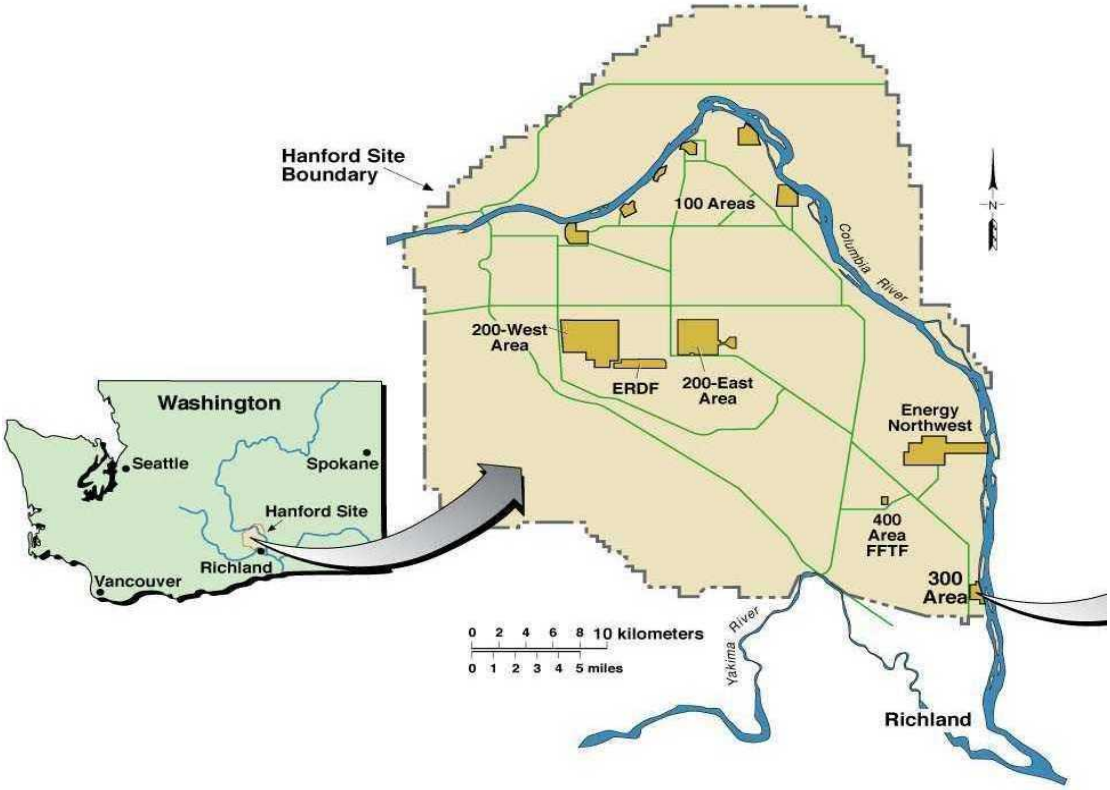
Frequently Asked Questions (FAQ's) about Hanford

1. **I've heard of Hanford, but I don't know much about it. Where is it and what was and is 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 30 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.

2. **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. Much of that 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 2,000 additional shipments are planned in coming years, though shipments are not currently being made from Hanford. Oregon works to ensure that these and other shipments are conducted safely and in compliance with State laws.

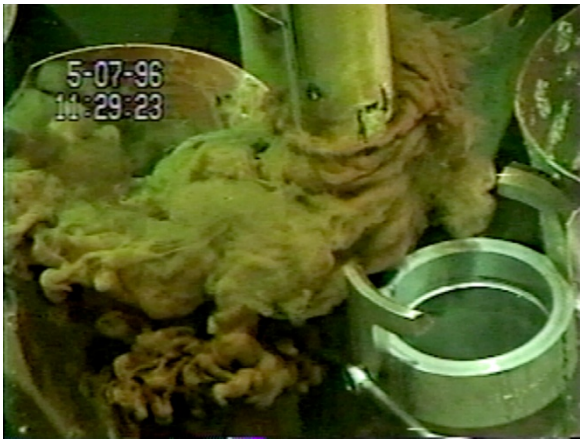
Also, a fire, explosion, or other accident involving Hanford's contaminated facilities or underground waste storage tanks could cause an airborne release of radioactive materials. The state works with Umatilla and Morrow counties and other state and federal agencies to ensure that emergency plans are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

3. 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 were 800 separate waste sites along the Columbia River and another 800 on Hanford's Central Plateau. 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 worker 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 methods and equipment necessary to deal with the wastes have to be created before cleanup can occur. Some of the work at Hanford is among the most complex environmental cleanup occurring in the world.

For example, irradiated nuclear fuel was stored underwater in two basins just a quarter mile from the Columbia River at the K-East and K-West reactors. The fuel was not designed to be stored for an extended period. Over the more than 20 years that it was under water, it corroded, creating a layer of radioactive sludge at the bottom of the basins. In 1994, DOE identified the K-Basins as an urgent priority – as it was determined that an earthquake could damage the basins, causing water to drain. Once exposed to the air, the fuel may have ignited, sending a plume of radioactive materials into the air. It was decided that the best solution was to pack the 105,000 uranium fuel rods and fragments into water filled canisters, move them out of the basin, dry the fuel, repackage it, and move it to an interim storage facility away from the river.



Sludge being stirred up by movement of spent fuel in the K Basins

It took six years to design and construct the unique equipment needed to collect and sort the fuel underwater, as well as a vacuum drying facility, storage containers, and the building used to store the repackaged fuel. Procedures for each step of the process had to be developed and

practiced. Workers collecting the fuel were repeatedly hampered by visibility problems as the fine sludge would cloud the water and force them to wait for the water to clear. The last of the fuel elements were moved from the two basins in October 2004. The sludge has been consolidated into one of the two basins and still awaits treatment and final disposal.

The K-Basins spent fuel project is just one example of many at Hanford where entirely new equipment and procedures needed to be developed, designed, tested, adjusted, and then used. 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 answer below).
- 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.

4. 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 $40 billion. The site's average budget is about $2 billion per year. The estimate to complete the remaining Hanford cleanup is at least $110 billion more. About 11,000 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 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.

5. **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.

At least 67 of the 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.

In October 2012, DOE confirmed that the inner shell of one of Hanford's 28 double-shell tanks was also leaking into the space between the two tank shells.

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.

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 then 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.

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. Construction on the Waste Treatment Plant began in 2002, but the facilities are not scheduled to begin start-up operations until 2019 and to reach full operations until 2022 at the earliest. It is then expected to take 25 years to vitrify all of Hanford's tank waste, with the work completing no later than 2047. DOE has yet to resolve some serious design problems with portions of the Waste Treatment Plant, putting those deadlines at serious risk of not being met.

6. **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 had entered and flowed downstream in the Columbia River. Extensive monitoring indicates that 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. Oregon works closely with other State, County and Federal agencies to plan for and practice how to respond to this very unlikely event.

7. **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.

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).

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.deq.state.or.us/WQ/TMDLs/columbia.htm

http://yosemite.epa.gov/r10/ECOCOMM.NSF/Columbia/columbia

8. 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.

In January 1991, Congress (through then-Congressman, now Senator, Ron Wyden) created a "Watch List" of tanks that required special safety precautions. Sixty of Hanford's underground waste storage tanks were on the Watch List at one time or another – many for more than one safety-related issue. Resolving all of these tank safety issues took until August 2001, when the Watch List was closed.

There was also an effort to move free liquids from Hanford's older single-shell tanks to the 28 newer double-shell tanks, to lessen the risk and impact of further tank leaks. That process was completed in 2004. Ten tanks have also now been substantially emptied of their sludge as well.

In addition, Hanford needed new treatment facilities for liquid effluent waste; for handling and packaging waste; and a disposal facility for the more than 15 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 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.
- 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. 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 is expected to be completed in most places along the Columbia River corridor by 2015. Groundwater treatment systems along the river will operate well into the future.

9. **I've read that the Yucca Mountain nuclear waste disposal project has been cancelled, and I've heard that much of Hanford's most radioactive waste was to go there. What will be done with that waste now?**

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 Question 5 for further explanation). The vitrified waste will also need to be stored indefinitely until there is some alternative to Yucca Mountain. 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.

Federal law requires that the irradiated nuclear fuel and the vitrified high-level waste be disposed in a deep geologic facility. DOE is pursuing a process to identify a voluntary host site for consolidated storage of irradiated nuclear fuel from commercial nuclear power plants and high-level waste from DOE sites like Hanford. DOE is also hoping to identify a voluntary host for a deep geologic repository, although it doesn't envision one operating before about 2048.

10. **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; and 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://oregon.gov/ENERGY/NUCSAF/index.shtml. There, you can find links to a variety of citizen groups that are engaged in the Hanford cleanup.

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