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# Hanford Cleanup…Restore the Columbia River Corridor Transition the Central Plateau Prepare and Plan for the End State

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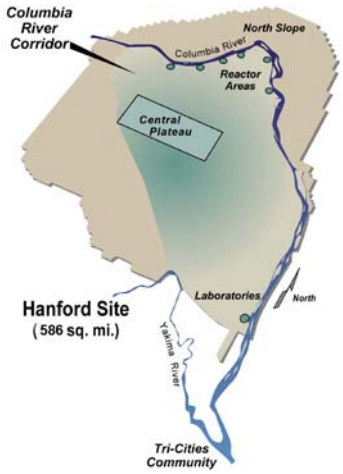
## ABSTRACT

The U.S. Department of Energy's (DOE) Hanford Site in southeastern Washington State was established during World War II to produce plutonium for nuclear weapons as part of the top-secret Manhattan Project. In 1989, Hanford’s mission changed to cleanup and closure; today the site is engaged in one of the world's largest and most aggressive programs to clean up radioactive and hazardous wastes. The size and complexity of Hanford’s environmental problems are made even more challenging by the overlapping technical, political, regulatory, financial and cultural issues associated with the cleanup.




The physical challenges at the Hanford Site are daunting. More than 50 million gallons of liquid radioactive waste in 177 underground storage tanks; 2,300 tons of spent nuclear fuel; 12 tons of plutonium in various forms; 25 million cubic feet of buried or stored solid waste; 270 billion gallons of groundwater contaminated above drinking-water standards spread out over about 80 square miles; more than 1,700 waste sites; and approximately 500 contaminated facilities.

With a workforce of approximately 7,000 and a budget of about $1.8 billion dollars this fiscal year, Hanford cleanup operations are expected to be complete by 2035, at a cost of $60 billion dollars.

## INTRODUCTION

This paper provides an outline of the significant progress, challenges and elements of the Hanford cleanup, many of which are described in more detail in the Hanford session as well as in other WM ‘06 sessions and poster sessions.

DOE has three federal offices at Hanford, the Richland Operations Office (RL), the Office of River Protection (ORP), and the Pacific Northwest Science Office (PNSO). ORP manages waste retrieval from, and closure of, the 177 underground waste tanks, and construction of a waste treatment plant that will turn the most dangerous of the liquid radioactive and chemical wastes into a stable glass form for disposal at a national repository. RL is responsible for cleaning up the balance of the Hanford weapons production legacy – spent nuclear fuel,

remaining plutonium, all buried and solid wastes, and Hanford Site facilities large and small. The third federal office, PNSO, oversees the Pacific Northwest National Laboratory (PNNL), but is not involved with Hanford cleanup.

To establish a series of deadlines for the cleanup, DOE, the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology) in 1989 signed the landmark Hanford Federal Facility Agreement and Consent Order, commonly known as the Tri-Party Agreement (TPA). The TPA outlines legally-enforceable milestones for the Hanford cleanup until its completion.

By 2005, Hanford Site workers had made significant cleanup progress – including mitigating two of the three "urgent" risks at the site. More than 2,300 tons of spent nuclear fuel had been packaged and moved out of wet storage just 400 yards from Columbia River; 20 tons of plutonium-bearing materials were stabilized and packaged for eventual disposal offsite; six million tons of contaminated soil had been cleaned up from waste sites along the Columbia River; five of nine plutonium reactors had been partially demolished and placed in interim safe storage; thousands of drums of transuranic waste had been dug up and safely shipped to permanent disposal in New Mexico; and hundreds of waste sites were remediated. These cleanup measures have reduced the risk of contamination to the groundwater and are part of Hanford's overall strategy for protecting the nearby Columbia River.

## RESTORE THE COLUMBIA RIVER

### River Corridor Cleanup

Over the past decade, significant progress has been made on cleaning up the portion of Hanford closest to the river, but enormous challenges still lie ahead. In April 2005, DOE awarded the River Corridor Closure Contract, which will drive cleanup of about 210 square miles of the site by 2015 -- with significant incentives to finish by 2012. The River Corridor Closure Contract is a cost-plus-incentive-fee closure contract that incentivizes the contractor to reduce cost and accelerate schedule. For every dollar saved over the target cost, the contractor will earn an additional 20 cents. For every dollar spent above the target cost, the contractor loses 30 cents from their potential fee. Completing this work at the contractor's bid target cost and schedule of $1.9 billion and seven years will represent a major acceleration in the cleanup of Hanford's River Corridor compared to the original estimates of $3.2 billion and 10 years. As this work is completed, the active portion of the Hanford cleanup will shrink to an approximately 75-square-mile area of the site known as the Central Plateau.

H Reactor during Interim Secure Storage

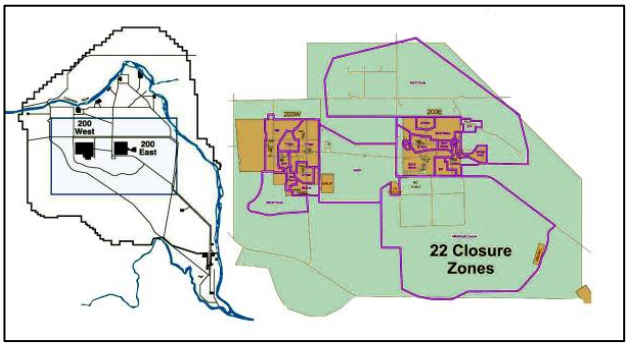
Central Plateau disposal area

K Basin sludge

River Corridor building demolition

# TRANSITION THE CENTRAL PLATEAU

## Central Plateau Remediation




The Central Plateau is composed of approximately 75 square miles in the middle of the Hanford Site and served as the center of former production mission activities from the mid-1940s through the late 1980s. The production mission resulted in the construction of hundreds of processing and support facilities, tank systems, liquid and solid waste disposal and storage facilities, utility systems, and wells. Today, thousands of facilities and waste sites in the plateau require cleanup – including 5 massive “canyon” facilities, 884 waste sites and 592 facilities.

The goal is to have this complex area cleaned up no later than 2035, and DOE is today developing an integrated acquisition approach for the final cleanup contracts. The overall objective of the Central Plateau remediation is to protect human health and the environment from the significant quantity of material there, and to keep contamination from further impacting the groundwater underneath the site. This will be achieved by removing contaminated materials or placing them in a secure configuration that minimizes further migration to the groundwater and the potential for human intrusion.

The approach to Central Plateau cleanup uses three key concepts – closure zones, closure elements, and closure process steps – to create an integrated picture of actions required to complete remediation. Our near term actions are focused on mitigating the most significant risks.

## Plutonium Finishing Plant – Deactivation, Decontamination and Decommissioning

The Plutonium Finishing Plant (PFP) served for over forty years as a cornerstone provider of plutonium feed stocks to the United States nuclear defense complex. The PFP operations gave Hanford and the Manhattan Project the capability to make plutonium metal “buttons” for safer shipping of plutonium to weapons fabrication sites elsewhere in the United States.


Plutonium Finishing Plant glovebox to be removed

An inventory of nuclear material remains at the plant along with a variety of residue forms adhering to equipment, piping, and process enclosures. In 2004, all remaining plutonium was stabilized and packaged for eventual shipment off the Hanford Site.

PFP is now undergoing deactivation and decommissioning (D&D), a massive undertaking complicated by the fact that the facility’s 50-year operating history includes more than 200 contamination events, two explosions, and a criticality accident. The closure scope includes 63 buildings located on 6 hectares with residual plutonium remaining in thousands of feet of process equipment, drain lines and underground tanks.

The PFP complex includes:

- 23,226 square meters of plutonium processing area
- 4 remote process cells and 4 major chemical storage areas
- 231 gloveboxes, hoods and conveyors
- 21 vaults and vault-type rooms
- An estimated inventory of 100 kg of plutonium remaining in the complex process systems and 150 kg in below grade waste tanks and sites
- Over 600 plutonium solution storage containers with residuals

The schedule for completing D&D activities at PFP is currently being reevaluated to consider how long the 4 metric tons of separated Category-1 special nuclear material will remain on site, and the increased safeguards and security measures needed to protect that material in today's environment.

**Retrieving Suspect Transuranic Waste from Hanford's Burial Grounds**


Retrieving suspect transuranic waste

The burial grounds at Hanford contain about 15,000 cubic meters of suspect-transuranic (TRU) waste. During production activities in the 1970s and 80s, waste suspected of containing transuranic (mostly plutonium) isotopes was placed in burial grounds with the intent that it would ultimately be retrieved and sent to a future national TRU repository for disposal. The Waste Isolation Pilot Plant in New Mexico opened for this purpose in 1999, and Hanford began retrieving its suspect TRU waste in 2003. To date, approximately 12,000 drums have been retrieved. The unearthed drums are evaluated to determine whether they are actually TRU waste; about half have ended up being low-level waste instead. As workers begin to retrieve the older drums, more are degraded and require special handling. The condition of these containers underscores the importance of getting the suspect TRU out of the ground at Hanford.

**Groundwater**

Hanford's four decades of plutonium production resulted in widespread contamination to the soils at the site. As a result, approximately 80 square miles of groundwater have been contaminated above drinking water standards. The largest impacts to groundwater by far have been from historic discharges of contaminated liquid to ponds and trenches -- unfortunate early practices that ended many years ago.

Removing the sources of contamination to prevent further migration into the groundwater remains the highest priority. Other groundwater protection strategies include re-lining underground piping to prevent leaks and reducing other artificial recharge; treating the contamination already in the groundwater to the extent we can; and putting in place robust remediation systems using barriers and innovative technologies to treat and remove sources. In addition,

groundwater monitoring systems are used to track the plumes and give us feedback on the performance of our remediation systems.

Hanford’s groundwater remediation involves a variety of activities including mortar-lining of leaky water pipes Measuring

The Hanford’s Groundwater Management Plan (DOE 2003) defines Hanford’s groundwater goals: protection of the groundwater from further degradation, remediation of existing groundwater plumes to reduce risk and restore groundwater resources, and monitoring the groundwater conditions to support cleanup and management decision. The overall strategy is to restore the aquifer to its highest beneficial use practicable within a reasonable time frame. The protection of the Columbia River water quality and return of groundwater to beneficial use are the primary objectives of groundwater remediation actions.

## CONCLUSION

Hanford cleanup has met critical cleanup milestones and gained momentum, but a lot of tough work remains as the site works its way toward the final end state articulated in the recently-released Hanford Site End State Vision Document. This tough work includes not only the obvious technical challenges, but also numerous legal, regulatory, management, social, contractual and financial challenges as well. Protection of the Columbia River will be the ultimate measure of our success.

## REFERENCES

1. U.S. Department of Energy, U.S. Environmental Protection Agency, and State of Washington Department of Ecology, *Hanford Federal Facility Agreement and Consent Order*, 1989 as amended.
2. The Hanford Comprehensive Land-Use Plan, 1999a
3. Hanford Site End State Vision Document, DOE/RL-2005-57
4. Hanford’s Groundwater Management Plan, DOE 2003