Tank Waste Treatment News

Volume 2, Issue 1

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

Tank Waste Treatment News (TWTN) is a quarterly newsletter providing current information about treatment and long-term storage of Hanford's tank waste.

In This Issue

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 1943 to 1987. During that time, 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 56 million gallons of dangerous waste. Some of these tanks have leaked, contributing to more than 70 square miles of contaminated **groundwater** currently under Hanford. This tainted groundwater threatens the Columbia River and all life that depends on it.

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DEPARTMENT OF ECOLOGY
State of Washington

Tanks and Treatment to Unite

Ecology's mission at the Waste Treatment Plant (WTP) is to treat, store, and dispose of Hanford's 56 million gallons of **mixed waste**. This waste is currently in 177 **underground storage tanks** in groups called *tank farms*. WTP, also known as the Vit Plant, will split Hanford's tank waste into **high-level waste** (HLW) and **low-activity waste** (LAW), and turn it into glass form using **vitrification**. In the past, roughly one million gallons of tank waste leaked to the soil, causing significant contamination and threatening **groundwater** and potentially the **Columbia River.** Our goal is to protect people and the environment from this dangerous waste.

An important step in ensuring WTP operates safely and as designed is integrating U.S. Department of Energy (USDOE) staff and contractors working in the tank farms and WTP. Over the years, the two have had their own identities and responsibilities. But as WTP startup draws nearer, USDOE is creating a "One System" team, a move that Ecology supports. Doing so will help answer some of the remaining questions for WTP, and help the community understand what is necessary to make WTP successful.

The lead USDOE contractor in the tank farms is Washington River Protection Solutions (WRPS). Bechtel National, Inc. (BNI) is the lead construction contractor for WTP. WRPS's contract expires in 2013, with options to extend it through 2018. BNI's contract expires in 2019, when WTP commissioning will be complete. Before this happens, USDOE will contract an operator for WTP.

Integration Goals

Tank farm and WTP staff will both be responsible for tasks necessary to starting WTP. The combined staff must integrate their work to ensure efficient, effective waste transfer and treatment. That's why it's important that knowledge-sharing and collaborative planning on the following issues begins now.

Waste Acceptance Criteria

Restrictions will be placed on the waste coming into WTP to ensure it's in a form appropriate for the treatment system. The waste acceptance criteria will be a recipe for tank farm workers to follow when they prepare batches of waste for treatment. They will mix, blend, possibly grind, and characterize tank waste before they send it to WTP. Workers will sample for levels of chemicals and **radionuclides** and make any necessary adjustments to the waste. (See the sidebar on page 2 for information on **plutonium** levels in tank waste.)

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In total, it will take a minimum of 210 days to prepare each batch for treatment. Thirty days will be spent thoroughly mixing and sampling the waste. The remaining 180 days will be used to analyze the samples and modify the waste to meet the acceptance criteria for WTP.

Equipment and Facilities

WRPS needs to lay piping from the tank farms to WTP, but this isn't as straightforward as it may sound. WTP needs more funding to startup by 2019 and be fully operational by 2022, deadlines established by a legal agreement. Funding needs are projected to reach $970 million in 2013 to address technical concerns and maintain construction schedules. Current 2013 federal funding for WTP is $280 million less than what's needed to operate WTP in 2019.

Because the **Pretreatment** Facility (PTF) has the most challenging technical issues (see "Focus on Pretreatment" in Volume 1, Issue 3 of TWTN), USDOE is considering starting the LAW Vitrification Facility without PTF. This plan requires WRPS to install additional pipelines to feed waste directly to the LAW Vitrification Facility.

Some contaminants (technetium, iodine, and other volatiles) are released as vapors during vitrification. These contaminants will be caught in the scrubber and would be recycled to PTF for processing in another batch. However, without PTF, new pipelines would have to be installed to return this large recycled waste stream to the tank farms.

In addition to the extra pipelines, this plan would require tank farm workers to pretreat waste either inside or near the tanks. Although there may be benefits in starting the LAW Facility before PTF, USDOE should critically evaluate these benefits against the costs and changes in operation for a temporary solution.

Facilities must be also available in the tank farms to adequately mix, blend, grind, characterize, and deliver waste in accordance with WTP's waste acceptance criteria. This could happen within the tanks or at a new, not-yet-constructed facility.

USDOE also needs a facility to store the treated HLW, which will account for 10 percent of the waste after treatment. Hanford's vitrified HLW canisters were destined to go to the **deep geologic repository** at **Yucca Mountain** (see "Yucca Mountain – The Saga Continues" in Volume 1, Issue 4 of TWTN). Since the federal government canceled this project in 2010, a larger quantity of HLW canisters will have to be stored at Hanford until a national repository exists. The remaining 90 percent of the waste will be treated LAW canisters. These will be permanently disposed in Hanford's Integrated Disposal Facility.

Timing and Coordination

Tank farm and WTP employees need a shared understanding of their combined mission, regulatory strategy, technical issues, schedule, and startup planning. They must work together to identify all of the work that they must do and how and when to do it.

Pu: What's the Stink about Plutonium Levels in Hanford's Tanks?

Recently, concerns have been raised about higher amounts of **plutonium** in some of Hanford's tanks than was previously thought. Because Hanford has so many tanks and the waste composition varies greatly from tank to tank, USDOE hasn't fully characterized the waste in all the tanks. So people have asked, *"How can you build a treatment facility for waste that you don't know everything about?"*

To model a system with uncertainties (such as Hanford's tank farms), a set of variables can be used to represent, or *bound*, the unknown. This is called a *bounding approach*. In 2000, WTP design began based on four types of waste, each with different characteristics. These were thought to bound the types of waste WTP would treat. The waste types were created by making assumptions based on tank waste samples, modeling waste streams as they were produced in Hanford's processing plants, and modeling how waste changed as it sat in the tanks. Many of the parameters that define these waste types consider chemical and radionuclide ingredients, and the size and hardness of waste particles. The four types have now been expanded to 13, which refined the original four.

One of the concerns stemming from the recent report about plutonium levels is that some of the particle sizes may be larger than what WTP's **pulse jet mixers** can keep suspended, allowing solids to settle in the bottoms of waste-mixing tanks. This would keep these particles from being processed and could plug pipes or, if enough plutonium particles amassed, cause a criticality. (A *criticality* is when enough radioactive materials are present to sustain a chain reaction.) In 16 of Hanford's tanks, the plutonium particle size and amount may require the waste to be held in the tank system until it can be ground to reduce particle size and blended with other waste to reduce the concentration of plutonium before being sent to WTP. This will be outlined in waste acceptance criteria.

None of this is a surprise, and the recent plutonium report is the result of ongoing studies to help further understand the issue and identify solutions. At WTP, plans, such as periodically cleaning out the bottoms of waste-mixing tanks, are underway to lessen the impacts of these types of waste.

Ecology Presents at Waste Management Conference

To ensure that Washington State's opinions on Hanford's Waste Treatment Plant (WTP) are known, Ecology presented a paper at the annual Waste Management Conference. Over 2,000 people from all over the world convened to discuss cost-effective and environmentally responsible solutions to the safe management and disposal of radioactive waste.

Left: Conference-goers join the opening session, just one of hundreds of presentations about nuclear waste that were offered during the week.

Tank Waste Treatment Section Manager Suzanne Dahl and Education & Outreach Specialist Erika Holmes attended sessions about the U.S. Department of Energy's plans for the next few years at Hanford, Hanford tank waste, the future of **Yucca Mountain**, the Blue Ribbon Commission on America's Nuclear Future final recommendation report (see page 4 for more info), and engaging citizens in nuclear issues.

Right: Suzanne presents our paper, "Full Focus Needed on Finishing Hanford's Waste Treatment Plant."

The State's preferred path forward for WTP requests that the U.S. Department of Energy:

- Maintain focus on completing the five major WTP facilities.
- Construct a second **low-activity waste vitrification** facility (see "Supplemental Waste Treatment Solution Clear as Glass" in Volume 1, Issue 2 of TWTN).
- Prepare infrastructure for waste feed from tank farms and facilities to handle the WTP waste streams.

Left: Suzanne talks with representatives from the Waste Isolation Pilot Plant (WIPP) located in Carlsbad, New Mexico. WIPP is our nation's only successful disposal site for radioactive waste. Currently, it accepts defense-related **transuranic waste**, including shipments from Hanford, for disposal in large underground vaults cut into saltstone. Due to precipitation slowly changing the salt formation, the vaults will eventually collapse on themselves, forever entombing the waste. Some supporters would like to see WIPP accept **high-level waste** in the future.

Blue Ribbon Commission Finalizes Disposal Recommendations

The Blue Ribbon Commission on America's Nuclear Future (BRC) has submitted its final report to the Secretary of Energy. The Commission was formed in January 2010 to consider alternatives for long-term storage of the nation's **high-level waste** (HLW) and **spent nuclear fuel**.

Last summer, after the BRC issued its draft report recommending a new strategy for managing HLW and spent nuclear fuel, Ecology submitted a letter formally responding to it. In summary, our comments asked the BRC to add language guaranteeing that treatment and disposal of HLW be given priority. We also asked them to recommend that the Nuclear Regulatory Commission (NRC) complete the **Yucca Mountain** repository licensing process (see "Yucca Mountain – The Saga Continues" in Volume 1, Issue 4 of TWTN).

Unfortunately, the BRC did not modify their recommendations to include our suggestions. Most notably for the State of Washington, no recommendations concerning the future of Yucca Mountain were made, still leaving us responsible for storing 60 percent of the nation's defense-related HLW with no definite end in sight. But it is clear that Commission members agree with Ecology that the Nuclear Waste Policy Act (NWPA) legally designates Yucca Mountain as the nation's only repository for HLW. Their report states, "The NWPA … now provides only for the evaluation and licensing of a single repository site at Yucca Mountain, Nevada. The Act should be amended … "

Although the NRC is legally required to finish the licensing process, this seems unlikely without funding, which the federal government ended October 1, 2011. In a post-Yucca Mountain reality, our best path forward is for Congress to take swift action to change NWPA so other disposal sites can be considered.

Inheriting Hanford: A New Way to Engage

One of the problems for Hanford today is a lack of public interest in the cleanup process, and Ecology is always looking for creative ways to engage new (and younger) people. Hanford cleanup will continue until at least 2047, and one of the state and federal government's most important responsibilities is informing and engaging the public. Public interest, knowledge, and perceptions of Hanford affect cleanup decisions and the budget.

Ecology recently attended a forum bringing together state and federal agencies, nonprofits, involved citizens, educators, and retired workers with a common goal: getting more young people interested in Hanford. With all of its intimidating acronyms, jargon, and bureaucracy, we agreed this is a tall task. Often when people take that first step of attending a public meeting or reading a Hanford report, they soon find themselves bored, confused, or both.

At the forum, participants discussed how to make Hanford more accessible, understandable, and even more memorable. We agreed that the relationships we'd built with others working on Hanford issues were one of the things that kept us all interested. So we created Inheriting Hanford, a website where people new to Hanford can connect with others who have similar interests but more experience than they do.

Lots of Hanford information is available online; that's not the purpose of Inheriting Hanford. On this website, you can find a mentor to help you navigate and understand all that information — free of charge with no strings attached! You decide who to talk to and how and when you communicate. Rather not have a one-on-one discussion? Browse events like movie nights and discussion groups. You can also become a mentor to someone else.

People in the Northwest all inherit Hanford's waste. Arm yourself with knowledge by visiting Inheriting Hanford!

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 approximately 50 miles of it flow through the Hanford Site.

Deep geologic repository: A long-term nuclear waste disposal site excavated underground, below 980 feet, in a stable geologic environment.

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 solids derived from this liquid waste that contain 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.

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.

Pulse jet mixer: An air-driven device with no moving parts that suspends solids in liquid waste. It works like a large turkey baster, repeatedly sucking in waste and then expelling it back out, to keep particles from settling.

Radionuclide: A nuclide that has artificial or natural origin and exhibits radioactivity.

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

Transuranic Waste: Waste that is not categorized as **high-level waste** but contains more than 100 nanocuries of alpha-emitting **radionuclides** per gram with half-lives greater than 20 years. Transuranic elements are those after uranium (atomic number 92) in the periodic table.

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 are do not comply with State environmental laws. The double-shell tanks have two steel liners in concrete and are compliant because they detect and contain leaks.

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

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

Yucca Mountain: A Nevada mountain designated as the nation's **deep geologic repository** in 2002. As of early 2010, the federal government cut funding for this project and tasked the BRC with finding alternatives.

Defense Nuclear Facilities Safety Board Public Hearing and Meeting

March 22, 1:00 - 9:00 p.m.

Voice your opinions on technical safety issues at Hanford's Waste Treatment Plant

Three Rivers Convention Center
7016 W. Grandridge Boulevard
Kennewick, WA 99352

More information

Join Ecology's Hanford Education & Outreach Network: a Facebook page, an email list, and our ECOconnect blog. All three tools are moderated (spam free!), and we encourage participants to share and discuss Hanford information, resources, and events.

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