Oregon Department of **ENERGY**

Frequently Asked Questions About **Hanford**

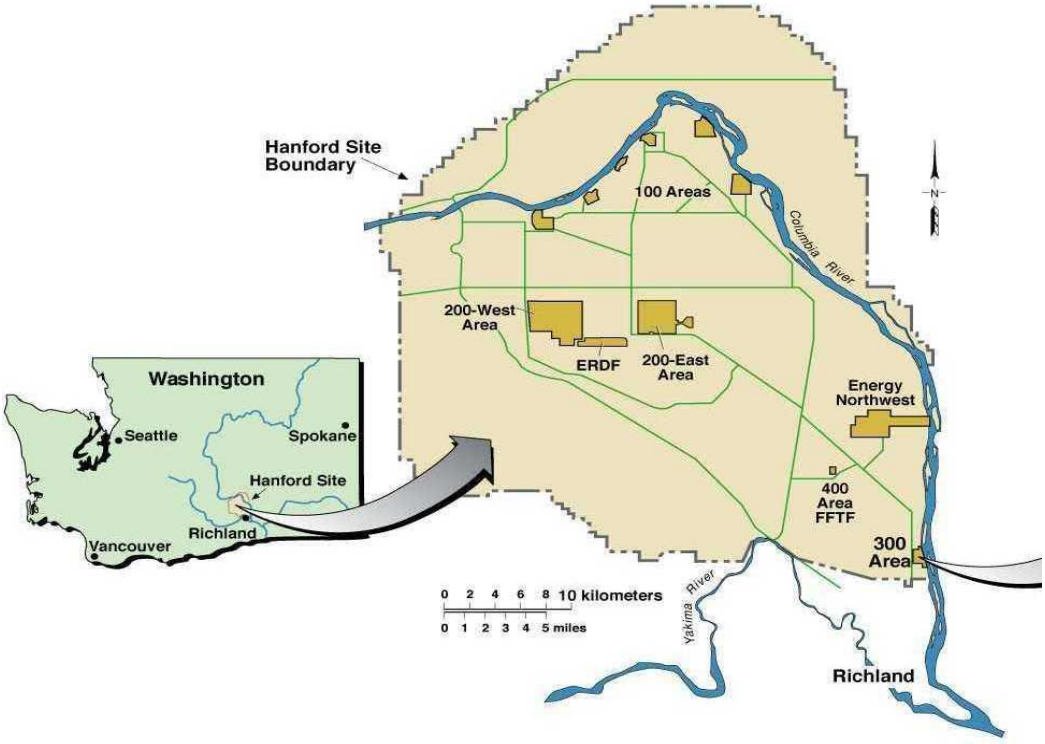
Updated August 2017

OREGON DEPARTMENT OF ENERGY

Hanford FAQs

I've heard of Hanford, but I don't know much about it. Where is it? What is and was done there?

The 586 square-mile Hanford Site is located in southeastern Washington State. It is just north of the City of Richland and about 35 miles north of the Oregon/Washington border. During World War II, the federal government relocated residents who lived within the area and built facilities to produce plutonium for an atomic bomb. From 1944 through 1989, Hanford's primary mission was to produce plutonium for America's nuclear weapons program.



Plutonium production processes created large amounts of radioactive and chemically hazardous wastes. During the production years, the most dangerous radioactive wastes were stored in large underground tanks while hundreds of billions of gallons of liquid and millions of cubic feet of solid waste were disposed to the soil and groundwater environments at Hanford. At the time, it was assumed that the disposal of most of these wastes would be permanent. However, the spread of contamination from the liquid waste disposal and the need to remove solid wastes from the proximity of the Columbia River and elsewhere has necessitated that much of this waste be dug up, treated or repackaged, and moved. Beginning in 1989, Hanford's mission began to transition to environmental cleanup. Cleanup of both chemical and radioactive contamination continues today and will likely continue for the next several decades.

It is the largest environmental cleanup project in the world. Hanford is owned and operated by the U.S. Department of Energy (DOE), which also oversees the cleanup.

Why is Oregon involved in the Hanford cleanup, since the site is located in Washington?

Radioactive and chemical wastes generated during Hanford's production years and disposed or leaked to the soil caused extensive contamination of Hanford's groundwater. The contamination poses a potential long-term threat to the Columbia River, and to species that use the river, such as salmon and steelhead. The Columbia River flows through a 50-mile stretch of the Hanford Site. Oregon's primary involvement is to ensure that cleanup decisions that are made at Hanford are protective of the Columbia River, both now and in the future.

Oregon residents have a long history of concern and involvement regarding Hanford. Public hearings and meetings on Hanford cleanup proposals often draw large crowds in Oregon cities.

The State of Oregon has an advisory board on Hanford, called the Oregon Hanford Cleanup Board. The Cleanup Board has 20 members, including 10 citizen members and a representative of the Confederated Tribes of the Umatilla Indian Reservation. It provides recommendations and advice on the Hanford cleanup to DOE and its regulators. It also may make recommendations to the Oregon Governor, the Oregon Legislature, and the Oregon Department of Energy.

In addition, DOE has shipped extensive amounts of radioactive waste through Oregon that was generated during the cleanup at Hanford and at other DOE sites around the nation. Hanford has a large inventory of a particular type of radioactive waste (called transuranic) which is to be disposed at an underground disposal facility in New Mexico. Hanford made more than 600 shipments of this waste from 2000 through 2011. As many as 6,000 additional shipments are planned in coming years, likely beginning sometime after 2020. Oregon works to ensure that these and other shipments are conducted safely and in compliance with State laws.

Also, a fire, explosion, or other accident involving Hanford's contaminated facilities or underground waste storage tanks could cause an airborne release of radioactive materials. The state works with Umatilla and Morrow counties and other state and federal agencies to ensure that emergency plans are in place and regularly tested to ensure a prompt and appropriate response to such an event.

Why is the Hanford cleanup taking so long?

There are many reasons. The primary reason is the unprecedented extent of environmental contamination that occurred at Hanford from the production of plutonium and the difficulty in

cleaning up these wastes. There are hundreds of contaminated facilities that need demolition. Workers often deal with high levels of radioactivity or chemical contamination that requires them to use remote-handled equipment or robotics. Sometimes they must be completely covered with protective suits and breathing apparatus for additional protection. Combining these restrictions with complicated procedures greatly adds to the time necessary to complete the work.

In some cases, the wastes are unique to Hanford, and the equipment necessary to deal with the wastes often have to be developed, designed, manufactured and tested and procedures developed and tested before cleanup can occur. Some of the work at Hanford is among the most complex environmental cleanup occurring in the world.

In other cases the time required is simply due to the sheer volume of the work. For example, millions of tons of contaminated soil have been dug up from along the Columbia River and hauled to a lined, engineered disposal site that is several miles from the river. That project is nearing completion.

There are several other reasons that the cleanup has and will continue to take so long.

- The cleanup is tremendously expensive, which adds to the time that cleanup will take (see next question and answer).
- Environmental laws require identifying how much and what kind of contamination is present and the threat posed by the contamination. Environmental laws also require identification of several cleanup alternatives to manage contaminants at a specific location; developing those alternatives to assess risks, effectiveness and costs; providing regulators and the public with an opportunity to weigh in; then finally selecting and implementing the preferred alternative. In most cases, this process is necessary before waste sites or contaminated buildings can actually be cleaned up.
- There have been several false starts, “missteps” and bad decisions along the way which hampered progress. For example, several efforts to design and construct large tank waste treatment facilities were later cancelled, and one project to immobilize much of Hanford’s tank waste through use of grout was also abandoned.

How much is cleanup going to cost? Why is it so expensive?

The sheer volume of waste and the complexity of cleanup makes Hanford cleanup incredibly expensive. Dealing with hazardous and radioactive waste also greatly adds to the costs. To ensure worker safety and prevent the spread of contamination, relatively straightforward activities such as drilling a well and analyzing samples is tens or even hundreds of times more expensive than if those activities took place on an uncontaminated site.

Hanford cleanup to date has cost about $45 billion. The site's average budget is more than $2 billion per year. The estimate to complete the remaining Hanford cleanup is at least $110 billion more. About 9,000 workers are involved with the cleanup.

Even at $2 billion per year, the site budget is limited by budget targets and Congressional allocations, rather than on the capacity needed to perform cleanup work. When Hanford received almost $2 billion in additional funding during a two and a half year period as part of the American Recovery and Reinvestment Act, Hanford workers demonstrated that considerable additional cleanup progress can be made when additional funds are provided.

What is the plan for Hanford's tank waste?

The most hazardous of the liquid wastes generated during plutonium production were stored in underground storage tanks. As those storage tanks began to fill, additional tanks were built. Hanford has 177 underground waste storage tanks that hold about 56 million gallons of highly radioactive waste.

DOE is building a massive complex of waste treatment facilities at Hanford, collectively called the Waste Treatment Plant. These facilities are intended to permanently immobilize the waste through a process called vitrification. Glass-forming materials are added to the waste under heat to form molten radioactive glass. The molten material is then poured into stainless steel containers to cool and harden into glass. The waste will still be radioactive, but it will no longer be as mobile or able to easily spread into the environment. Treating the tank waste is one of the most urgent, expensive, and difficult tasks at Hanford.

Construction on the Waste Treatment Plant began in 2002, but serious design problems with portions of the facilities is expected to delay full operation of the facility until at least 2036.

When the Waste Treatment Plant is fully operational, Hanford's tank waste will first go through a complex pre-treatment process to separate the most highly radioactive elements (such as cesium) from the rest of the waste. The most highly radioactive segment of waste makes up a small percentage of the waste volume. This portion of the waste will be sent to the high-level vitrification facility. Once turned to glass, this waste is intended to go to a national deep geologic disposal facility – which the United States currently does not have (see below, for question related to Yucca Mountain). In the interim, the vitrified waste will be stored indefinitely on the Hanford Site.

The portion of the waste with lower levels of radioactivity (low activity), which by volume will be the majority of the tank waste, will also go through some immobilization treatment. A vitrification facility for this low activity waste is also being constructed at Hanford, although this facility will not have sufficient capacity to treat all of the waste by a 2047 deadline. DOE is

investigating whether other technologies may work to immobilize the waste. If not, the expectation is that an additional low-activity vitrification facility will need to be built.

Because of technical issues associated with the pre-treatment facility, DOE is currently pursuing a plan to bypass that facility in favor of a more simplified pre-treatment process to remove solids and certain radioactive materials, and send that waste feed directly to the low-activity vitrification facility. This effort is called direct-feed low-activity waste, or direct-feed LAW. DOE estimates it could have this in operation by 2023.

Vitrification is a proven technology that is being used elsewhere in the United States and in Europe. However, the chemical complexity of Hanford's waste and the much larger quantity of waste at Hanford make Hanford's facilities much larger and more complex than any existing facilities.

The tanks are far beyond their design life expectancy; they are expected to become more fragile and less able to contain the waste as they continue to age. At least 63 of the 149 older-style single-shell tanks are believed to have leaked or released about one million gallons of high-level radioactive waste into the soil. One tank is known to be actively leaking. The estimate is that it is losing a few hundred gallons of waste per year.

One of Hanford's 28 double-shell tanks is now out of service after a leak was detected in its inner shell. Waste from that tank was transferred to other tanks.

What are the risks posed by Hanford?

The current risks are generally considered to be fairly low. Radiation and chemical exposure to site workers is strictly regulated by federal and state laws, although there have been a number of serious worker exposures during the cleanup – primarily to chemicals. Since access to the site is restricted, the day-to-day risk to the public is extremely low.

Future risk could come from contact with chemicals and radioactive materials that were previously disposed of at Hanford that entered the environment through groundwater flow. In the case of Oregonians, this risk would come from a dilute amount of chemical or radioactive material that entered and flowed downstream in the Columbia River. Extensive monitoring indicates this risk is very small today. The concern is that huge amounts of contaminants are slowly moving through the soil column and the groundwater at Hanford, and that far larger amounts of contaminants could reach the river in the decades or centuries to come.

There is also potential risk for people downwind from Hanford, including Oregonians, should an accident release radioactive materials to the air, and then be transported by wind. A large earthquake could also potentially cause a radioactive material release to the air. Oregon works

closely with other State, County, and Federal agencies to plan for and practice how to respond to this very unlikely event.

I use the river a lot for windsurfing (or for irrigation or drinking water). How can I find out if there are chemicals and radioactive waste from Hanford in the water, and whether the water really is safe?

There are chemical contaminants in the river from Hanford and from many other sources, such as farmers' fields, paper mills, and other industries, as well as radioactive materials from natural sources and from past nuclear weapons tests. Small amounts of chemical and radioactive materials from Hanford do enter the river, but are quickly diluted and generally not detectable beyond the immediate area where they enter the river. Measured concentrations consistently have been low, and no restrictions are in place for use or recreation in the river as a result of Hanford.

A number of health and environmental organizations regularly sample and test the Columbia River water and issue health advisories if there are concerns. For example, in September 2013, the Oregon Public Health Authority advised people to limit the amount of resident fish consumed that are taken between Bonneville Dam and McNary Dam due to moderate levels of mercury and PCBs (from sources other than Hanford). In August 2017, the Washington State Department of Health issued a similar advisory from McNary Dam upstream to the Interstate 90 bridge near Vantage, Washington. This area includes the entire portion of the river that runs through the Hanford Site. However, this advisory was also due to PCBs and mercury from sources other than Hanford.

Information on water quality within the river from the Oregon Department of Environmental Quality and the U.S. Environmental Protection Agency is on the following web sites:

- http://www.oregon.gov/deq/wq/Pages/WQ-Assessment.aspx
- https://www.epa.gov/environmental-topics/water-topics

What's been accomplished so far from the cleanup?

There has been considerable progress, especially in the past decade; although there is no doubt that we're not nearly as far along in the cleanup as anyone would have anticipated when the process started in 1989.

It was hard to see much cleanup progress during the first decade or so of cleanup, but in hindsight, a lot was done during that period that allowed the cleanup to move forward. Much of the early focus was spent dealing with urgent risk issues – risks that had to be resolved before much of the cleanup could begin.

For example, there was considerable concern about a fire or explosion in one of Hanford's underground waste storage tanks, as chemical processes within the waste generated flammable concentrations of hydrogen and other gases. Certain chemicals in other tanks also posed a possible risk of fire or explosion. It was feared that an explosion or fire inside a tank could cause the dome of the tank to collapse and provide an outlet for radioactive materials to reach the environment. Those issues have mostly been resolved.

In addition, Hanford needed new treatment facilities for liquid effluent waste; for handling and packaging waste; and a disposal facility for the more than 18 million tons of contaminated soil and building debris that would be generated during the cleanup. It took time for those facilities to be designed, sited, and constructed.

In some ways, the decade of the 1990s could be considered "getting ready for cleanup," while the decade of the 2000s was where we began to see considerable progress.

Among the most notable cleanup achievements so far are the following:

- More than 2,300 tons of corroding irradiated nuclear fuel stored in two leak-prone storage basins just a quarter mile from the Columbia River was packaged, dried, and moved to a much safer storage facility well away from the river.
- More than 13 tons of plutonium and plutonium-bearing materials was treated and stabilized for interim storage, and then shipped off-site. These materials posed risks to Hanford workers, and the facility they were stored in – the Plutonium Finishing Plant – was considered one of the highest risk facilities on site. With the plutonium stabilized and now removed from the Hanford Site, decommissioning and demolition is well underway on the Plutonium Finishing Plant. Demolition of the facility to "slab-on-grade" is expected to complete in late 2017 or early 2018.
- Six of Hanford's nine plutonium production reactors were cocooned and placed into safe long-term storage. This will allow radiation within the reactor blocks to safely decay (greatly reducing the radioactivity) before the reactors are torn down decades from now.
- Millions of tons of contaminated soil was dug up from along the Columbia River and hauled to an engineered disposal facility in the center of the Hanford Site. Prior to being removed, these wastes posed a threat to the river.
- Greatly expanded groundwater pump-and-treat systems have been installed and are operating – treating more than two billion gallons of groundwater per year. Hanford's groundwater is widely contaminated. The pump-and-treat systems, where contaminated groundwater is pumped to a treatment facility to remove contaminants,

will initially help prevent contaminants from reaching the Columbia River and ultimately will clean-up the contaminated groundwater.

- Hundreds of contaminated buildings have been torn down.
- More than 640 truckloads of transuranic waste have been shipped off-site to a disposal facility in New Mexico. Transuranic waste is predominantly protective clothing and building debris that is contaminated with small amounts of plutonium. Because it will be hazardous for tens of thousands of years, it is buried deep underground to keep it away from people and the environment.
- Surface cleanup was completed in most places along the Columbia River corridor in 2015. Groundwater treatment systems along the river will operate well into the future.

I've read that the Yucca Mountain nuclear waste disposal project might be revived and that much of Hanford's most radioactive waste is to go there. What is the status on that?

Federal law requires that the irradiated nuclear fuel and the vitrified high-level waste be disposed in a deep geologic facility. The State of Nevada has vehemently opposed the siting of Yucca Mountain and through litigation and other means has been able to keep Yucca Mountain from going forward. There is considerable Congressional support for Yucca Mountain, but even if it were to go forward, the licensing processes will take years. Litigation will likely delay that process even further. Only a test tunnel has been constructed at Yucca Mountain. Waste emplacement tunnels would have to be mined and railroad access built to the site.

For the time being, Hanford waste that was intended to go to Yucca Mountain will be stored at the Hanford Site. Irradiated nuclear reactor fuel is already in storage at Hanford, and the expectation is that this storage facility will be safe and appropriate for decades to come.

The most radioactive portion of Hanford's high-level radioactive tank waste is intended to be immobilized through a process called vitrification (see page 4 for further explanation). The vitrified waste will need to be stored indefinitely until Yucca Mountain or some alternative is available. If construction of a deep geologic disposal facility continues to be delayed, additional storage facilities will need to be constructed, adding to the costs at Hanford.

How can I get up-to-date information about meetings and events about Hanford, and about groups involved in Hanford cleanup?

The U.S. Department of Energy has a calendar of events available on its web site, at http://www.hanford.gov/pageaction.cfm/calendar. The calendar includes notices of public meetings and public comment periods, as well as other items of interest.

The Hanford Site also posts notices and information on items of interest on its main website page, www.hanford.gov, and on its social media sites:

- Facebook - http://www.facebook.com/hanfordsite
- Twitter - http://www.twitter.com/hanfordsite
- YouTube - http://www.youtube.com/hanfordsite

A number of citizen groups are involved with the Hanford cleanup. Most are represented on the Hanford Advisory Board (HAB) – which is a federally chartered board to provide advice on Hanford cleanup to the U.S. Department of Energy and its two regulators – the State of Washington and the U.S. Environmental Protection Agency. The HAB is a 32-member board, which includes representatives from the State of Oregon, Native American tribes, local governments, the Hanford workforce, and citizen groups. Information on the HAB can be found at http://www.hanford.gov/page.cfm/hab.

The State of Washington's Department of Ecology, Nuclear Waste Program also maintains a website about the work at Hanford, including a calendar of events and opportunities to comment on various proposed actions at Hanford. Their web site can be found at http://www.ecy.wa.gov/programs/nwp/index.html. Ecology also maintains a general Hanford cleanup information line, which is 800-321-2008, and an e-mail box (Hanford@ecy.wa.gov).

The Oregon Department of Energy also maintains a web site that includes Hanford information at http://www.oregon.gov/energy/facilities-safety/safety/pages/default.aspx.

FOR MORE INFORMATION

The Oregon Department of Energy
550 NE Capitol Street NE
Salem, OR 97301
503-378-4040 | 800-221-8035
askenergy@oregon.gov
www.oregon.gov/energy