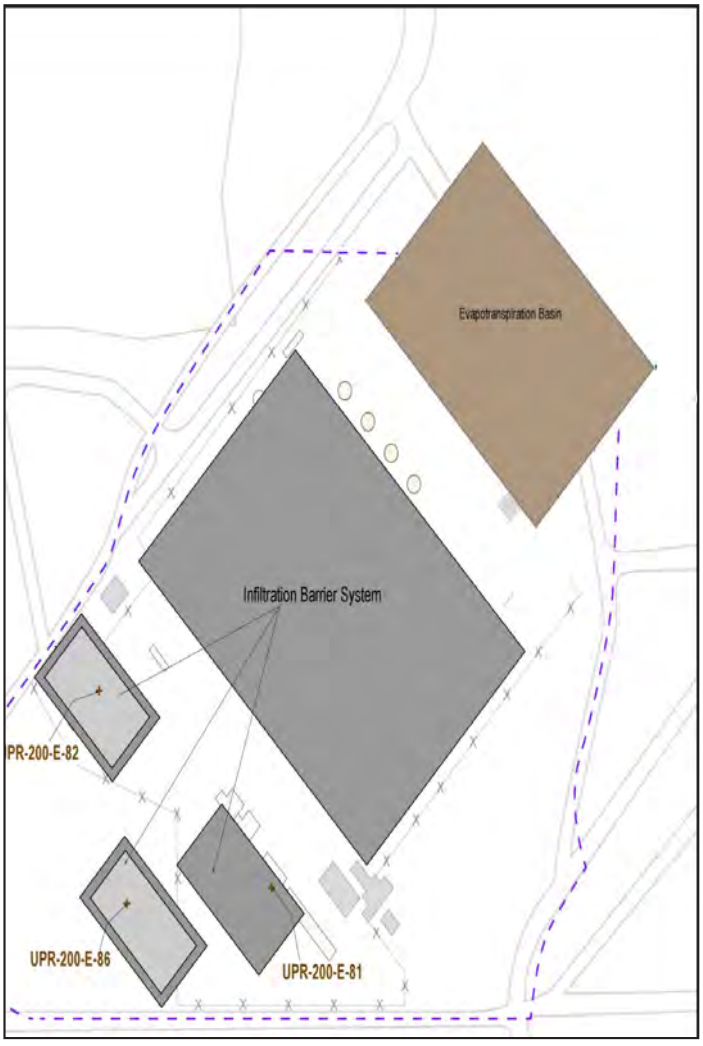
The DOE-preferred alternative described in the CMS consists of a set of small isolation and infiltration barriers placed over select parts of the farm (see diagram, next page).

Ecology approved the CMS with the requirement that a barrier must completely cover the C-Farm. Ecology acknowledged that groundwater remediation will be managed through the 200-BP-5 and 200-PO-1 CERCLA Groundwater Operable Units. The proposed Feasibility Study for Interim Action in 200-BP-5 Operable Unit will cite capture and removal of Technetium (Tc-99) as the preferred alternative, with Tc-99 cited as a primary contaminant of concern for C-Farm.

Investigation shows need to remove contaminants under C-Farm

We have finished our review of an investigation report on soil contamination at Hanford's C-Farm of underground tanks. The report (RPP-RPT-58339, Phase 2 RCRA Facility Investigation Report for Waste Management Area C) concluded that there are localized areas of shallow soil contamination at concentrations that exceed risk thresholds. However, soil contamination at depth (at or near the water table) is widely distributed and not well defined.

Based on this report, we have determined that there is a need to capture and remove contaminants of concern from the groundwater under C-Farm.



In the diagram the darker shade of grey indicates the interim barriers (identified as "Infiltration Barrier System"). The larger Interim barrier covers all 12 larger "100-Series" C-Farm tanks.

Appendix I Performance Assessment

We are meeting regularly with DOE and their contractor to resolve our comments on the TPA Appendix I PA (IPA), which DOE sent to Ecology in October 2016. The IPA consisted of a set of the following four documents:

1. Baseline Risk Assessment for Waste Management Area C (RPP-RPT-58329, Rev. 2).
2. Analysis of Past Tank Waste Leaks and Losses in the Vicinity of Waste Management Area C at the Hanford Site, Southeast Washington (RPP-RPT-59197, Rev. 1).
3. RCRA Closure Analysis of Tank Waste Residuals Impacts at Waste Management Area C, Hanford Site, Washington (RPP-ENV-58806, Rev. 0).
4. Performance Assessment of Waste Management Area C, Hanford Site, Washington (RPP-ENV-58782, Rev. 0).

We completed our review and provided comments to DOE in 2017 for first three documents. We provided comments for the fourth in 2018. Comments are available for public viewing as part of the Administrative Record online at https://pdw.hanford.gov/arpir/.

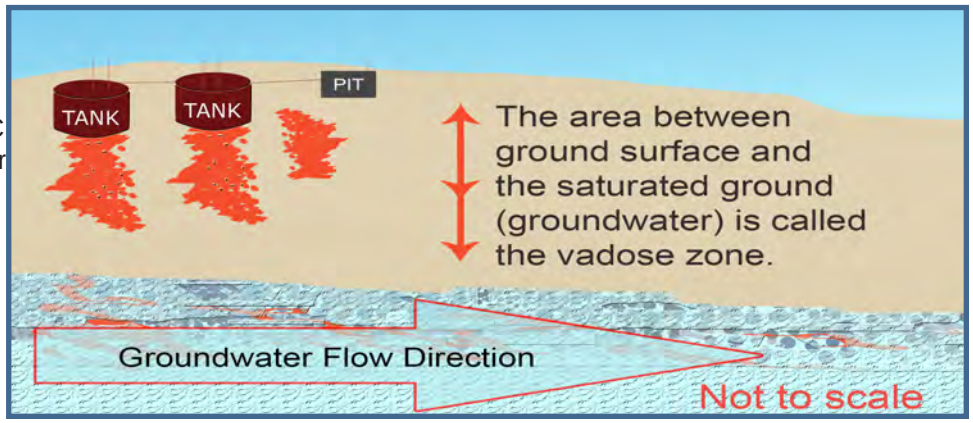
An interim barrier covers all of Hanford's SX tank farm. The evapotranspiration basin at top left holds runoff from the barrier, rather than allowing it to seep into the soil.

C-Farm Waste Incidental to Reprocessing evaluation

DOE published its draft C-Farm Waste Incidental to Reprocessing (WIR) Evaluation for public comment in June 2018. We reviewed and provided comments to DOE on this document. We believe that DOE is unable to show compliance with the evaluation process as required in DOE's M 435.1-1, the *Radioactive Waste Management Manual*. The WIR evaluation relies, in part, on one of the IPA documents (see item 4, above), which we also commented on in 2018.

The WIR evaluation considers only the residuals in the tanks. To close the tank farm, we will consider impacts from the residuals and any contamination that is in the soil. In Appendix H of the TPA, DOE agreed to establish an interface with the Nuclear Regulatory Commission (NRC). This interface is necessary and essential for the Tri-Party agencies, DOE, Ecology, and EPA, to reach formal agreement on the retrieval and closure actions for the tank residuals and contaninated soil in the tank farms. DOE has an Interagency agreement with the NRC to address only the tank residuals.This agreement will not request NRC consultation on the contaminants in the soil column.

We expect DOE to follow the procedure in Appendix H, and reach formal agreement with NRC on retrieval and closure actions for the single-shell tanks.



Vadose zone is the area between the ground surface and the saturated zone.

Interim barriers help prevent migration of waste into groundwater

Waste from past tank leaks can slowly make its way through the soil (known as the vadose zone) to the groundwater. Precipitation can speed that process as moisture from rain or melted snow carry leaked contaminants deeper. At the 241-T, -TY, and -SX farms, workers have installed interim barriers to prevent surface moisture from seeping into the ground.

The interim barriers at the T and TY tank farms cover small areas around tanks known to have leaked. These were two-year demonstration projects, whose objective was to evaluate the barriers' effectiveness in drying the soil. Well after the demonstration period ended, the soil under the barriers continues to dry.

The interim barrier at the SX farm, completed in September 2018, is the first to cover an entire tank farm. Its objective is to proactively minimize risks to human health and the environment from all tanks at the farm. Some of the tanks are presently sound, but may deteriorate before the waste can be retrieved from them.

The depth to which interim barriers are effective varies depending on geology, weather, temperature, chemical and physical properties of the released waste, and other factors. For tanks that are currently sound but may later leak due to corrosion, interim barriers would prevent rain or snowmelt from coming in contact with the leaked contaminants. This would prevent or slow the spread of contaminants through the vadose zone, and, ultimately, to the groundwater.

Ecology and DOE have agreed to install interim barriers over the TX and U farms next.
We are negotiating with DOE on the installation of interim barriers over Hanford's remaining SSTs farms, in the following order: S, BY, A, AX, BX, B, T, TY. These farms were prioritized according to the amount of technetium-99 (which is easily transported by water) and other contaminants in the tanks, while also considering other risk factors.

Active ventilation project for tank T-111

The SST T-111 entered service in 1945 and contains about 447,000 gallons of sludge and liquid waste. In 2015, the tank was believed to be leaking, based on tank monitoring data. To address the possibility of a leak, Ecology and DOE agreed to evaluate the use of a portable exhauster to increase air flow through the tank and evaporate the remaining liquid. Since then, a considerable amount of liquid is thought to have been evaporated. The exhauster is continuing to operate although any further benefit is uncertain.

Ecology has expressed concern about similar waste evaporation initiatives being proposed by DOE. Waste evaporation is considered a treatment and subject to RCRA permitting. The condensate must be collected and managed as a dangerous waste, rather than simply discharged to the environment. Ecology and DOE must also agree on the effectiveness of evaporation in limiting the amount of waste that may leak from the SSTs.

Tank T-111 is located in the T Tank Farm in the 200 West Area of the Hanford site. The yellow portion is the 241-T interim barrier.

Double-Shell Tanks

There are 28 DSTs at the Hanford Site. The following DST activities were completed in fiscal year 2018:

- Enhanced annulus video inspections for tanks AP-102, AP-103, AP-104, AP-105, AP-106 AP-108, AW-101, AW-102 and AW-104.
  Note:
  AP-106 is the Waste Treatment Plant Low Activity Waste feed tank.
  AP-108 will receive waste from the Tank-Side Cesium Recovery project – TSCR.
  AW-102 is the evaporator feed tank.
- Ultrasonic testing inspections of the primary tank wall and secondary tank bottom for tanks AY-101, AZ-101, and AZ-102.
- A comprehensive annulus visual inspection of tank AY-101.
- Wall thinning was detected around the circumference of tank AY-101. This is due to the tank being used to receive condensate (essentially uninhibited water that increases the corrosion rate) from the AY/AZ ventilation system and the waste being unmixed. Caustic solution was added to the tank and the waste recirculated to provide corrosion protection. In the future, the AY/AZ ventilation condensate will be transferred to the Liquid Effluent Retention Facility and 200 Area Effluent Treatment Facility for treatment and disposal.
- The DOE and contractor Washington River Protection Solutions demonstrated a remote tool for inspecting the air channels in the refractory beneath the primary tanks in the DSTs. The tool will improve the ability to assess the integrity of the tanks.

Work planned in FY 2019 includes:

- Enhanced annulus video inspections in tanks AN-101, AN-102, AN-103, AN-104, AN-105, AN-106, AN-107, AZ-101, and AZ-102.
- Ultrasonic testing inspections in tanks AN-102, AP-107 which will feed the TSCR, and AP-108 which will receive the column wash and drains from TSCR.
- Continue annual comprehensive inspection of tank AY-101 annulus.
- Investigate and develop nondestructive examination methods, in particular long-range, guided wave, ultrasonic testing for examining the DST primary tank bottoms. Begin field testing.

Waste on floor of outer shell in AY-102 annulus

DOE is procuring an annulus floor cleaning system for the DSTs. The AY-101 DST in particular required extensive work to remove corrosion on the outer surface of the primary tank before ultrasonic testing could be performed. Other tanks also have significant amounts of debris on the annulus floor. The debris interferes with efforts to perform ultrasonic testing on the secondary tank bottom. Some tanks (notably AP-102) have experienced thinning of the secondary tank bottom due to corrosion from the underside.

The DST system is currently permitted as final status operating to interim status requirements in the Hanford Sitewide Dangerous Waste Permit. The DST system portion of the Permit is being developed as part of the Revision 9 permit renewal.

AY-102 recovery project update

Tank AY-102 was the first of the 28 DSTs constructed at Hanford. In 2012, waste leaked from the primary (inner) tank to the secondary (outer) tank.

The AY-102 Recovery Project was established to retrieve waste from AY-102 and transfer it to sound DSTs. Waste retrieval from AY-102 started on March 3, 2016. First liquid supernatant was pumped to AW-105, followed by sludge retrieval to AP-102. Waste retrieval was completed in February 2017. About 97 percent of the waste was retrieved.

The primary tank was then inspected and the tank bottom was found to be severely corroded. DOE determined that the tank could not be repaired and decided to close the tank. A closure plan will be developed for the tank and included in the Hanford Sitewide Permit.

In 2018 the residual waste in the tank and annulus was rinsed with 24,000 gallons of water to remove soluble radionuclides (primarily technetium-99), and 14,000 gallons of caustic was then added for long-term corrosion protection. In September 2018, the AY-102 primary tank contained about 14,000 gallons of waste (6,000 gallons of liquid and 8,000 gallons of solids). The annulus contained about 5,000 gallons of waste (4,000 gallons of liquid and 1,000 gallons of solids). The tank is being actively ventilated and a portion of the liquids will evaporate.

No waste is believed to have leaked to the environment.

2015 photo showing several workers digging trenches at AY-102 in preparation for waste retrieval. Many of the trenches throughout the tank farms must be hand dug, to avoid hitting unmapped pipes or conduit.

242-A Evaporator

The 242-A Evaporator concentrates waste from the DSTs to reduce waste volume. This operation is essential to make space available for retrieval of waste from SSTs. During operation, the evaporator returns concentrated waste to the DSTs and sends condensed vapors to the Liquid Effluent Retention Facility and 200 Area Effluent Treatment Facility for treatment and disposal.

The slurry transfer lines SL-167 and SL-168, which return concentrated waste from the 242-A Evaporator to the DSTs, did not pass recent leak testing. The evaporator can't be operated without one of the lines being available. As a result, the schedule of evaporator campaigns for the upcoming year is uncertain. DOE is evaluating alternatives for repairing or replacing the slurry transfer lines, and the impacts of not being able to access the evaporator for up to 30 months.

An independent qualified registered professional engineer has completed an integrity assessment of 242-A Evaporator to confirm that the system is not leaking and is fit for use. We reviewed the integrity assessment report and had several concerns:

- Required inspections of several evaporator components were not conducted.
- No basis was provided for a number of components to substantiate that they were "fit for use."
- We strongly disagree that the next integrity assessment be delayed for 15 years. The regulations say the schedule must be based on results of past integrity assessments, age of the tank system, materials of construction, characteristics of the waste, and any other relevant factors. A 15 year delay is inconsistent with dangerous waste regulations and other state dangerous waste permits.

Because of these concerns, we are not accepting the integrity assessment as complete and adequate.

DOE completed the most recent evaporator campaign (EC), EC-09, in June 2018. Due to failure of the PB-1 recirculation pump, the campaign achieved a net waste volume reduction of only 20,000 gallons(see table for the recent history of waste volume reductions). Net waste volume reduction includes water added for line flushes or other reasons. DOE is purchasing a new PB-1 pump and refurbishing an existing spare pump. After upgrades were completed in 2014, the evaporator has freed up about 2.9 million gallons of DST space. (see table)

DOE is proposing a cold run, followed by a short hot run, in June 2019, while work to install new slurry transfer lines progresses. The purpose of the cold run is to ensure that the operating staff remains proficient and to maintain operational readiness.

The evaporator is currently permitted as final status in the Hanford Sitewide Dangerous Waste Permit, Revision 8C. Changes to the permit are being managed by the permit modification process. The permit is being updated as part of the Revision 9 permit renewal.

Evaporator Campaigns	Net waste volume reduction (gal)
13-01 (September 2014)	701,000
EC-01 (May 2015)	381,000
EC-02 (July 2015)	384,000
EC-03 (September 2015)	375,000
EC-04 (April 2016)	258,000
EC-05 (April 2016)	46,000
EC-06 (July 2017)	210,000
EC-07 (August 2017)	315 000
EC-08 (May 2018)	166,000
EC-09 (June 2018)	20,000
TOTAL	**2,856,000**

Summary of campaigns since 2014