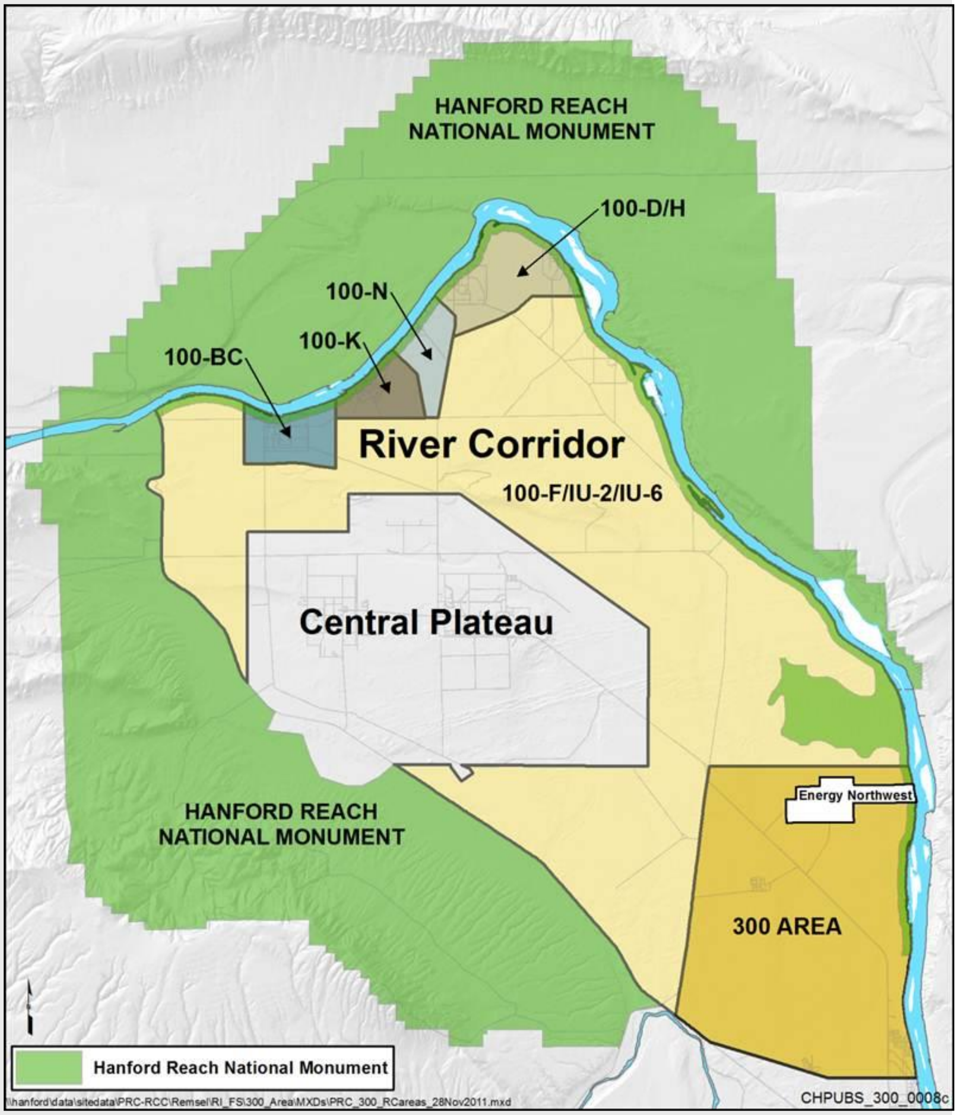
100-D/H Area Proposed Plan – Questions and Answers



100-D/H is one of six Hanford cleanup areas along the Columbia River. Past reactor and production operations resulted in soil and groundwater contamination. There will be approximately 300 waste sites addressed in the final Record of Decision.

Q: Give an overview from production to now and into the future (history of reactors).

A: Suggest replacing the answer to this question with the information: http://www.hanford.gov/page.cfm/100Area

The Columbia River flows through the northern Hanford Site before turning south toward the city of Richland. The region of the Site along the shoreline is known as the Hanford River Corridor. The River Corridor consists of six areas; the 100-BC, 100-K, 100-N, 100-D/H, and 100-F/IU areas where the production reactors were located, and the 300 Area which was used for fabrication of nuclear fuel assemblies and research involving the processing of irradiated fuel (Map on cover).

Between 1943 and 1963, nine plutonium production reactors were built along the Columbia River. Production of special nuclear materials (principally Pu-239 and tritium) for America's nuclear weapons program was the primary function of the reactors. All reactors have been retired from service. Liquid and solid wastes discharged during the reactor operational periods were the primary contaminant sources in the reactor areas.

A special "interim safe storage" project – called cocooning - has been completed at the C, F, D, DR, H and N reactors. In "cocooning," about 80 percent of the reactor complex is demolished down to the four-foot-thick solid concrete walls surrounding the reactor core. All remaining openings – except for one door – are sealed with cement or steel plate, and a new roof is placed over the facility. The single remaining door is welded shut and opened once every five years for inspection. This process significantly reduces the surveillance and maintenance costs and reduces the risks to people and the environment. The reactors will remain in this cocooned state for up to 75 years, giving radiation in the reactor cores time to decay and DOE time to determine a disposal option.

To explain very simply how the Hanford reactors worked: uranium fuel, fabricated in the 300 Area, was placed into horizontal tubes that run through the reactors. Control rods, which were used to slow or stop the nuclear reactions inside the reactors, were withdrawn. Withdrawal of the control rods initiated the fission reaction, which changed a small fraction of the uranium to plutonium, and also generated a lot of heat. Water from the Columbia River was pumped through the reactors, running right past the uranium fuel in the tubes, to cool them off.

During their years of operation, Hanford's reactors were modified many times. Larger and more robust pumps were installed, while thinner process tubes with larger openings were installed. These modifications allowed more cooling water to flow through the reactors, thus enabling them to operate with more uranium fuel or with uranium of higher enrichment levels. The additional uranium increased plutonium production.

Q: Give some details about the reactor areas concerned in the 100 D/H Proposed Plan.

A: Suggest replacing the answer to this question with the information at these links: http://www.hanford.gov/page.cfm/HReactor

http://www.hanford.gov/page.cfm/DDRReactors

The 100-D/H Area includes three deactivated nuclear reactors and support facilities that operated to produce plutonium from 1944 to 1967. The 100-D Area was home to two of Hanford's nine reactors built to produce plutonium for the nation’s defense program. D Reactor operated from 1944 to 1967, and DR Reactor operated from 1950 to 1964. The reactors were placed in interim safe storage in 2004 and 2002, respectively.

Recent 100-D Area work has mainly involved cleaning up deep waste sites contaminated with hexavalent chromium, which was added to the cooling water for the reactors to prevent corrosion of the piping system.

To clean up chromium contamination in the 100-D Area, DOE recently completed two excavations to a depth of 85 feet, removing 2,544,464 tons of contaminated material that was taken to the landfill at Hanford called the Environmental Restoration Disposal Facility, or ERDF. Some of this contaminated soil required treatment for stabilization at ERDF prior to being placed in the landfill.

H Reactor began operating in 1949. It was built as part of Hanford's first Cold War expansion. The decision to build H Reactor came as one of America’s responses to Russia’s demonstration of nuclear capabilities. The design is similar to the World War II reactors (B, C, D, and F). It was shut down in 1965 and cocooned in 2005.

Q: Where did the contaminants in the groundwater and soil come from?

A: Liquid and solid wastes discharged during the reactor operational periods were the primary contaminant sources in the reactor areas. Contaminant sources in the 100 Areas included cooling water facilities, underground piping, liquid and solid waste disposal sites, and unplanned releases.

Groundwater contaminants t in the 100-D/H Area include:

Hexavalent chromium —used for anti-corrosion. It is recognized as a human carcinogen.

Nitrate — an oxidizing agent, nitrate salts are found naturally on earth as large deposits.

Strontium-90 – a radioactive isotope of strontium produced by nuclear fission with a half-life of 28.8 years.

Q: How has contamination spread in the environment?

Some of the contaminants released to the soil exhibit low mobility and are found primarily near the disposal sites. Mobile contaminants move relatively freely and have spread beyond disposal areas.

Low mobility contaminants, including many metals and radionuclides, were found at the greatest concentrations within and near the areas of discharge. When little or no liquid effluent was discharged to a waste site, soil contamination remained in the shallow sediment. Disposal of high volumes of contaminated liquid waste resulted in dispersion of low mobility contaminants deeper in the ground, in comparison to low-volume liquid discharge sites.

Mobile and moderately mobile contaminants common to the 100-D/H Area include nitrate and hexavalent chromium. Sodium dichromate, which was the source of hexavalent chromium, was added to reactor cooling water as an anti-corrosion agent. Large volumes of water containing hexavalent chromium were discharged to the soil via trenches, cribs, and leaks from pipelines and retention basins. Cooling water was also released through outfall piping to the Columbia River. Large groundwater mounds developed beneath high-volume surface discharge sites and increased the spread of contaminants in groundwater during operations.

Historical process information suggests that small volumes of high-concentration solutions of sodium dichromate leaked or spilled in the 100 Areas (for example, during the transfer of sodium dichromate from rail cars to storage tanks). At some locations in the 100-D Area, concentrations of hexavalent chromium in groundwater exceeded the concentrations found in reactor cooling water, indicating a high-concentration source. Remedial actions have included excavation of contaminated soil. Some of these excavations have extended to groundwater. There are very few (8-10) waste sites remaining in 100 D/H.

Q: How is the contamination spread being monitored?

A: Hanford is one of the most heavily monitored sites in the world. An extensive environmental monitoring program has existed for decades. Each year, monitoring staff collect thousands of environmental samples both onsite and within a 50-mile radius of the Hanford Site. There are 50 air sampling stations, located onsite and as far away as Walla Walla, Yakima, Moses Lake, Mattawa, and McNary Dam.

Samples include surface water, wildlife, soil, groundwater, foodstuffs, vegetation, and air. Samples are analyzed to detect radionuclides and other site contaminants. Several state and federal agencies also have programs to monitor and confirm the accuracy of the information collected at Hanford.

Q: What is the interconnectivity of the areas with the groundwater?

A: Monitoring is used to track contaminants from source areas, which are typically identified based on waste sites associated with a production process or area. For 100-D/H, the waste sites were divided into the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 source operable units. Contaminants in groundwater from these four source operable units identify the 100-HR-3 groundwater operable unit. Results of groundwater contaminant monitoring at the Hanford Site, including the 100-HR-3 operable unit, are reported annually.

Q: How are they being cleaned up (How do interim cleanup actions work, and explain the interconnectivity of the two areas with the groundwater)?

A:

In the early 1990s, the U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), and Washington State Department of Ecology (Ecology) decided that sufficient information about contaminated soil and groundwater in the Hanford Site River Corridor was available to begin interim remediation with a focus on protecting the Columbia River. This decision led to an early start for cleanup of contaminated soil and groundwater in the River Corridor. Key components of the early cleanup included removing contaminated facilities and soil (waste sites) near the river, and implementing interim cleanup actions.

At the 100-D/H Area, a series of investigations were conducted for waste sites in the source operable units (100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2) and groundwater in the 100-HR-3 operable unit. The investigations provided an initial characterization of the nature and extent of contamination, identified contaminant concentrations in waste sites that were above human health direct contact risk levels, and determined that hexavalent chromium concentrations in groundwater were above drinking water standards (DWSs) and entering the Columbia River at concentrations considered toxic to aquatic organisms. This led to the selection of interim actions to remediate source and groundwater contamination under interim action Records of Decision, issued by EPA to identify specific response actions. The response actions included removal of contaminant sources (waste sites) and treatment of groundwater to remove contaminants and prevent discharge of contaminants to the Columbia River.

For a majority of the waste sites, cleanup is done by digging up the contaminated soil and safely disposing of it. This cleanup approach is known as removal, treatment, and disposal (RTD). Hexavalent chromium groundwater contamination is treated by use of pump and treat (P&T) systems. This approach uses wells to extract contaminated groundwater, a treatment system to remove the contamination, and other wells to inject the treated water back into the groundwater. Other cleanup approaches included installing chemical reaction barriers to bind contaminants, which reduces or stops the contamination reaching the Columbia River.

Q: How does the interim decision-making process work, what interim decisions were made, and when did those decisions go into effect)?

Commented [VJJ1]: How this process works is very complex, not easily explained as to interaction of RCRA, CERCLA, TPA. Text inserted is from RI/FS

A: In 1989, the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology) signed the *Hanford Federal Facility Agreement and Consent Order* (the Tri-Party Agreement) to provide a framework for the cleanup of the Hanford Site. The scope of the agreement addressed the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) remediation of inactive hazardous waste sites and active waste management, *Resource Conservation and Recovery Act of 1976* (RCRA) corrective action for solid waste management units, and closure of RCRA treatment, storage, and disposal (TSD) units across the Hanford Site.

In 1991, the Tri-Parties determined there was a need to prioritize the CERCLA investigations and identify early actions to address waste sites and groundwater contamination. *Hanford Past-Practice Strategy* provided the basis for prioritizing investigations and cleanup actions across the Hanford Site. This strategy emphasized the need to address waste sites and groundwater contamination that may pose a near-term impact to public health and the environment. In addition, the strategy proposed a bias for action to clean up waste sites and existing contamination where the need for a remedy was evident

The first interim action record of decision for 100-D/H was issued in 1995. An interim action addresses more immediate threats until the remedial investigation/feasibility study process needed to make a cleanup decision with a permanent remedy can be performed. A final decision follows the interim decision.

Remediation and characterization of the waste sites in 100 D and 100 H began in 1996 under the authority provided by the interim action RODs and RCRA closure plans, and continues to the present. Remediation consists mainly of (1) RTD of contaminated soil, debris, and waste material; and (2) verification sampling and computer modeling (as needed) to determine whether direct exposure and groundwater protection cleanup requirements have been achieved. After remediation, the excavations are backfilled with approved material, and native shrub steppe flora are planted

The Tri-Parties decided that all groundwater would be cleaned up under the CERCLA remedial action process that included the 100-HR-3 OU. Groundwater cleanup at 100-HR-3 was initiated following the 1996 interim action record of decision that identified P&T as the remedial action.

Q: What cleanup work remains that is discussed in this Proposed Plan?
A. The proposed plan addresses cleanup of approximately 300 waste sites.

Commented [LM2]: This answer needs to include things like drilling groundwater monitoring wells which will be sampled on x frequency. I imagine an explanation that is something like: The interim cleanup actions for 100-D/H resulted in remediation of xxx waste sites. This proposed plan discusses remediation of xx waste sites that remain and….. The current plan is….but we want public input….Your input can help us by sharing…..

Commented [VJJ3]: These are the same; explaining the number of wells, sampling frequency, etc. would be very complex. Better to reference the RI/FS for details

Q: What future cleanup work remains after the 100-D/H record of decision goes into effect, such as reactor dismantlement and restoration, and what is the estimated timeframe for that work?

A: The 100-D/H Proposed Plan identifies the preferred alternative and remedial actions that will be completed under this alternative. The remedial actions include RTD and monitored natural attenuation with institutional controls for waste sites, and increased capacity pump and treat and monitored natural attenuation for groundwater. There are 106 waste sites identified for RTD and 37 for monitored natural attenuation with institutional controls. One other waste site includes a maternal bat colony. The associated pipeline in the underground tunnel is proposed for end capping and an institutional control for entry restriction. The estimated time to achieve waste site cleanup is 25 years. The proposed plan identifies increased capacity P&T and monitored natural attenuation for groundwater cleanup. The estimated times to achieve cleanup requirements are 12 years for hexavalent chromium, 6 years for nitrate, and 44 years for strontium-90.

The 100-D/H record of decision goes into effect when issued by EPA. The record of decision will identify the cleanup work remaining under CERCLA for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 operable units. There is not a definite timeframe that has been determined for dismantlement of the reactors that have been cocooned. The assumption is that about 75 years is needed for the reactors' radioactivity to decay to levels low enough to allow dismantlement.