WASHINGTON and OREGON

Hanford Site

Background

Located in southeastern Washington along the Columbia River, the 586-square mile Hanford Nuclear Site was the first and primary plutonium production facility for the United States' nuclear weapons program. The site, which began operations in 1944, includes nine closed reactors, five chemical separations plants, plutonium processing facilities, hundreds of waste burial grounds, more than 60 square miles of contaminated groundwater and 177 underground high-level waste (HLW) tanks containing 56 million gallons of highly radioactive waste.[1] Between the start of operations in 1944 and the shutdown of the last reactor in the late 1980s, Hanford produced more than two-thirds of the nation's estimated 111 metric tons of plutonium.

FIGURE 1: N Reactor at Hanford. Photo courtesy of U.S. Department of Energy.

The production of plutonium generated large amounts of radioactive and chemically hazardous waste. Currently, Hanford houses more than 60 percent of the nation's high-level radioactive waste.[2]

Hanford is the world's largest single environmental cleanup project, with an annual cleanup budget of approximately $2.4 billion.[3] The shift from operations to cleanup came in 1989, when the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency and the Washington State Department of Ecology signed the Hanford Federal Facilities Agreement Consent Order, also known as the Tri-Party Agreement.[4] The Tri-Party Agreement outlines legally enforceable milestones for all aspects of cleanup at Hanford, including tank waste removal and treatment, mixed waste treatment and disposal, environmental restoration activities and low-level waste (LLW) disposal.

Major Accomplishments

Since 1989, much has been accomplished given the enormity and complexity of the contamination, including:

[1] Exchange Monitor. (n.d.). The Hanford Waste Treatment Plant: A 21st century solution to a 70-year-old problem. Retrieved from https://www.exchangemonitor.com/long-form-stories/the-hanford-waste-treatment-plant-a-21st-century-solution-to-a-70-year-old-problem/.
[2] Exchange Monitor. (n.d.). The Hanford Waste Treatment Plant: A 21st century solution to a 70-year-old problem. Retrieved from https://www.exchangemonitor.com/long-form-stories/the-hanford-waste-treatment-plant-a-21st-century-solution-to-a-70-year-old-problem/.
[3] Congressional Research Service. (2013, November 1). *Energy and water development: FY2014 appropriations*. Retrieved from https://fas.org/sgp/crs/misc/R43121.pdf.
[4] U.S. Department of Energy, Office of River Protection. (2019, January 21). Tri-party agreement. Retrieved from https://www.hanford.gov/page.cfm/TriParty.

- Cleanup and disposal of more than 17 million tons of contaminated soil and building debris, much of it from liquid waste sites, burial grounds, and nuclear facilities along the Columbia River corridor;
- Removal of spent nuclear fuel (SNF) from basins adjacent to the Columbia River;
- Shipment of more than 5,000 cubic meters of transuranic (TRU) waste to the Waste Isolation Pilot Plant (WIPP);
- Shipment of all weapons-grade plutonium for consolidation to the Savannah River Site;
- Installation of extensive pump-and-treat systems and chemical barriers along the Columbia River corridor and in the Central Plateau to reduce groundwater contamination and prevent contaminated groundwater from entering the river;
- "Cocooning" of seven of the nine reactors to allow the radiation to decay. A seventh reactor was cleaned up and converted into a museum. The remaining two are on their way to interim safe storage or "cocooning;"
- Removal of most HLW from 17 aging single-shell underground waste storage tanks;
- Completing deactivation, decommissioning, decontamination, demolition, and placement of a soil cap over the Plutonium Finishing Plant, one of the most contaminated facilities in the DOE EM complex;
- Startup of pre-treatment of waste stored in underground storage tanks through the Tank Side Cesium Removal (TSCR) unit;
- Risk mitigation activities were completed for two tunnels storing radioactive and hazardous waste, and three underground liquid disposal structures in the Central Plateau; and
- Removal of highly radioactive sludge from a concrete basin in reactors near the Columbia River.

Site-Specific Issues

Washington and Oregon officials have sought assurance of adequate, long-term funding (through approximately 2070) to ensure that cleanup is completed, especially when work at most other sites is done. DOE EM estimates the remaining Hanford cleanup to cost well over $300 billion.[5] However, funding limitations put many cleanup milestones at risk and increase overall life cycle costs of cleanup.

Both the state of Washington's and neighboring Oregon's primary concern is the threat Hanford's legacy contamination poses to the Columbia River, which bisects the site. Much of Hanford's 56 million gallons of HLW is contained in 177 underground tanks: 149 single-shell tanks and 28 double-shell tanks. In the 1950s, the single-shell tanks began leaking into the surrounding soil. Currently all single-shell tanks are well past their design lives and have been stabilized by removing all free liquid, minimizing the chance of further leakage. Current remediation plans call for construction of multiple facilities, collectively referred to as the Waste Treatment Plant, to vitrify the HLW and low activity waste (LAW). The vitrified HLW will be stored onsite and eventually disposal of in a deep geologic repository and the vitrified LAW will be disposed of in a landfill at Hanford.[6] Oregon and Washington remain concerned about construction delays, cost overruns, and technical challenges plaguing the Waste Treatment Plant facilities as well as the slow pace of waste retrieval from Hanford's aging tanks.

The Waste Treatment Plant is not scheduled to begin full operations until 2036, and that date is considered at risk due to the aforementioned construction delays, cost overruns and technical challenges. In the meantime, DOE EM has begun to use a simplified and much smaller pretreatment facility, the tank-side cesium removal (TSCR) system. The TSCR system started operations in 2022. DOE EM is required to begin treating LAW by 2023, and many start up activities are being achieved to meet that goal.

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[5] U.S. Department of Energy, Richland Operations Office. (2022, January). *2022 Hanford lifecycle scope, schedule and cost report* (USDOE Doc. No. DOE/RL-2021-47). Retrieved from https://www.hanford.gov/files.cfm/2022_LCR_DOE-RL-2021-47_12-27.pdf.

[6] U.S. Department of Energy, Office of River Protection. (n.d.). *Hanford Vit Plant: Protecting the Columbia River*. Retrieved from https://www.hanfordvitplant.com/protecting-columbia-river.

Work is underway on several other important and expensive cleanup priorities, all of which have their own challenges. This work includes finishing interim safe storage of the KE and KW Reactors; transfer of 1,936 capsules of cesium and strontium from pool storage to dry storage; and removal of highly concentrated radioactive waste from beneath a hot cell in the 324 building, just a few miles from the city of Richland.[7]

Relationship to Other Sites in the Complex

Though much of Hanford's cleanup activities will occur on-site, waste and materials will need to be sent to other sites in the complex, including TRU waste to WIPP and spent nuclear fuel and vitrified HLW to a deep geologic repository. In 2000, DOE EM selected Hanford to receive potentially tens of thousands of shipments of LLW and mixed LLW from other DOE sites for disposal at the site; however, litigation initiated by the state of Washington resulted in a moratorium on most new waste shipments to Hanford until the Waste Treatment Plant is in full operation. That suit has, to date, effectively removed Hanford as an option for off-site waste disposal for other DOE sites.

[7] Oregon Department of Energy. (2014, September). *Hanford cleanup: The first 25 years*. Retrieved from https://www.oregon.gov/energy/safety-resiliency/Documents/Hanford%20 25%20Year%20Report.pdf.