Hanford Cleanup Overview

THE HANFORD SITE

Fact Sheet – January 2024

Aerial view of the Hanford Site's 200 East Area.

Background

The 580-square-mile Hanford Site in southeastern Washington state was created in 1943 as part of the Manhattan Project to produce plutonium for the nation's defense program. Today, waste management and environmental cleanup, including protection of the Columbia River, are Hanford's primary missions.

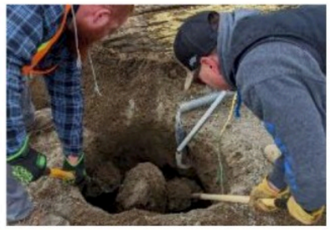
Waste Generation and Cleanup

The process of making plutonium is extremely inefficient in that a significant amount of liquid and solid waste is generated while only a small amount of plutonium is produced. Additionally, all the facilities and structures that were associated with Hanford's defense mission must also be deactivated, decommissioned, decontaminated, and demolished. That environmental cleanup project is the work that about 11,000 Hanford employees are involved in today.

Crews responsible for cleanup are dealing with several different kinds of waste in many different forms, with many of the wastes being potentially harmful to people and the environment. Precautions have been taken so that the waste does not contaminate the air, the ground, the water table underneath the ground, the Columbia River, the people who are doing the cleanup work, or the people and environment near the Hanford Site.

THE HANFORD SITE | Infrastructure Needs for the Future

Fact Sheet – January 2024

Hanford's infrastructure support consists of electrical, water, roads and sewer.

Mission

Hanford's cleanup mission requires critical infrastructure that provides power, water, electricity, roads and other services that support environmental cleanup and the Hanford Site's transition to 24/7 operations to treat liquid tank waste. As cleanup of large areas of the Site has been completed, infrastructure has been right-sized to meet the future mission. At the same time, the demand for safe and reliable services in operations areas is increasing. The acceleration of infrastructure projects across the Site ensures the U.S. Department of Energy can be successful in its mission to protect workers, the public and the environment.

Infrastructure Supports the Hanford Mission

Modernizing and repairing antiquated infrastructure supports the Hanford transition to 24/7 tank-waste treatment operations at the Waste Treatment and Immobilization Plant and critical remediation work, through the following:

- Storing, treating and disposing of liquid tank waste and solid waste containing hazardous chemicals and radioactive material
- Removing groundwater contaminants and cleaning up contaminated facilities and soil sites
- Monitoring and maintaining the remaining lands

Reliable Infrastructure

Reliable infrastructure provides a safe and secure Site with emergency response capability, as well as electrical utility and facility services needed to support an increased pace of operations.

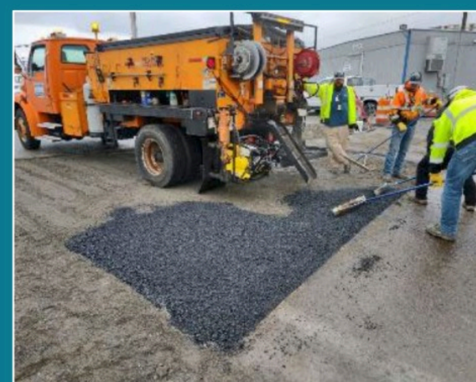
Ensuring Reliable Infrastructure Investments

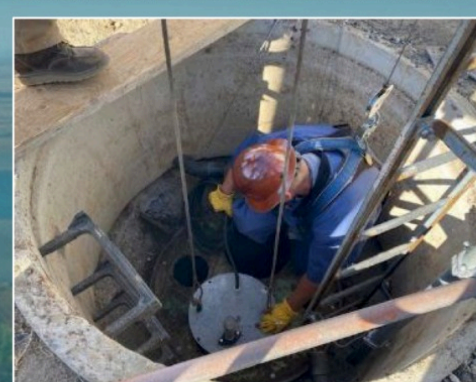
Investments in infrastructure reduce the footprint as areas are cleaned, updating old infrastructure that serviced past missions, and supplying services to new facilities to ensure success of the Hanford cleanup mission.

Hanford's Infrastructure Organization

Hanford's infrastructure organization also supports lease agreements with the Energy Northwest Columbia Generating Station and the Laser Interferometer Gravitational-Wave Observatory (LIGO).

Modernizing and repairing infrastructure.



U.S. DEPARTMENT OF ENERGY

Reactors in Interim Safe Storage

Fact Sheet – January 2024

Background

Between 1943 and 1963, nine plutonium-production reactors were constructed on the Hanford Site along the Columbia River in Washington state as part of the nation's Manhattan Project. The last reactor was shut down in 1987, at the end of the Cold War. The reactors were then deactivated and decommissioned, and the support facilities demolished, in accordance with a federal *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) removal action.

Six of the nine reactors (C, D, DR, F, H and N) were placed in Interim Safe Storage (ISS) between 1998 and 2012. ISS for these reactors consisted of removing hazardous materials from the reactor building, demolishing support facilities and sealing all openings to the reactor building. A steel roof designed to last 75 years was installed to prevent deterioration of the building and release of contamination while in ISS. This process provides an environmentally secure and cost-effective approach to safeguarding human health and the environment until final disposition of the reactors.

The seventh reactor, K East, was placed in ISS in October 2022. The ISS process for K East was the same as the other reactors except instead of a roof, a full steel enclosure was built around the reactor building. A similar enclosure is planned for the eighth reactor, K West, when it is placed in ISS, which is projected to be completed by 2032. Hanford's ninth reactor, B Reactor, was the world's first full-scale nuclear reactor and has been designated a National Historic Landmark and will not be placed in ISS.

K East Reactor in 2020.

K East Reactor in October 2022, after Interim Safe Storage.

Long-Term Stewardship Program

All seven reactors placed into ISS have been transitioned into the Long-Term Stewardship (LTS) Program. Under the LTS Program, the reactors are inspected externally every year and internally every 6 to 10 years to ensure facility conditions have not degraded. Much of the land surrounding the reactors in ISS has also been transitioned to the LTS Program.

N Reactor in 2005.

Surveillance and Maintenance

Surveillance and Maintenance activities are performed in accordance with the *Hanford Federal Facility Agreement and Consent Order* (aka Tri-Party Agreement) and CERCLA post-remediation requirements to ensure the reactors in ISS are maintained in a safe, environmentally secure and cost-effective manner. These activities are required to be performed (up to 75 years) until final disposition of the reactors.

N Reactor in 2015, after Interim Safe Storage.

100 K Area

Fact Sheet – January 2024

The U.S. Department of Energy (DOE) and contractor Central Plateau Cleanup Company manage the demolition of facilities, and remediation and Interim Safe Storage of the last reactors in Hanford's 100 Area.

Background

The K East and K West Reactors and associated spent-fuel storage basins were built in the mid-1950s in support of Hanford's plutonium-production mission. The reactors' fuel storage basins provided temporary storage of irradiated fuel discharged from the reactors prior to shipment to fuel processing facilities at the Hanford Site. The reactors were shut down in the early 1970s; however, spent-fuel storage basins were later modified and reactivated to provide temporary storage of N Reactor fuel awaiting processing at Hanford's Plutonium Uranium Extraction Plant. The plant was shut down in 1988, leaving 2,300 tons of fuel in the basins. The bulk of the fuel was removed from both basins between 2000 and 2004 and the K East Basin was demolished in 2009. More than 100 facilities in the K Area supported basins operations, including burial grounds for disposal of waste generated during reactor operations. Additionally, over 150 waste sites requiring remediation were created as a result of reactor and facility operations.

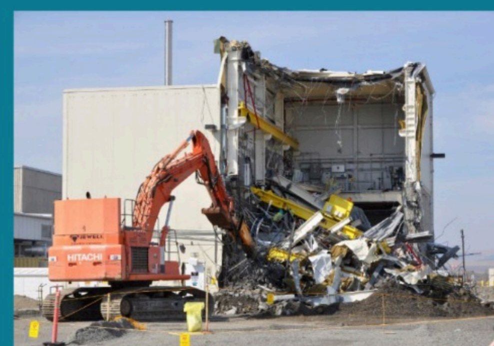
Mission

The DOE's mission is to complete remediation of the 100 K Area waste sites; deactivate, drain and demolish the 1.2-million-gallon K West Basin and other structures; and place the K East and K West Reactors into a long-term storage configuration called Interim Safe Storage.

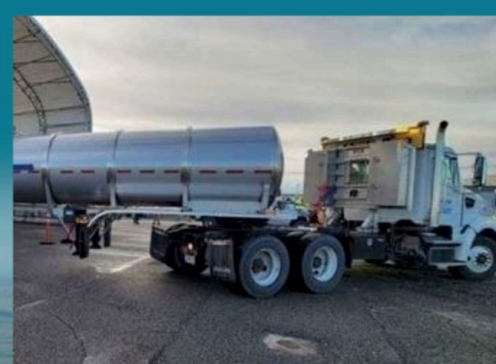
Progress

- Completed removal of radioactive sludge from the K West Basin in 2019.
- Completed Interim Safe Storage of the K East Reactor building in 2022.
- Completed remediation of 100 waste sites and demolition of 70 facilities.
- Initiated K West Basin debris sorting and staging in preparation for basin deactivation, draining and demolition.

K East Reactor Interim Safe Storage enclosure, completed in October 2022.



Workers demolished a K West Reactor facility called the sludge annex in 2023, as they continue risk-reduction work in the 100 K Area to prepare to remove the reactor's spent-fuel storage basin.



Water from the 1.2-million-gallon K West spent-fuel basin will be transported via tanker truck to Hanford's Effluent Treatment Facility for processing.

THE HANFORD SITE

Groundwater Cleanup

Fact Sheet – January 2024

The 200 West Pump and Treat Facility is the largest of Hanford's six groundwater treatment plants.

A worker samples groundwater along the Columbia River.

The U.S. Department of Energy (DOE) and contractor Central Plateau Cleanup Company (CPCCo) are safely cleaning up groundwater at the Hanford Site in southeastern Washington state.

Background

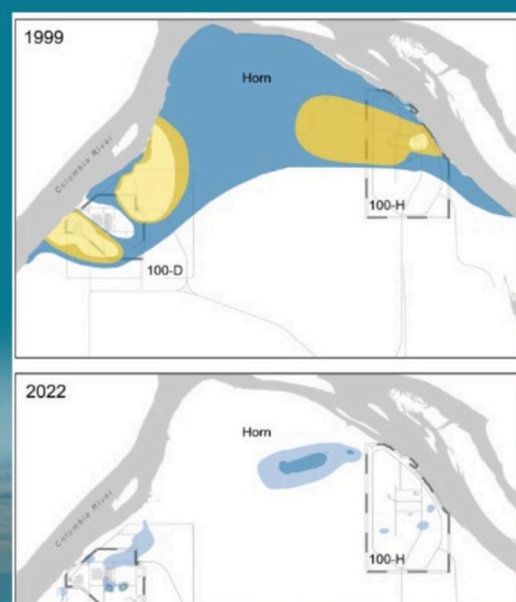
Hanford's groundwater cleanup program includes a network of more than 2,000 wells and other infrastructure. The DOE operates five pump-and-treat systems along the Columbia River and one at the center of the Hanford Site. Combined, these systems treat more than 2 billion gallons of groundwater annually — enough to fill trucks lined up from Los Angeles to New York.

Mission

During Hanford's plutonium production mission, significant amounts of solid and liquid wastes were discharged to the environment as planned and unplanned releases.

These discharges caused multiple, large-scale plumes — areas of contamination — in the groundwater. Contaminants include long-lived radioactive contaminants and other chemicals that pose risks to human health and the environment.

The DOE applies pump-and-treat technology to shrink large plumes as part of a multiple-technology strategy. In addition to pump-and-treat methods, the strategy includes using passive approaches and targeted treatment to clean up the groundwater and protect the Columbia River.



Significant reduction of the size and concentration of the contaminant plumes along the Columbia River from 1999 to 2022.

Canister Storage Building

Fact Sheet – January 2024

A multicanister overpack containing spent nuclear fuel is delivered to the Canister Storage Building.

The U.S. Department of Energy and contractor Central Plateau Cleanup Company are safely and compliantly managing interim storage of spent nuclear fuels at the Canister Storage Building at the Hanford Site in southeastern Washington state.

Background

The Canister Storage Building (CSB) plays an important role in Hanford's cleanup mission by providing interim storage of spent nuclear fuel.

The CSB is a 42,000-square-foot facility on Hanford's Central Plateau. It is composed of three belowgrade concrete vaults, each capable of holding 220 carbon-steel tubes. The tubes, each 40 feet long and 28 inches in diameter, have been placed vertically in Vault 1. Multicanister overpacks — 2-foot-by-14-foot stainless steel containers containing spent nuclear fuel — are safely stored in the tubes until a final disposal decision is made. Vault 1 stores more than 400 multicanister overpacks, containing approximately 2,300 tons of irradiated spent nuclear fuel, mainly from Hanford's N Reactor and the Shippingport reactor in Pennsylvania. The irradiated fuel was cleaned and relocated to the CSB to provide safe interim storage in a single location. Vaults 2 and 3 are available for future storage, if needed.

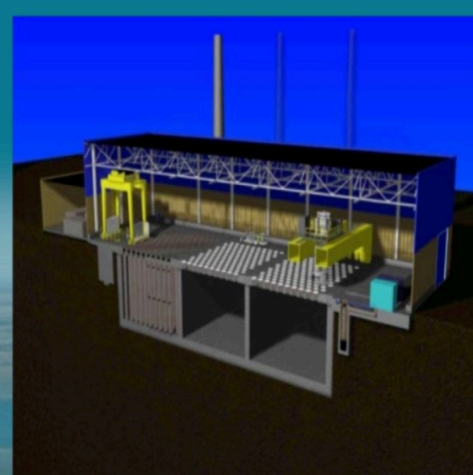
Adjacent to the CSB is an interim storage area, which also contains irradiated fuel packaged in various containers. The irradiated fuel will be repackaged and ultimately sent to a national geological repository.

Mission

The CSB and interim storage area will continue to safely store spent nuclear fuel until a national geological repository is available for final disposition.

A crane inside the Canister Storage Building was used to place multicanister overpacks into belowgrade concrete vaults.

Workers handle an empty multicanister overpack, used to store irradiated spent nuclear reactor fuel.

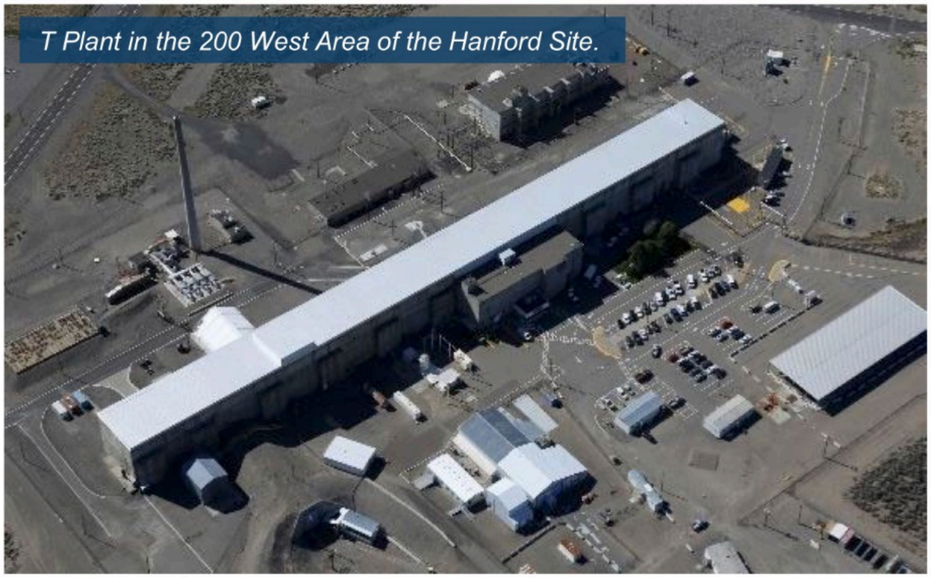


Rendering of Canister Storage Building belowgrade vaults.

T Plant and Sludge Interim Storage

THE HANFORD SITE

Fact Sheet – January 2024



T Plant in the 200 West Area of the Hanford Site.

At the Hanford Site in southeastern Washington state, the U.S. Department of Energy and contractor Central Plateau Cleanup Company manage T Plant, the oldest nuclear facility in the nation that is still operating with a current mission.

Background

When completed in 1944, T Plant was the world's first large-scale plutonium processing facility. A series of chemical processes at T Plant extracted plutonium from uranium fuel rods irradiated at Hanford's B Reactor. The plutonium processed at T Plant was used for the Trinity Test in New Mexico in July 1945 and to create the atomic bomb dropped on Nagasaki, Japan, on Aug. 9, 1945.

T Plant ceased plutonium processing operations in 1956 but later resumed service as a decontamination, repair and waste-handling facility. As a waste-handling facility, T Plant was used to treat waste, sample gases inside waste drums and repackage waste generated at the Hanford Site to ensure waste packages complied with state and federal regulations for transportation, storage and disposal.

Mission

Today, T Plant is providing safe and compliant interim storage for radioactive sludge from a fuel storage basin near the Columbia River at Hanford's K West Reactor. Removing that sludge from the basin and storing it approximately 12 miles away at T Plant significantly reduced risk to the nearby Columbia River. T Plant can be viewed using the self-guided Hanford Virtual Tour.

T Plant also stored fuel removed from the Shippingport Atomic Power Station in Pennsylvania, the world's first nuclear power plant, until it was moved to Hanford's Canister Storage Building in 2002.

T Plant is providing safe, interim storage for radioactive sludge from a fuel storage basin at Hanford's K West Reactor.

Crews performed extensive testing and training to prepare for receipt and storage of sludge containers.

THE HANFORD SITE

Plutonium Uranium Extraction Plant

Fact Sheet – January 2024

The Plutonium Uranium Extraction Plant was the fifth and final plutonium processing facility built at Hanford.

The U.S. Department of Energy and contractor Central Plateau Cleanup Company are working to reduce the risks of aging facilities across the Hanford Site in southeastern Washington state.

Background

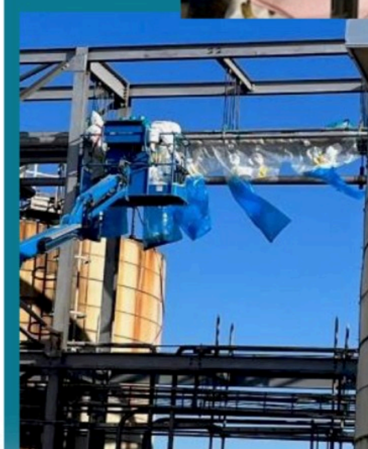
The Plutonium Uranium Extraction Plant (PUREX) was the fifth and final chemical processing facility built at Hanford. The plant operated from 1956 to 1972, and again from 1983 to 1988. It was used to recover plutonium, uranium and neptunium from irradiated fuel rods received from Hanford Site reactors. By 1958, PUREX processed 79% of the total plutonium output from the Site, which led to the eventual shutdown of Hanford's other plutonium processing facilities. The facility's efficiency was crucial during the Cold War.

The PUREX complex is located near the center of the Hanford Site in an area known as the Central Plateau and includes several buildings and support structures. PUREX is approximately 1,005 feet long, 104 feet high (with approximately 40 feet below ground), and 62 feet wide. The main portion of the facility — called the "canyon" because of the large open area inside — is approximately 860 feet long and contains 11 separate areas that housed the fuel-processing equipment. During its operating life, PUREX supplied about two-thirds of the plutonium produced by the United States.

Future

Today workers are focused on risk-reduction activities to prepare the contaminated PUREX canyon and support facilities for demolition. This work includes deactivation and decontamination activities, such as removal of hazardous and radiological waste, and demolition and stabilization. Workers also perform surveillance and maintenance of the PUREX complex to keep the facility in a safe configuration through the demolition and stabilization processes.

Workers drain old chemical-feed lines.

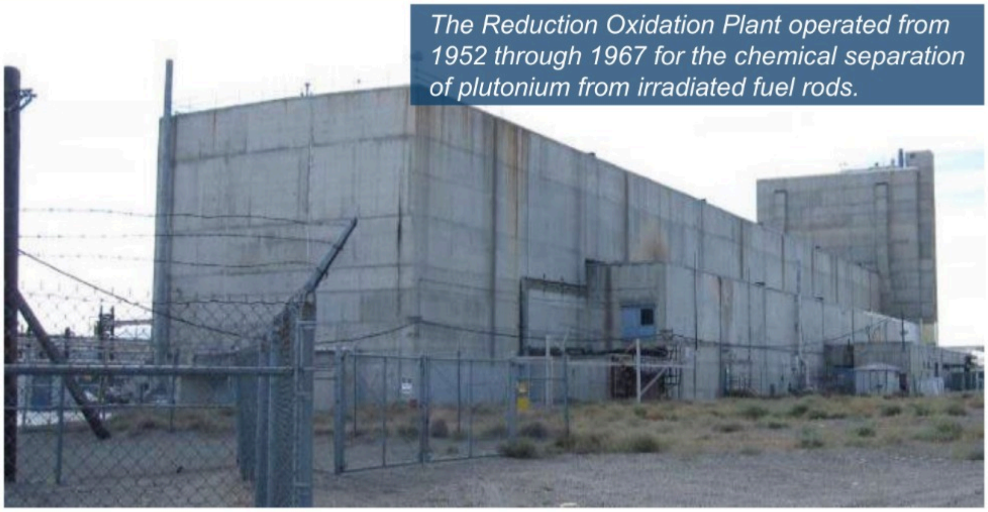


Workers are removing hazards such as asbestos on old pipelines at the facility.

Aging former support facilities are being demolished and removed prior to demolition of the main facility.

Reduction Oxidation Plant

Fact Sheet – January 2024



The Reduction Oxidation Plant operated from 1952 through 1967 for the chemical separation of plutonium from irradiated fuel rods.

The U.S. Department of Energy and contractor Central Plateau Cleanup Company are working to reduce the risks of aging facilities, such as the Reduction Oxidation Plant (REDOX), across the Hanford Site.

Background

The REDOX was the fourth of five processing facilities on the Hanford Site. The REDOX was used from 1952 through 1967 for the chemical separation of plutonium and uranium from irradiated fuel rods. The facility is 470 feet long and 160 feet wide.

The facility processed approximately 24,000 tons of uranium fuel rods during operations. It had the capacity to process up to 12 tons of uranium each day, compared to about 1.5 tons for Hanford's B Plant and T Plant. The REDOX used a solvent extraction process, which was more efficient at extracting plutonium than previous processes. Operations at REDOX also consolidated plutonium processing, which previously required multiple facilities and processes, into one building.

Future

In December 2023 workers completed a major upgrade to the facility's ventilation system to support future cleanup activities. Workers continue surveillance and maintenance activities to keep the facility in a safe condition and ensure compliance with environmental regulations. Workers are also removing radiological and chemical hazards from the plant to prepare the facility for demolition, including asbestos, process equipment and piping, and ancillary structures such as chemical tanks.

Removal of the Plutonium Recovery Cage is a key risk-reduction activity at the Reduction Oxidation Plant.

A new ventilation system supports future cleanup activities inside the facility.

Workers are preparing to demolish tanks that supplied chemicals during fuel processing.

222-S Laboratory Complex

THE HANFORD SITE

Fact Sheet – January 2024

The 222-S Laboratory complex is located near the center of the Hanford Site in the 200 West Area.

The laboratory has 11 hot cells, which allow crews to remotely handle and analyze radioactive samples.

222-S Laboratory Overview

The 222-S Laboratory is the primary on-site laboratory for analysis of highly radioactive samples in support of all Hanford Site projects.

U.S. Department of Energy contractor Hanford Laboratory Management and Integration has the sole responsibility for operating, managing and maintaining the lab. Analyses are performed on a wide variety of air, liquid, soil, sludge and biological samples.

The laboratory studies the physical and chemical characteristics of waste to support retrieving waste from Hanford's large underground tanks, provides data to support tank closure requirements, and supports the Vadose Zone Program, which tests for potential threats to groundwater.

The contractor is supporting Hanford's Direct-Feed Low-Activity Waste (DFLAW) Program, which will treat tank waste by immobilizing it in glass for safe disposal. During 24/7 DFLAW treatment operations, laboratory staff will characterize tank waste to ensure it is suitable to be treated at the Site's Waste Treatment and Immobilization Plant.

222-S Laboratory Quick Facts

History: Operations began in 1951 to support producing plutonium for the nation's defense.

Facility: The laboratory is a 70,000-square-foot facility with several support buildings.

Equipment: The laboratory contains more than 100 pieces of analytical equipment, 156 fume hoods, 46 remote manipulators to perform work, and 11 hot cells.

Central Waste Complex

Fact Sheet – January 2024

At Hanford's Central Waste Complex, chemical and radioactive waste is stored until it can be treated, repackaged and disposed of.

The U.S. Department of Energy and contractor Central Plateau Cleanup Company are safely and compliantly managing radioactive and hazardous waste stored at the Central Waste Complex at the Hanford Site in southeastern Washington state.

Background

The Central Waste Complex (CWC) is a radioactive- and hazardous-waste storage facility located on the Hanford Site's Central Plateau. The CWC has approximately 300,000 square feet of storage space — the equivalent of six football fields — and stores approximately 11,000 waste containers that are mostly 55-gallon drums in buildings and outdoor storage areas.

The waste at CWC is mixed low-level waste, transuranic and transuranic mixed waste. Mixed waste contains both chemical and radioactive constituents. Transuranic waste consists of tools, rags, protective clothing, sludges, soil and other materials contaminated with radioactive elements, mostly plutonium, and it requires disposal in a geologic repository. The wastes come from on-site sources, such as projects to retrieve waste from burial grounds and deactivation and decommissioning work. Some waste originated from off-site sources, such as the Rocky Flats site in Colorado.

Mission

The CWC stores chemical and radioactive waste until it can be shipped for treatment and/or disposal. Mixed low-level waste will be disposed of at an on-site permitted landfill and transuranic waste will be shipped to the Waste Isolation Pilot Plant in New Mexico beginning in 2028. The CWC facilities can be viewed using the self-guided Hanford Virtual Tour.

Workers at a Central Waste Complex outside storage area load a container of waste for shipment to a local waste management facility for repackaging.

Waste boxes in storage at the Central Waste Complex after repackaging at a local waste management facility.

Transuranic waste being loaded into a special monitor to determine its radioactivity content.

Environmental Restoration Disposal Facility

Fact Sheet – January 2024

The Environmental Restoration Disposal Facility supports cleanup activities across the Hanford Site.

The U.S. Department of Energy and contractor Central Plateau Cleanup Company are safely and compliantly operating the Environmental Restoration Disposal Facility (ERDF) at the Hanford Site in southeastern Washington state.

Background

The ERDF is a large engineered landfill located in the center of the Hanford Site. The facility is used for the disposal of low-level radioactive, chemical and mixed wastes generated from demolition, remediation and other cleanup activities across the Site. The facility began operating in 1996 and is regulated by the U.S. Environmental Protection Agency under the federal *Comprehensive Environmental Response, Compensation, and Liability Act*. The ERDF contains double-lined disposal cells with a drainage system that collects potentially contaminated water from rain and dust-suppression activities, which has come in contact with the waste. The facility covers an area of approximately 107 acres and its size provides tremendous flexibility in disposing of different waste forms, ranging from soils to large pieces of contaminated equipment.

The ERDF has been expanded from its original two cells to include six additional disposal cells and two Super Cells (each equivalent to two original cells). It can be expanded as needed to increase capacity to support ongoing Hanford cleanup activities. To date, nearly 19 million tons of waste have been disposed of at ERDF.

Mission

The ERDF provides compliant disposal of waste generated from Hanford Site cleanup. It currently supports disposal of waste generated from Hanford's Tank Farms and 100 K Area facility deactivation, demolition and waste site remediation, among other projects. The ERDF can be viewed using the self-guided Hanford Virtual Tour.

Rolling containers are used to offload bulk waste into the facility's disposal cells.

Workers use a crane to place a large item into a Super Cell for disposal.

The Environmental Restoration Disposal Facility can accept various types of waste generated during Hanford Site cleanup.

Hanford Tank Farms

Fact Sheet – January 2024

Underground Waste Storage

Hanford is home to 177 underground waste storage tanks: 149 single-shell tanks (SST) and 28 double-shell tanks (DST), ranging from 0.055 to 1.265 million gallons in capacity. Those tanks are organized into 18 different groups, called farms.

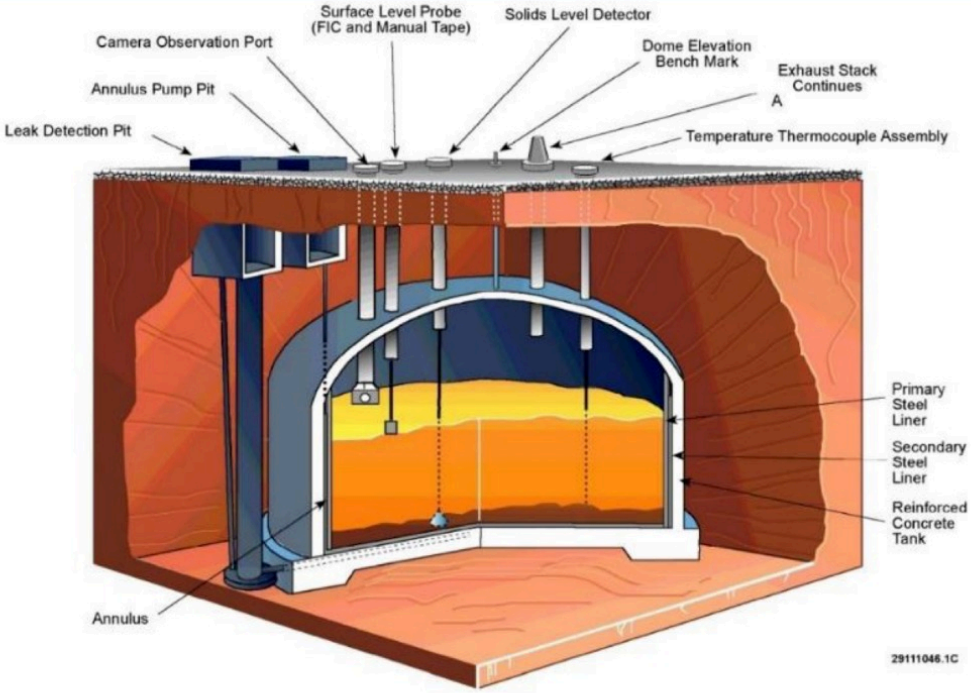
During the nation's defense effort in World War II, Hanford was built with secrecy and speed while workers did their best to safeguard the environment by building nuclear-waste storage tanks.

The first SSTs were put into service in 1944 and were designed to be in use for about 20 years. They were built with a carbon-steel liner surrounded by a layer of thick, steel-reinforced concrete and buried 10 feet below the ground. In the 1950s some of the SSTs began leaking waste into the surrounding soil. The waste in the tanks has now been stabilized by removing all free liquid from it, minimizing the chance of further leakage.

Tank Farms under construction.

Hanford Double-Shell Tanks

Fact Sheet – January 2024



The U.S. Department of Energy (DOE) and contractor Washington River Protection Solutions (WRPS) are committed to maintaining the integrity and safe operating condition of Hanford's double-shell tanks (DST). The DSTs store waste and receive additional waste from Hanford's single-shell tank-waste retrieval (transfer) actions. The DSTs will support feeding waste to Hanford's low-activity waste vitrification (immobilization in glass) facility at the Waste Treatment and Immobilization Plant.

Hanford's 28 DSTs were constructed between 1968 and 1986. They range in capacity from 1 million to 1.265 million gallons and contain three waste forms: sludge, saltcake and supernatant. The sludge contains insoluble metal wastes and fission products. The saltcake contains evaporated soluble salts. The supernatant is liquid containing dissolved salts and soluble fission products.

Each DST consists of a primary carbon-steel tank inside a secondary carbon-steel liner, surrounded by a reinforced concrete shell. The primary tank rests on an 8-inch-thick insulating slab, separating it from the liner and providing air circulation and leak-detection slots under the bottom of the primary tank. There is a 30-inch-wide air space called the annulus between the liner and tank, which allows inspections of the outside of the tank and inside of the liner. Tank monitoring technologies include robotic equipment and ultrasonic inspections.

Tank AP-106 Operational History

Tank AP-106 is one of eight DSTs that make up Hanford's AP Tank Farm. The tank was placed into service in 1986 and has recently been emptied of all waste in preparation to be repurposed for other waste storage.

The tank is key to DOE's direct-feed low-activity waste approach to treating tank waste. The tank will receive waste treated by the Tank-Side Cesium Removal System and be used as the feed tank for low-activity waste vitrification (immobilization in glass).

Tank capacity: Approximately 1.2 million gallons

Most recent core sample: 2019

Most recent annulus visual inspection: 2023

Next annulus visual inspection: 2027

Most recent ultrasonic testing inspection: 2024

Next ultrasonic testing inspection: 2034

Air-slot visual inspection: 2024

A/AX Tank Farms Retrievals

Fact Sheet – January 2024

Aerial view of Hanford's AX Tank Farm

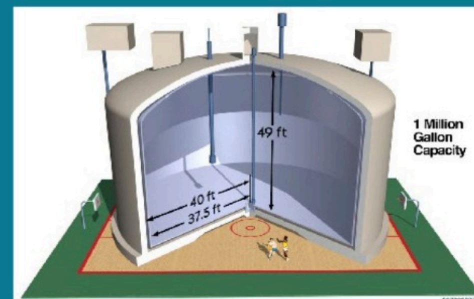
The U.S. Department of Energy (DOE) and contractor Washington River Protection Solutions are retrieving waste from underground storage tanks in the A and AX Tank Farms on the Hanford Site in southeastern Washington state.

Background

Hanford's A and AX Tank Farms consist of six 1-million-gallon single-shell tanks constructed between 1953 and 1955 (A Tank Farm) and four 1-million-gallon single-shell tanks constructed between 1963 and 1965 (AX Tank Farm). The A and AX Tank Farms are part of the overall Hanford Site legacy of 56 million gallons of radioactive and chemical waste stored in 156 underground tanks. The waste is left over from World War II and Cold War production of nuclear materials for the nation's defense. Due to the ages of the single-shell tanks, the waste inside must be retrieved (transferred) to newer, double-shell tanks. Retrieval requirements are driven by a U.S. District Court order and an agreement between the DOE, U.S. Environmental Protection Agency and Washington State Department of Ecology.

Mission

The overall mission of A/AX Tank Farms retrieval is to safely retrieve tank waste from the aging, single-shell tanks into newer, double-shell tanks until it can be treated for safe disposal. The A/AX Tank Farms facilities can be viewed using the self-guided Hanford Virtual Tour.



Typical 1-million-gallon tank.

Workers prepare Tank A-101 for future waste-retrieval activities.

High-pressure water is used to break up waste in Tank AX-101.

U.S. DEPARTMENT OF ENERGY

Hanford Tank B-109 Overview

THE HANFORD SITE

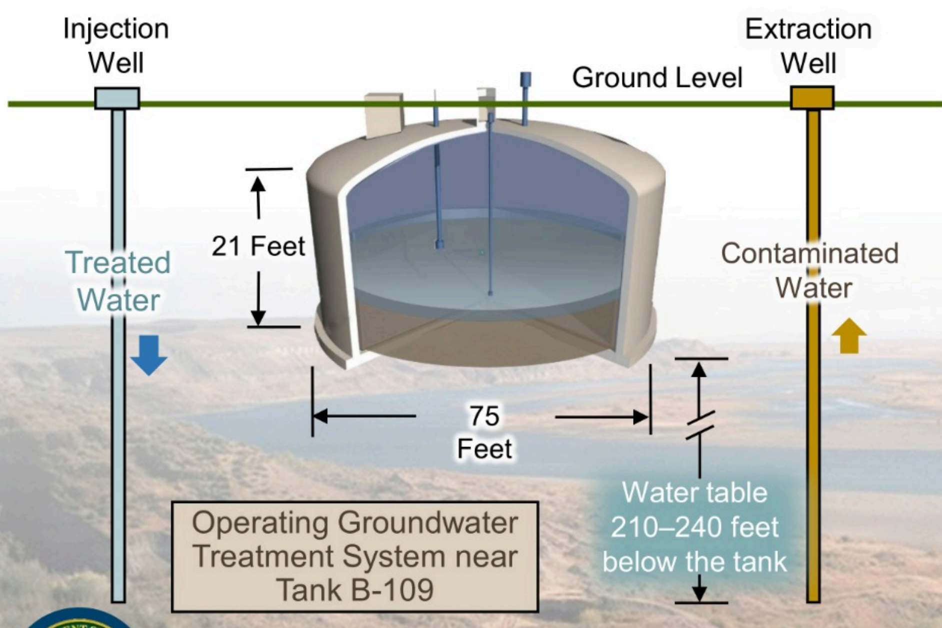
Fact Sheet – January 2024

The Department of Energy (DOE) has determined that underground waste-storage Tank B-109 is likely leaking to the soil beneath it; however, there is no increased health or safety risk to Hanford workers or the public.

Contamination in the tank area is not a new issue and mitigation actions have been in place for years. Active groundwater treatment systems operating in the area were installed several years ago to capture and treat contamination resulting from the discharge of approximately 52 million gallons of contaminated liquids to the surrounding soils during historical operations to produce materials for the U.S. nuclear weapons program.

Tank B-109 was previously emptied of pumpable liquids, leaving a very small amount of liquid waste in the tank. The water table in the area ranges from 210 to 240 feet below Tank B-109. DOE estimates it could take more than 25 years for any contamination from Tank B-109 to reach the water table. The contamination would then be captured and removed by the groundwater treatment systems in place.

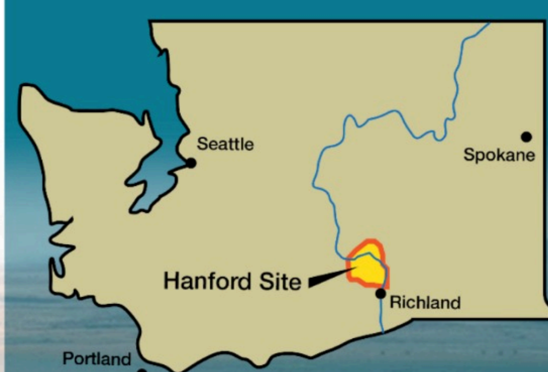
Design work is underway for the installation of an interim surface barrier over the B Tank Farm to prevent water from rain and snowmelt from pushing existing contaminants to the groundwater. Construction is expected to begin in 2028. Safely managing all Hanford tank waste is a top priority for DOE. When it comes to the overall long-term tank waste mission, DOE continues to focus on safe, efficient and effective tank-waste treatment capabilities.



Tank B-109

Key Takeaways

- There is no increased risk to the Hanford Site workforce or the public.
- The tank was previously emptied of pumpable liquids, leaving a very small amount of liquid waste in the tank.
- Contamination in this area is not new and mitigation actions have been in place for years.
- Existing groundwater treatment systems will capture and treat any contamination that may reach groundwater.
- DOE continues to assess and explore other capabilities to reduce the release of contaminants to the environment.

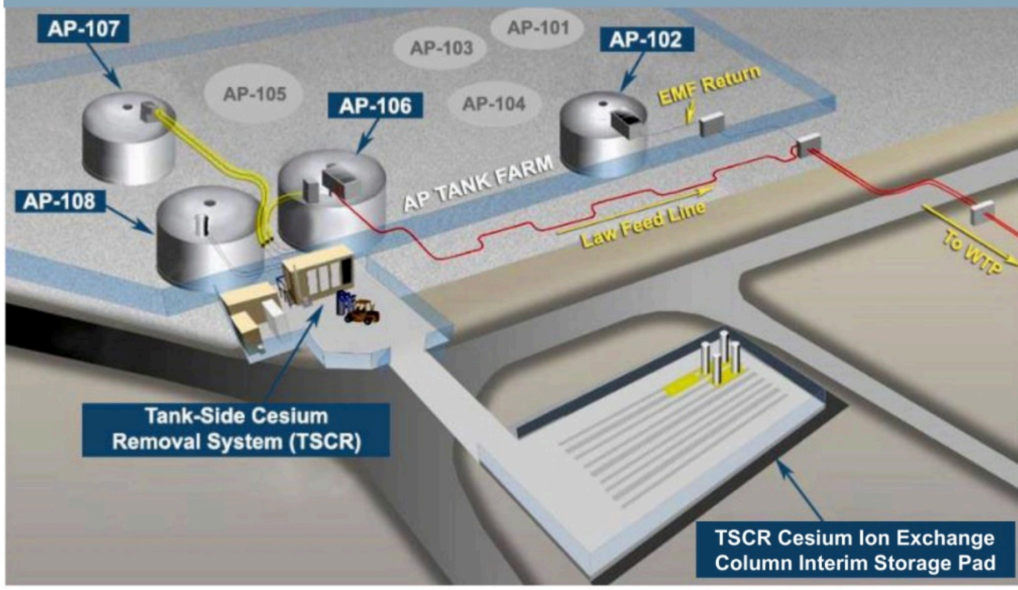


U.S. DEPARTMENT OF ENERGY

THE HANFORD SITE

Tank-Side Cesium Removal

Fact Sheet – January 2024



Background

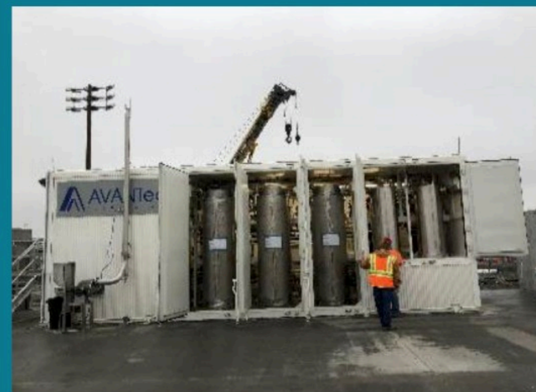
The Tank-Side Cesium Removal (TSCR) System filters undissolved solid material and removes cesium from liquid waste. These materials account for 99.9% of the radioactivity in the waste stream. The system provides a low-activity waste stream that can be sent to Hanford's Waste Treatment and Immobilization Plant's (WTP) Low-Activity Waste Facility for vitrification (immobilization in glass). The system is located just outside Hanford's AP Tank Farm, which stores the waste before and after TSCR treatment. The system is comprised of a main process enclosure, a control room, and ancillary enclosures containing support systems. The system uses three specialized filters called ion exchange columns to remove radioactive cesium from the waste stream. As part of the U.S. Department of Energy's comprehensive Direct-Feed Low-Activity Waste Program, the TSCR System provides the following benefits:

- Treats liquid waste to provide low-activity waste feed for the WTP
- Creates space in double-shell waste-storage tanks, the first step to feeding waste to the WTP
- Supports phased mission progress and a scale-up of treatment capabilities
- Entails a small modular approach, resulting in lower costs

Phased Approach for Cesium Removals

- The TSCR demonstration project is a modular at-tank cesium-removal capability.
- The Advanced Modular Pretreatment System will address the need for a long-term cesium removal capability. This phase is planned to commence after the TSCR demonstration project has operated for sufficient time to inform a subsequent alternatives analysis.

The TSCR facility can be viewed using the self-guided [Hanford Virtual Tour].



Tank-Side Cesium Removal System enclosure with the bay doors open.

Inside the Tank-Side Cesium Removal System.

Spent ion exchange columns on the Tank-Side Cesium Removal System storage pad.

U.S. DEPARTMENT OF ENERGY

Test Bed Initiative

Fact Sheet – January 2025

An internal storage-tank filter system for pretreating low-activity tank waste

Pretreated waste will be shipped off-site in federally certified and regulated shipping containers called totes.

Background

The U.S. Department of Energy (DOE) is responsible for managing nearly 56 million gallons of radioactive and chemical waste generated from the Hanford Site's national defense role during World War II and the Cold War. The waste, stored in underground tanks on the Site, must be treated in accordance with the federal and state disposal regulations.

Test Bed Initiative

DOE is pursuing a waste disposal option called a Test Bed Initiative (TBI) to determine the suitability of Hanford's waste for off-site disposal. The TBI could significantly enhance the tank waste mission by providing an additional treatment option. A 2017 TBI demonstration indicated it is possible to pretreat Hanford's liquid low-activity tank waste by removing certain radioactive components. This allows the resulting pretreated low-level waste to be stabilized into a solid form by mixing it with cement-like grout and then disposed of at an out-of-state commercial disposal facility.

In October 2024 DOE finished pretreating nearly 2,000 gallons of tank waste to demonstrate the feasibility of low-level waste off-site disposal. The process used an internal tank filter system to pretreat the liquid waste by filtering out key radioactive components. The pretreated waste was collected in portable shipping containers called totes, designed and certified to meet federal transportation requirements. The totes will be sent to licensed off-site waste disposal facilities for final treatment and disposal of the waste. Recent lab analysis of the pretreated waste showed that its radioactivity is 80% lower than maximum levels allowed for shipment in the totes that will be used. Lab results confirm that the totes are sturdier and more robust than necessary to provide safe, off-site transportation.

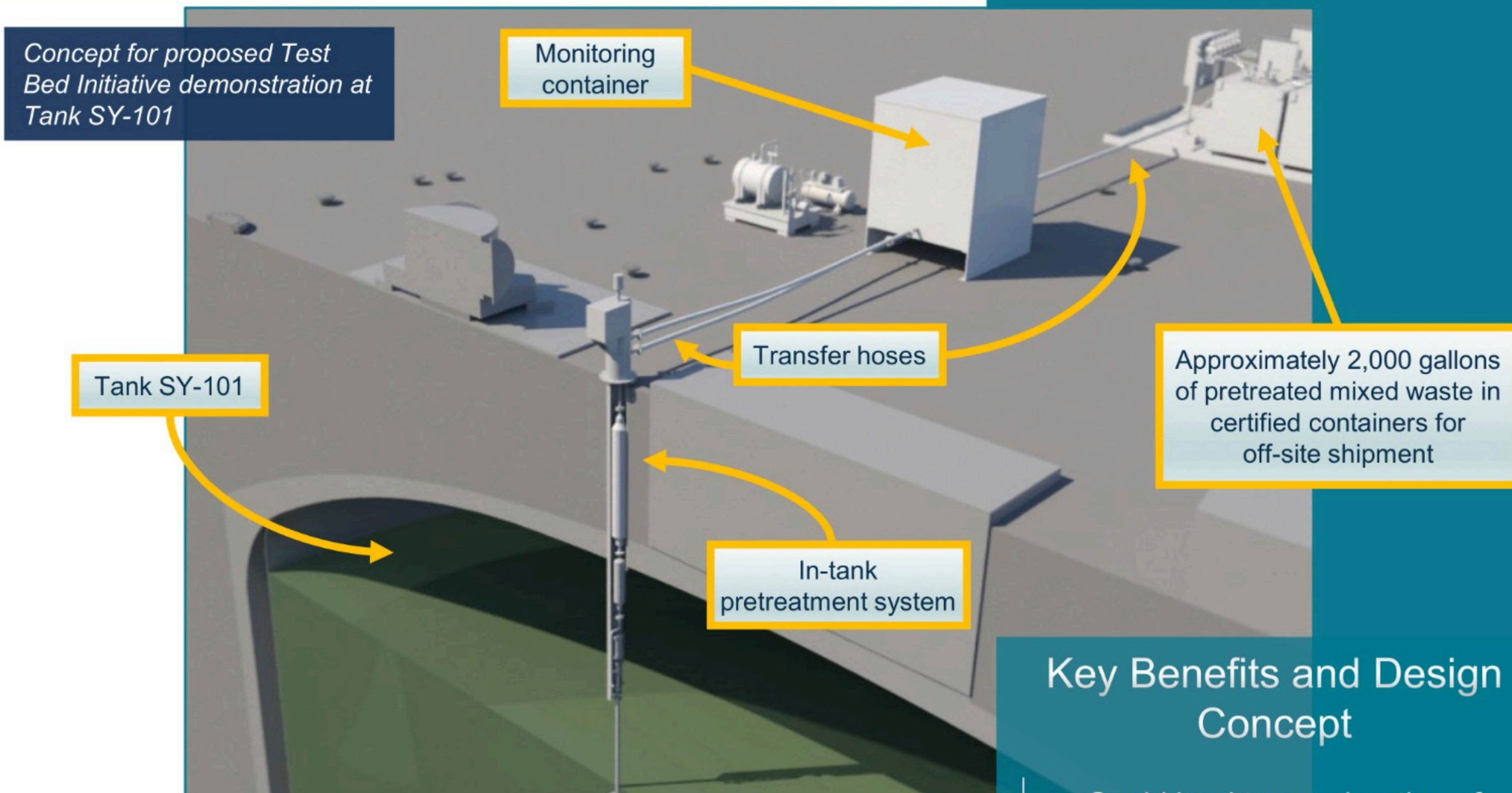
Conclusion

DOE continues to explore new and innovative ways to perform its cleanup mission to ensure the safety of its workforce, the public and the environment. The TBI approach can be used in Hanford locations with limited existing infrastructure to create valuable tank-waste storage space. The initiative uses existing technology and off-site commercial facilities to permanently remove waste from Hanford.

Low-Level Waste Off-site Disposal

THE HANFORD SITE

Fact Sheet – January 2024



Background

The U.S. Department of Energy (DOE) is pursuing an end-state, waste characteristics-driven approach to waste treatment, which would open an additional waste disposal pathway that could significantly enhance the Hanford cleanup mission. The DOE is pursuing these activities to initiate ways to reduce cleanup costs and accelerate the cleanup schedule. A demonstration in 2017 provided the necessary proof-of-concept to treat tank waste from the Hanford Site. This demonstration allowed for mixed low-activity waste from Hanford to be sent to an off-site commercial treatment facility, followed by off-site disposal. The approach leverages waste treatment technology advancements, along with regulatory changes for commercial facilities, to allow disposal of mixed low-level radioactive waste resulting from pretreated tank waste.

Successful deployment of this approach in the Hanford 200 West Area could economize existing tank storage space, reduce risks, and achieve safe, meaningful, and near-term reduction in environmental risk and liability.

Key Benefits and Design Concept

- Could lead to acceleration of the tank waste mission
- Creates space in waste-storage tanks
- Removes cesium and solids to separate mixed low-activity waste from tank waste
- Moves stabilized-waste disposal out of state
- Simple design limits costs and addresses safety
- Could lead to significant cost savings that could be used to accelerate other Hanford tank waste priorities
- Uses existing tank equipment
- Demonstrates a waste removal approach for areas of limited infrastructure

THE HANFORD SITE

Waste Treatment and Immobilization Plant

Fact Sheet – January 2024

The Low-Activity Waste Facility at Hanford's Waste Treatment and Immobilization Plant.

The U.S. Department of Energy (DOE) and contractor Bechtel National Inc. are safely and compliantly constructing the Waste Treatment and Immobilization Plant (WTP) and associated support facilities at the Hanford Site in southeastern Washington state, in preparation for immobilizing tank waste in glass for safe disposal.

Overview

As originally envisioned, the Hanford WTP would treat high-level and low-activity radioactive waste simultaneously. To begin treating waste as soon as practicable, DOE developed a sequenced program that would treat low-activity waste first, in 2025. DOE expects to begin treating high-level waste about a decade later.

The program is called direct-feed low-activity waste (DFLAW). It sends pretreated low-activity waste from Hanford's Tank Farms, where the waste is stored, directly to the Low-Activity Waste (LAW) Facility at the WTP.

In a process called vitrification, the low-activity waste will be sent to the LAW Facility and mixed with glass-forming materials and then fed into two 300-ton melters and heated to 2,100 degrees Fahrenheit. The melters are approximately 20 feet by 30 feet and 16 feet high. The glass mixture will then be poured into stainless steel containers, each of which holds 6.6 tons of waste.

Several WTP infrastructure facilities, collectively called the Balance of Facilities (BOF), have been modified to support the LAW Facility and Effluent Management Facility (EMF), which will process liquid secondary waste, called effluent, generated by the LAW Facility. When operational, the LAW Facility will produce up to five containers of waste each day, which will be disposed of at Hanford's Integrated Disposal Facility.

Background

The Hanford Site, located in southeastern Washington state, was used to produce plutonium over a 40-year period, helping end World War II and playing a major role in the nation's defense efforts during the Cold War. As a result, 56 million gallons of radioactive and chemical wastes are now stored in 158 underground tanks on the Hanford Site. To address this challenge, DOE contracted Bechtel National Inc. to design and build the world's largest radioactive-waste treatment plant.

The WTP will use a process called vitrification to immobilize Hanford tank waste in glass. The glass form is stable and impervious to the environment. In this form, the waste's radioactivity will dissipate over hundreds to thousands of years.

Construction Facts for Low-Activity Waste Facility

SIZE: 330 feet by 240 feet by 90 feet tall

CONCRETE: 28,500 cubic yards

STRUCTURAL STEEL: 6,200 tons

HVAC DUCTWORK: 943,500 pounds

PIPING: 103,000 feet

ELECTRICAL CABLE: 843,000 feet

CRAFT HOURS TO BUILD: 2,337,000 hours

U.S. DEPARTMENT OF ENERGY

Direct-Feed Low-Activity Waste Program

THE HANFORD SITE

Fact Sheet – January 2024

Background

The U.S. Department of Energy (DOE) is on the verge of achieving a cleanup commitment decades in the making: treating Hanford's tank waste using the Direct-Feed Low-Activity Waste (DFLAW) Program. Tank-waste treatment is a key component of DOE's strategic cleanup vision. "Direct-feed" means Hanford's tank waste will be separated to remove the more radioactive portion (cesium and solids) so that the resulting low-activity (less-radioactive) waste can be fed directly to the Waste Treatment and Immobilization Plant's (WTP) Low-Activity Waste (LAW) Facility for immobilization in glass.

DFLAW is a collection of interdependent projects and infrastructure, managed as a program, that will operate together to vitrify (immobilize within glass) and dispose of low-activity waste. Supporting DFLAW requires significant upgrades to Hanford Site infrastructure and coordination and integration among DOE field offices and Hanford contractors. DFLAW will be the most highly integrated operational program at Hanford and in the DOE complex. The DFLAW facilities can be viewed using the self-guided Hanford Virtual Tour.

Mission

Safely, efficiently and effectively treat Hanford tank waste.

Vision

Unified, prepared and empowered team driven to achieving effective tank waste treatment.

Supporting DFLAW

The DFLAW Program is one of the highest priorities in the DOE Office of Environmental Management portfolio. The program requires a sitewide commitment to excellence to drive the cultural, operational and performance transformation necessary to integrate efforts for 24/7 sitewide operations to immobilize tank waste in glass.

The One Hanford focus continues to shape conditions for DFLAW mission success and the transition to production operations.

U.S. DEPARTMENT OF ENERGY

THE HANFORD SITE

242-A Evaporator

Fact Sheet – January 2024

The 242-A Evaporator is a vital facility for tank space management, supporting the Direct-Feed Low-Activity Waste Program and tank waste retrieval.

The U.S. Department of Energy and contractor Washington River Protection Solutions are safely and compliantly operating and upgrading the 242-A Evaporator, managing tank waste volume at the Hanford Site in southeastern Washington state.

Background

The 242-A Evaporator is located near the center of the Hanford Site in the 200 East Area. Since its construction in 1977, the evaporator has removed more than 81 million gallons of liquid from radioactive and chemical waste stored in Hanford's large underground tanks. The evaporator boils liquid tank waste to evaporate water and reduce the waste's volume. This creates more space in the tank storage system to receive waste retrieved from older tanks, to meet cleanup milestones. As Hanford prepares to treat tank waste for safe disposal under the Direct-Feed Low-Activity Waste Program, workers are upgrading the evaporator and other Site facilities to support 24/7 treatment operations.

Mission

The evaporator mission is to create more storage in the tank system by evaporating water from liquid tank waste. This supports continued operations to retrieve waste from Hanford's older tanks for treatment and safe disposal.

Control room operators for the 242-A Evaporator train on a simulator.

242-A Evaporator at night.

Replacement transfer lines between waste-storage tanks and the 242-A Evaporator.

Liquid Waste Processing Facilities

Fact Sheet – January 2024

The Liquid Waste Processing Facilities include the Liquid Effluent Retention Facility (above) and the Effluent Treatment Facility (below).

The U.S. Department of Energy and contractor Washington River Protection Solutions are managing and upgrading the Liquid Waste Processing Facilities at the Hanford Site in southeastern Washington state to prepare for waste treatment in support of Hanford's Direct-Feed Low-Activity Waste (DFLAW) Program.

Background

The Liquid Waste Processing Facility (LWPF) is comprised of the following systems that work together to fulfill its mission for the Hanford Site:

- Liquid Effluent Retention Facility (LERF): a set of retention basins designed to store liquid waste until it can be processed at the Effluent Treatment Facility
- Effluent Treatment Facility (ETF): a processing plant where chemical and radioactive contaminants are removed from the liquid waste
- State-approved Land Disposal Site (not pictured): a system used for discharging verified treated effluent from the ETF to the environment
- Treated Effluent Disposal Facility (not pictured): a system used for discharging nonhazardous Hanford waste to two state-approved infiltration basins

Mission

The facilities will store, treat and dispose of large volumes of liquid waste from the Hanford Site as the last step in the cleanup process. Upon startup of the Waste Treatment and Immobilization Plant, LWPF operations will expand to manage liquid waste from the plant's Effluent Management Facility.

Upgrade of the Effluent Treatment Facility to enhance reliability during direct-feed low-activity waste operations.

An additional electrical house was added to provide power to new facility infrastructure needed to support direct-feed low-activity waste operations.

The Effluent Treatment Facility load-in building will enhance facility throughput during direct-feed low-activity waste operations.

U.S. DEPARTMENT OF ENERGY

THE HANFORD SITE

Integrated Disposal Facility

Fact Sheet – January 2024

Aerial view of the Integrated Disposal Facility at the Hanford Site, November 2023.

The U.S. Department of Energy and contractor Central Plateau Cleanup Company are preparing the Integrated Disposal Facility at the Hanford Site in southeastern Washington state to receive vitrified (immobilized in glass) low-activity waste and mixed low-level waste from Hanford Site cleanup operations.

Background

The Integrated Disposal Facility (IDF) is a federal *Resource Conservation and Recovery Act* disposal facility that will accept low-level radioactive, chemical and mixed wastes. It is in the central part of the Hanford Site. The IDF is an engineered landfill consisting of two large, double-lined disposal cells with a drainage system that collects potentially contaminated water from rain and dust-suppression activities, which has come in contact with the waste.

The IDF is approximately 1,500 feet wide, 765 feet long and 45 feet deep. The facility was designed to be expanded as needed. Waste will be containerized and treated or stabilized before disposal. Construction activities at IDF were completed in late 2023 and startup of IDF operations will align with the start of operations at Hanford's Waste Treatment and Immobilization Plant in 2025.

Mission

The IDF primary mission is to support 24/7 operations of Hanford's Direct-Feed Low-Activity Waste Program. The program will treat millions of gallons of low-activity radioactive and chemical waste from Hanford's large underground tanks using vitrification (immobilization in glass) for safe disposal, and treat secondary waste from the Waste Treatment and Immobilization Plant. The IDF will receive more than 200,000 containers over its operational life. The IDF can be viewed using the self-guided Hanford Virtual Tour.

This 80-by-80-foot concrete pad at the Integrated Disposal Facility will be used to stage some waste prior to encasing it in a special cement-like substance.

The Integrated Disposal Facility includes two 400,000-gallon tanks to collect potentially contaminated water from rain and dust-suppression activities.

A special transporter will carry containers of vitrified waste to the Integrated Disposal Facility during direct-feed low-activity waste operations.

Analytical Laboratory

Fact Sheet – January 2024


Hanford's Analytical Laboratory will analyze samples during the waste vitrification (immobilization in glass) process.


Chemists inside the Analytical Laboratory, May 2022.

Analytical Laboratory Overview

The Hanford Waste Treatment and Immobilization Plant (WTP) will use the process of vitrification to treat most of Hanford's tank waste. Vitrification involves immobilizing the waste in a solid glass form that is stable and impervious to the environment. In this form, its radioactivity will dissipate over hundreds to thousands of years. Initially, the WTP will begin treatment of low-activity tank waste in support of the Direct-Feed Low-Activity Waste (DFLAW) Program.

The WTP waste vitrification process involves multiple steps of waste separation and preparation. The function of the Analytical Laboratory (LAB) is to analyze samples at key stages of the vitrification process to ensure the glass product meets all regulatory requirements and standards.

The LAB will receive samples from waste separation and preparation processes throughout the WTP site and is designed to process over 10,000 waste samples per year. During DFLAW operations, LAB technicians will analyze approximately 3,000 samples per year. Process samples will be delivered to the LAB via an automatic sampling system using a series of vacuum pumps and ductwork to transport samples between WTP facilities. Sample analysis will allow LAB technicians to ensure correct performance of process systems, verify the correct glass-forming "recipe" needed to produce a consistent glass product, and confirm a high-quality glass product that meets all regulatory requirements and standards.

Analytical Laboratory Construction Facts

SIZE: 320 feet by 180 feet by 45 feet tall

CONCRETE: 12,000 cubic yards

STRUCTURAL STEEL: 1,800 tons

HVAC DUCTWORK: 314,500 pounds

PIPING: 35,000 feet

ELECTRICAL CABLE: 172,000 feet

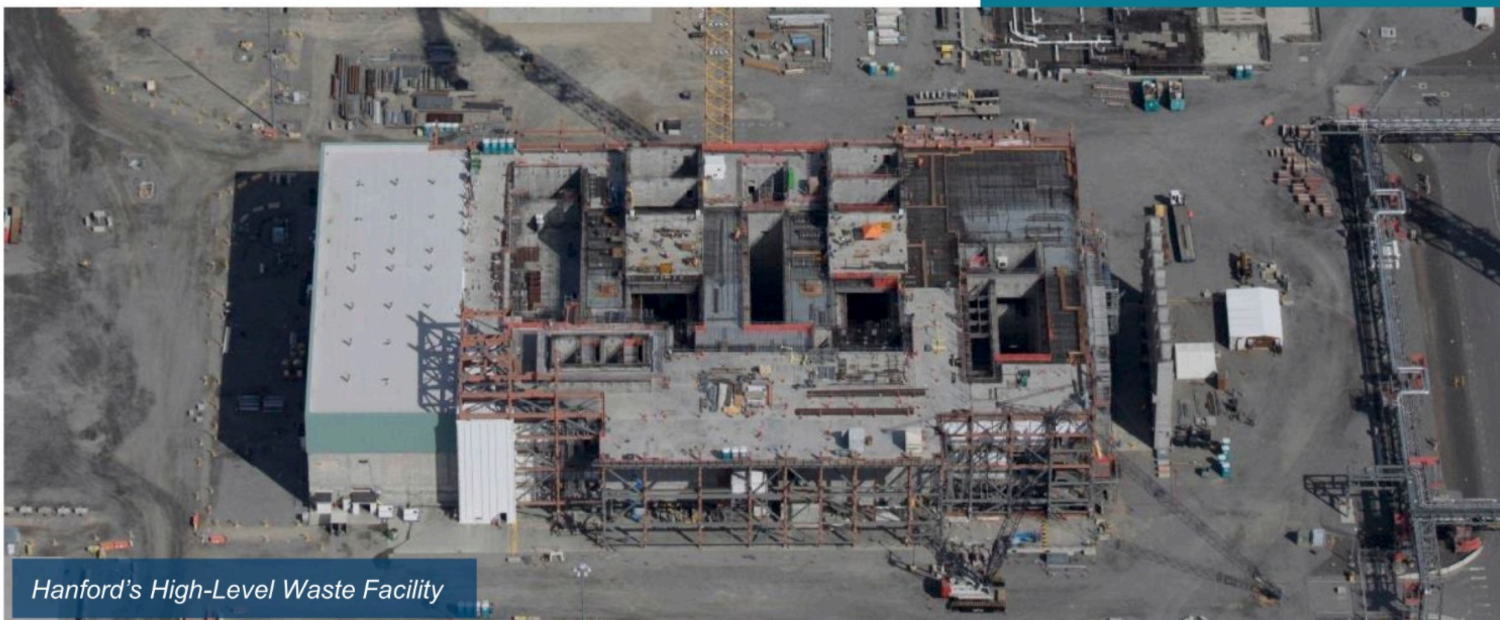
CRAFT HOURS TO BUILD: 635,000 hours

The LAB can be viewed using the self-guided Hanford Virtual Tour.

U.S. DEPARTMENT OF ENERGY

High-Level Waste Facility

Fact Sheet – December 2023



Hanford's High-Level Waste Facility

Overview

The U.S. Department of Energy (DOE) is committed to treating all Hanford tank waste in a safe, effective and efficient manner. DOE and its contractor partners are achieving important progress with Hanford's tank waste mission, demonstrated through preparations to treat low-activity waste under the Direct-Feed Low-Activity Waste (DFLAW) Program:

- 2022: Achieved large-scale tank waste treatment for the first time, using the Tank-Side Cesium Removal System, to treat waste to be fed directly to the Low-Activity Waste Facility at the Waste Treatment and Immobilization Plant (WTP) for vitrification, or immobilization in glass
- 2023: Successfully heated up the first WTP melter and produced the first test glass
- Achieved 76 of the 77 permits required to support the DFLAW Program

Hanford's progress in advancing the DFLAW Program is due in no small part to the alignment and shared focus among DOE and its contractor partners, the State of Washington, and the U.S. Environmental Protection Agency (EPA) on making tank waste treatment a top priority.

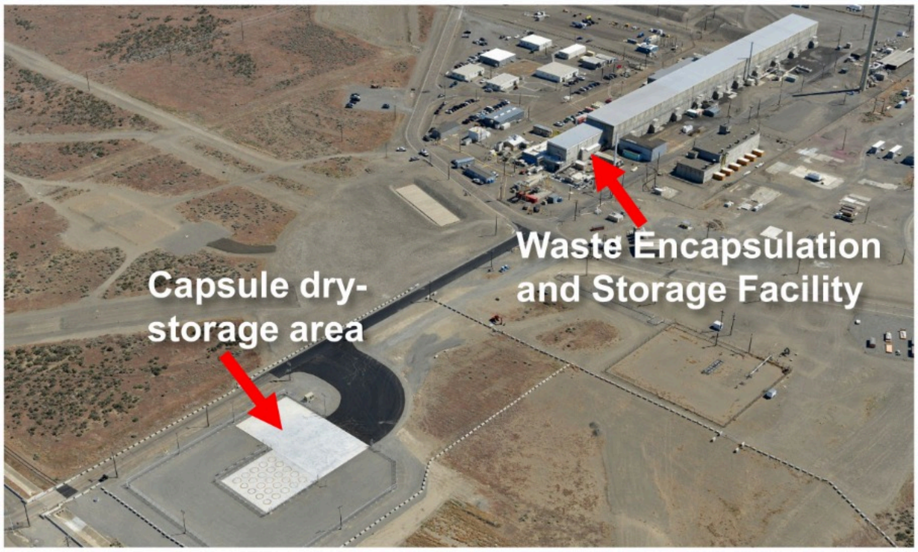
Building on that collaboration, and by applying lessons learned from recent DFLAW successes, DOE, the Washington State Department of Ecology (Ecology) and EPA are collaborating on establishing the path forward for the future vitrification of the high-level waste (HLW) fraction of the tank waste in the WTP HLW Facility.

The High-Level Waste Facility contains two identical, remotely operated melter caves.

Two 90-ton melters will produce a sturdy glass product in the High-Level Waste Facility.

Waste Encapsulation and Storage Facility

Fact Sheet – January 2024



The U.S. Department of Energy and contractor Central Plateau Cleanup Company are preparing to move some of Hanford's most hazardous waste from a water-filled basin to interim dry storage.

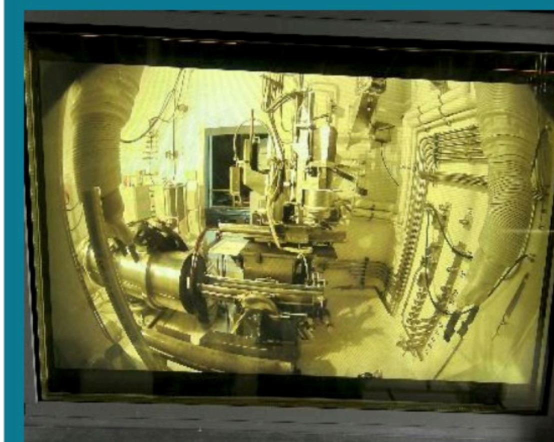
Background

The Waste Encapsulation and Storage Facility (WESF) provides safe and compliant underwater storage for 1,936 highly radioactive capsules containing cesium and strontium. In the 1970s, cesium and strontium were removed from underground waste-storage tanks at Hanford to reduce the temperature of the waste inside. Both elements were ultimately placed in sturdy, stainless steel capsules at WESF for safe storage and monitoring.

Mission

The cesium and strontium capsules are being safely stored at WESF until they can be transferred to interim dry storage pending final disposition. While the capsules are currently in a safe configuration, the WESF is an aging facility. Dry storage would eliminate the possibility of a release of radioactive material in the unlikely event of a loss of storage-pool water, and subsequent overheating and breach of the capsules. A mock-up facility for testing the capsule transfer equipment and for operator training has been constructed at Hanford. A dry-storage area for the concrete casks that will contain the capsules was completed in 2022. Installation of the capsule transfer equipment at WESF is planned to be complete in fall 2024 and transfer operations are expected to start in 2025. The transfer will allow for the eventual deactivation of WESF. The WESF can be viewed using the self-guided Hanford Virtual Tour.

The water around the cesium and strontium capsules stored in the Waste Encapsulation and Storage Facility pools glows blue. As the elements undergo radioactive decay, the radiation causes the water to produce the blue light known as Cherenkov Radiation.



Test equipment installed at a mock-up facility.

Concrete casks designed to hold cesium and strontium capsules are staged on an interim dry-storage pad.

THE HANFORD SITE

324 Building Disposition Project

Fact Sheet – August 2023

Background

The 324 Building, located in Hanford's 300 Area, supported research on radioactive materials from 1966 to 1996. Demolishing the building and remediating contaminated soil below the facility — designated the 300-296 Waste Site — are priorities for the U.S. Department of Energy (DOE) and contractor Central Plateau Cleanup Company (CPCCo), due to the facility's proximity to the Columbia River and city of Richland.

Demolition operations were postponed in 2010 after workers detected significant contamination in the soil under one of the building's "hot cells," which shielded workers from radiation while they used remotely operated equipment to conduct research. The contamination likely came from a spill of radioactive materials from one of the hot cells called B Cell.

While stabilizing the 324 Building in 2022 before excavating the contaminated soil through the floor of B Cell, CPCCo crews detected additional soil contamination. A 2023 analysis by CPCCo and the Pacific Northwest National Laboratory confirmed the area of contaminated soil is wider and deeper than previous measurements indicated.

Future

The 324 Building remains in a safe and stable configuration. The contaminated soil beneath the structure has remained stable for decades, and underground monitoring shows the contamination has not migrated toward groundwater.

Due to the larger volume of contaminated soil under the building and the additional challenges of maintaining an aging facility, DOE and CPCCo are revising demolition and remediation plans to use an approach that is safer for workers and the community and still protective of the Columbia River.

Working with the U.S. Environmental Protection Agency, DOE and CPCCo are resequencing the work. Crews will deactivate the facility, which includes grouting the B Cell and fixing in place any contamination; demolish the building; then construct a containment superstructure over the remaining foundation and remediate the contaminated soil below.

Crews will continue to monitor the soil and groundwater to ensure worker and public safety and health as they prepare the facility for demolition.

The 324 Building can be viewed using the self-guided Hanford Virtual Tour.

The 324 Building supported key projects, such as various waste treatment experiments and President Eisenhower's "Atoms for Peace" initiative.

Workers dressed in protective clothing remove waste from a hot-cell airlock for disposal.

Workers conduct annual maintenance on the 324 Building ventilation stack.

U.S. DEPARTMENT OF ENERGY

Additional Resources

Guests who would like to explore more can use the public resources below.

Hanford Videos

- Hanford 101: An Introduction
- Direct-Feed Low-Activity Waste Animation
- Vit Plant Melter Heatup Animation
- High-Level Waste 3D Process Animation
- Hanford Vit Plant Overview
- Hanford Made Video

Hanford Virtual Tour

https://vtours.hanford.gov/

These are public resources intended for independent educational viewing.

Sources and Disclaimer

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