

Providing the Washington State Department of Ecology's view on Hanford tank waste issues

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Why It Matters

The 586-square-mile Hanford Site is located in south-central Washington along the Columbia River. Hanford's mission included defense-related nuclear research, development, and weapons production activities from the early 1940s to approximately 1989. During that period, Hanford operated a **plutonium** production complex with nine nuclear reactors and associated processing facilities.

Today at Hanford, 177 **underground storage tanks** hold a total of 53 million gallons of dangerous waste. Some of these tanks have leaked, contributing to the [80 square miles of contaminated groundwater](#) under Hanford. This tainted groundwater [threatens the Columbia River](#) and all life that depends upon it.

This quarterly newsletter provides the latest information about the treatment and long-term storage of Hanford's tank waste. Find out more by following the [hyperlinks](#) in the articles. Terms in **bold font** are defined in the glossary on page 3.

Contacts

[Suzanne Dahl](#), Tank Waste Treatment Manager

[Erika Holmes](#), Outreach & Education

[Nuclear Waste Program](#)

3100 Port of Benton Boulevard

Richland, Washington 99354

hanford@ecy.wa.gov | 509-372-7880



Supplemental waste treatment solution clear as glass

At Hanford, emptying the large **underground storage tanks** and treating the dangerous radioactive and chemical (**mixed**) waste in them are two of the greatest challenges. The U.S. Department of Energy (USDOE) and its contractor Bechtel are building the **Waste Treatment Plant**, also known as the **Vitrification (Vit) Plant**, to treat this waste. Our job is to regulate the design, construction, and eventual operation of this facility through our [Dangerous Waste Permit](#).

The Vit Plant has three facilities that will separate and process tank waste: [Pretreatment \(PT\)](#), [Low-Activity Waste \(LAW\)](#) treatment, and [High-Level Waste \(HLW\)](#) treatment. At the heart of both the treatment facilities is [vitrification](#), or immobilizing waste in solid glass. Tank waste is separated into LAW and HLW in the PT Facility, sent to the appropriate vitrification facility, mixed with glass formers, and piped to large heating containers called melters. In November 2010, we moved one step closer to beginning this process when the Vit Plant received the [two melters](#) that will vitrify LAW.

Marvelous melters

During vitrification, the LAW melters will heat the mixture of tank waste and glass formers to 2,100°F (1,150°C). Then, the molten liquid will be poured into stainless steel storage containers where it will cool into solid glass logs. In glass form, the waste is still dangerous. However, it will be extremely durable and waterproof, which will protect humans and the environment for thousands of years as the radioactivity decays.

Fittingly for one of the most contaminated sites in the world, these LAW melters are engineering marvels each able to treat 15 metric tons of glass a day. This is at least [three times more than other melters in the world](#).

More LAW treatment needed

Despite the unprecedented output of these melters, the LAW Facility currently under construction is not enough to meet the [new deadline](#) of treating all tank waste by 2047! With the two current LAW melters running at full capacity, treatment would continue until 2080. That date would break the legally binding [Tri-Party Agreement \(TPA\)](#) between USDOE, Ecology, and the U.S. Environmental Protection Agency. To meet the 2047 deadline, an additional LAW treatment facility (or supplemental treatment), capable of treating 40 to 60 percent of the excess LAW, is needed.

USDOE is considering other methods, such as fluidized bed steam reforming, to treat the excess LAW and meet the 2047 deadline. This process uses super-heated steam and charcoal to bind liquid radioactive wastes into clay. At the *(Continued on page 2)*

(Supplemental waste treatment solution... continued from page 1)

USDOE Office of Environmental Management's Waste Processing Technical Exchange last November, numerous [presentations](#) focused on accelerating Hanford cleanup with steam reforming.

But Ecology is not interested in reconsidering how to treat the excess **LAW** for a number of reasons. The TPA requires some form of **vitrification** as the treatment method for excess LAW. We require technologically proven treatment method that will produce a waste form that is well understood, well tested, and durable for a long time.

We do not believe there are adequate resources or time to prove steam reforming produces a viable waste form that is as protective as glass within the next several years. This is based on the amount of time needed to:

- Design new treatment systems and appropriate **off-gas** systems.
- Test and thoroughly prove new waste forms.
- Fully understand the treatment system and its environmental impacts.
- Permit a new treatment technology.
- Construct and start up a second LAW treatment facility that is different from the one currently being built.

Let's build what we know

Ecology is advocating a second LAW vitrification facility. Vitrification technology is already being used in other parts of the United States and the world. More importantly, decades of testing on glass durability and glass formulation are already complete, proving it is a lasting, well-vetted waste form.

We think the best way to protect humans and the environment and stay on schedule is to build another vitrification facility at Hanford. The LAW Facility under construction is already designed and permitted. The second LAW facility would be built the same way.

The LAW glass will be permanently disposed at Hanford in [a landfill](#) above **groundwater** that feeds the **Columbia River**, an important resource for the Northwest. Many of the contaminants in this waste will last for thousands of years and are very mobile once in the environment. Vitrifying the LAW will help protect this great river.



Photo courtesy of Bechtel National, Inc.

Aerial photo of the Vit Plant construction site as of March 2011. Facilities clockwise from the top left are the Analytical Laboratory, Low-Activity Waste (LAW), High-Level Waste, and Pretreatment. Ecology supports the construction of a second LAW Facility to treat excess LAW and meet the cleanup deadlines.

BRC publishes “What We’ve Heard”

The [Blue Ribbon Commission on America’s Nuclear Future](#) (BRC) was formed by the United States Secretary of Energy in January 2010 to consider alternatives for long-term storage of the nation’s **high-level nuclear waste**. The BRC has released a [report](#) summarizing the major themes that arose from hearings, site visits, letters, and website comments.

The report highlights one of the main barriers to solving this problem: “failures that are primarily social and political, not technical” (page 4). It continues by summarizing the following other issues brought forth by the public:

- Program governance and execution.
- Nuclear waste fee and fund.
- Approach to siting.
- Reactor and fuel cycle technologies.
- Transport and storage of **spent nuclear fuel** and **high-level wastes**.
- Disposal system for highly radioactive waste.

This report’s purpose is to allow those who have commented to verify that their voices were heard and recorded accurately, and to allow those who have not commented to do so now.

Comments can be emailed to brc@nuclear.energy.gov.

The Commission will issue an interim report in July with advice and recommendations on managing the back end of the nuclear fuel cycle. A final report is due in January 2012.

Glossary

Columbia River: A 1,214-mile river that begins in British Columbia, Canada, flows down through Eastern Washington and heads west, forming the border between Washington and Oregon, before emptying into the Pacific Ocean. It is the largest river in the Pacific Northwest, and passes through the Hanford Site.

Groundwater: Water below the ground surface in a zone that is completely saturated.

High-level waste: Material resulting from the reprocessing of **spent nuclear fuel**. This includes liquid produced during reprocessing and solid material derived from this liquid waste that contains fission products in sufficient concentrations and other highly radioactive material that, by law, requires permanent isolation.

Low-activity waste: Waste that remains after as much radioactivity as is technically and economically practical has been separated from **high-level waste**. When immobilized in glass, it may be disposed of as low-level radioactive waste in a near-surface facility at Hanford.

Mixed waste: High-level radioactive waste mixed with dangerous chemicals.

Off-gas: A gaseous radioactive and hazardous byproduct of tank waste treatment.

Pretreatment: The first process in treating Hanford’s tank waste, which separates waste into **low-activity** and **high-level waste** for **vitrification**.

Plutonium: A heavy, radioactive metallic element with the atomic number 94. Plutonium-239 is the radioactive isotope used in nuclear weapons.

Spent nuclear fuel: Fuel taken from a nuclear reactor that was never processed for **plutonium** separation.

Underground storage tank: A tank that is entirely below the surface of and covered by the ground. At Hanford, there are two types of underground storage tanks with capacities ranging from 50,000 to one million gallons. The single-shell tanks have one steel liner encased in concrete, and the double-shell tanks have two steel liners encased in concrete.

Vitrification: A method used to immobilize waste (radioactive, hazardous, and mixed). This involves adding glass formers and waste to a vessel and melting the mixture into a glass form.

Waste Treatment Plant: Facility designed and built to thermally treat and immobilize (**vitrify**) tank waste at Hanford.

Ecology in the classroom and community

Hanford cleanup is a unique process marked by specialized terms, acronyms galore, and many different projects. Cleaning up the tank waste, for example, is just one of the ongoing missions.

Public involvement in decision making is a [legal requirement](#). But how can the average person make educated comments about topics they may not have any background in? Educating the public long before it's time to make a decision helps people meaningfully engage in Hanford issues.

Ecology's Nuclear Waste Program is committed to raising awareness about Hanford. We're organizing and increasing our educational outreach by building an Ecology Speakers Bureau with the help of Hanford Communities (read more in their [newsletter](#)).



Attendees of the 2011 State of the Hanford Site public meeting in Portland prepare to ask questions. Meetings were also held in Richland and Seattle.



Ecology's Erika Holmes testing dissolved oxygen levels in the Columbia River downstream of Hanford with high school students at the STEM (Science, Technology, Engineering, Math) Convocation.

community groups like the Horse Heaven Hills Kiwanis Club, whom we met with last November to share information about the Vit Plant.

Call Erika at (509) 372-7880 or email Hanford@ecy.wa.gov if your school or club is interested in learning more. To see pictures and read updates about some of the outreach we do, please visit our [ECOconnect blog](#), "like" our [Hanford Education & Outreach Network Facebook page](#), and join our [Hanford Education & Outreach email list](#)!

If you need this document in a format for the visually impaired, call the Nuclear Waste Program at 509-372-7950. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.

We reach all age groups through a range of activities: classroom and club presentations, community and educational events, conferences, and service-learning projects for students.

Seeing today's youth as stewards of future cleanup, we're partnering with area schools and universities. We've recently participated in [Salmon Summit](#), [Chiawana High School Science Field Day](#), Badger Mountain Elementary Science Night, and the [STEM \(Science, Technology, Engineering, and Math\) High School Convocation](#). We've also presented to classes at [Columbia Basin College](#), the [University of Washington](#), and [Portland State University](#).

In the local community, we exhibit at the [Hanford Health and Safety Expo](#), the [Benton-Franklin County Fair](#), and the [Tri-Cities Sportsmen Show](#). We'd like to reach more com-



Ecology's John Price speaking about human health issues at Hanford as part of the University of Washington's Public Health seminar series.