Tank Waste Treatment News

Volume 1, Issue 3

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

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 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 56 million gallons of dangerous **mixed waste**. Some of these tanks have leaked, contributing to the 80 square miles of contaminated **groundwater** under Hanford. This contaminated groundwater threatens the **Columbia River** and all life that depends on it.

This quarterly newsletter provides 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 2.

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DEPARTMENT OF ECOLOGY
State of Washington

Focus on Pretreatment

Despite years of sampling and analyses, Hanford's tank waste may bring many surprises when it is sent for treatment. Because of uncertainty about what's in the waste, no one knows exactly how well the processes in the **Pretreatment** Facility (PTF) of Hanford's **Waste Treatment and Immobilization Plant** (WTP or Vit Plant) will perform until we turn the key.

The U.S. Department of Energy (USDOE) is conservative in its design and uses high safety standards. Expert reviews, continual testing, and watchful oversight from the Defense Nuclear Facilities Safety Board instill confidence in WTP's design. Such efforts reduce risk and uncertainties.

But even a preliminary look at WTP design exposes its biggest limitations. The **Low-Activity Waste** (LAW) Facility can only treat one-third of the LAW stream that PTF will generate. A yet undetermined supplemental treatment is supposed to treat the rest of the LAW (see "Supplemental waste treatment solution clear as glass" in the June 2011 issue of *Tank Waste Treatment News* for more info).

The recommendation in the Environmental Management Advisory Board's June 2011 report to delay the decision of supplemental treatment by up to five years can only aggravate the problem of mismatched plant design (see our ECOconnect blog post from July 14, 2011 for more info).

Time keeps on slippin'

During the past 25 years, USDOE has not sustained a consistent course in tank waste treatment. In 2002, they started researching supplemental technologies to treat the two-thirds balance of LAW. Formal process selection and testing in a pilot plant was planned to be completed by 2007. This search for a suitable technology to treat the excess LAW continues today with little progress. The delay is a typical example of how work progresses in supplemental tank waste treatment projects at Hanford.

The repeated evaluation of supplemental technologies has drained attention from the all-important task of completing WTP and is delaying cleanup. The development of bulk vitrification cost taxpayers about $100 million with no benefit. Now steam reforming threatens a similar outcome (see our ECOconnect blog post from March 9, 2011 for more info). These new technologies, not yet properly tested on Hanford waste, will take several years to meet the required technology readiness level. Therefore, they do not meet the legal schedule for WTP construction and startup. *(Continued on page 2)*

(Focus on Pretreatment... Continued from page 1)

Does early LAW treatment = less focus on PTF?

Of all the WTP facilities, PTF poses the greatest design, construction, and operational challenges. Because full-scale vitrification processes have operated successfully at other locations for decades, the risks in LAW and High-Level Waste Facility design are small compared to the complex operations in PTF.

There are potential benefits to starting the LAW Facility early, including staggering the startup of WTP facilities and learning operational lessons from the LAW Facility.

Although Ecology supports starting the LAW Facility ahead of schedule in principle, this concept was evaluated in 2007 and proven to be difficult and costly. We are afraid the repeated attention given to this idea is detracting from operating *all* of WTP on schedule.

Starting the LAW Facility without the support of the PTF currently under construction presents many problems, including:

- Disrupting the ongoing construction of other WTP facilities.
- Designing and building a smaller version of PTF near the **underground storage tanks**.
- Installing new pipelines to feed waste to the LAW Facility.
- Recycling waste streams from the LAW vitrification system back to the underground storage tanks.

Ecology urges USDOE to first focus on completing PTF. We are concerned that the schedule for starting the LAW Facility early is not realistic. It could take significantly longer than USDOE anticipates to get the additional smaller pretreatment system designed, permitted, constructed, and operating. It is crucial that USDOE closely examine its efforts related to WTP and then move in a direction that supports full, sustainable operations of WTP above all else.

As the pictures in the following photo essay show, much work remains in PTF.

At Ecology, we believe patience and perseverance in pretreatment is prudent.

Left: Ecology staff head to the Pretreatment Facility to inspect progress and areas that will receive design changes.

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.

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

Ecology visits the Pretreatment Facility

Left: **Pretreatment** Facility engineer Robbie Biyani explains the hot cell, which will contain critical waste processing equipment like ultrafilters to remove solids and ion exchange columns to remove soluble radioactive material.

Center: **Waste Treatment Plant** permit writers Annette Carlson and Marcus Faber with Robbie and communications manager Dieter Bohrmann in front of vessel TLP-9A. This tank will send waste to the **Low-Activity Waste** Facility.

Center: Robbie explains the leak detection system to Dieter. The system will detect and contain any leak in the underground pipelines between the Pretreatment Facility and the **underground storage tanks** and from the Pretreatment Facility to the High-Level Waste and Low-Activity Waste facilities.

Right: A Bechtel employee shows the pipeline leak detection system process diagrams to Ecology staff.

Below: Views of the Low-Activity (left) and High-Level (right) Waste facilities from the top of the Pretreatment Facility.

BRC issues draft report recommending new spent fuel strategy

The Blue Ribbon Commission for America's Nuclear Future (BRC), formed by the Secretary of Energy in January 2010 to consider alternatives for long-term storage of the nation's **high-level nuclear waste**, has submitted a draft report. The report recommends a new strategy for managing **spent nuclear fuel**, which has seven key elements.

1. A new, consent-based approach to siting future nuclear waste management facilities.
2. A new organization dedicated solely to implementing the waste management program and empowered with the authority and resources to succeed.
3. Access to the funds nuclear utility ratepayers are providing for the purpose of nuclear waste management.
4. Prompt efforts to develop one or more **deep geologic repositories**.
5. Prompt efforts to develop one or more consolidated interim storage facilities.
6. Support for continued U.S. innovation in nuclear energy technology and for workforce development.
7. Active U.S. leadership in international efforts to address safety, waste management, nonproliferation, and security concerns.

Public comments on the draft report will be accepted through October 31, 2011. The BRC will consider those comments in preparing its final report, which is due in January 2012. You may submit comments through the BRC website, at one of several public meetings to be held during the comment period, via email to brc@nuclear.energy.gov, or in writing to:

Mr. Timothy A. Frazier, Designated Federal Officer
Blue Ribbon Commission for America's Nuclear Future
U.S. Department of Energy
1000 Independence Ave., SW
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Summer outreach recap and fall preview

Summer break from school doesn't mean educational outreach stops at Ecology.

Above: Students at Washington State University Tri-Cities summer science camp find radiation with a Geiger counter during a forensics session.

We ran five sessions of summer science camps at Washington State University Tri-Cities (WSU-TC). In the forensics sessions, students tested Richland tap water quality. They also learned to use a Geiger counter to detect small amounts of radiation from hidden sources. In the modeling sessions, we demonstrated Hanford **groundwater** contamination, and students built watershed models to better understand the water cycle and how pollution is incorporated into it. We also led a geology session at Kennewick's Parks & Recreation summer science camp.

After a Portland public meeting in July, we held a question and answer session with students in a globalization course at Portland State University. And, during the last week of August, we exhibited at the Benton Franklin Fair & Rodeo (blog | photos).

This fall, we've scheduled presentations for a new Hanford history course at Heritage University, a Pacific Northwest history class at Columbia Basin College, and the Columbia Basin Chapter of the American Society of Mechanical Engineers. We're also working on service-learning project with technical communication students at WSU-TC to develop Hanford-related, classroom-ready curricula for grades 4–12. But we're looking for more outreach opportunities! Please contact Erika Holmes with questions or requests (509-372-7880).

We also invite you to 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. We need *you* (and your friends and colleagues so please share these links) to build this collaborative network and make it useful. Join today!