



## **Relabeling and Grouting Tank Waste at Hanford**

### **Frequently Asked Questions**

#### **"What is the Deal with Hanford Tank Waste?"**

##### **Q: What is Hanford?**

The Hanford Site made plutonium for nuclear weapons for 45 years. Nuclear reactors bombarded uranium fuel rods—tubes inserted into a reactor and used as a power source to achieve and sustain a controlled nuclear chain reaction— which created new radioactive isotopes, including plutonium. Manhattan Project workers dissolved the fuel rods in chemicals to extract a tiny amount of plutonium.

##### **Q: What did they do with everything else that was left over after extracting the plutonium?**

The rest of the material—highly radioactive elements and toxic chemicals—had to be thrown away. However, you can't just throw these elements away, they need to be isolated from humans and the environment. Unfortunately, at Hanford, a lot of this waste ended up in the ground, groundwater, storage pools, tanks, and buildings. The worst of Hanford's waste ended up in 177 tanks buried underground and was labeled high-level waste. Storing this waste in the tanks was seen as a short-term solution. The Manhattan Project managers knew the waste would have to be dealt with later.

##### **Q: What makes Hanford's tank waste so dangerous?**

Radiation. Low to mid-levels of radiation are imperceptible to human senses. Engineers use special tools to measure its presence. There are different kinds of radiation that impact the human body in different ways. At Hanford Challenge, we're most concerned with gamma radiation which can go through your skin, bones, muscles, and organs, and cause damage to your cells.

Radiation changes over time, through a process called decay. Different radioactive elements take different amounts of time to decay. Different versions of the same element are called isotopes. The same radioactive element can have one kind of isotope that is no big deal, and another kind of isotope that is really bad. At Hanford, we're concerned with the radioactive isotopes that are extremely dangerous.

Different isotopes are dangerous in different ways, depending on the exposure pathway and volume. Though radiation can decay to a point where it isn't considered dangerous, it never truly goes away. Some isotopes decay quickly while others take a long time. A half-life is the time it takes for half of the radioactivity to decay. For example, Cesium-137 has a 30-year half-life.

Iodine-129 has a half-life of 15.7 million years. Unfortunately, the radioactive elements in waste at Hanford vary widely in type and volume and might be harmful if people are somehow exposed to the elements even thousands of years in the future.

The basic concept behind the cleanup of radioactive waste is to contain the radioactive elements while they decay and keep them from getting into our food, air, and water. At Hanford, a lot of the waste is already in the groundwater and soil. Some of the waste is contained for now, but it needs long-term solutions to keep it from spreading in the environment.

**Q: Are there other hazardous materials in the waste besides radiation?**

Unfortunately, radiation isn't the only problem. The federal government used chemicals to dissolve the fuel rods and for other parts of the plutonium production process. These chemicals do not decay and are hard to destroy. Mostly, they just need to be isolated from humans—similar to radioactive waste—so they don't get into our food, air, and water.

Almost all of Hanford's waste contains chemicals mixed with radioactive isotopes and is called mixed waste. One of the most prevalent toxic chemicals at Hanford is hexavalent chromium, which is cancer-causing.

The chemicals inside the tanks emit vapors that are vented into the surrounding environment. Over 1,800 toxic chemicals have been documented in the vapors contained within the headspace (top part under the dome) of the tanks. Tank vapors are incredibly dangerous to Hanford workers. Tank farm workers without supplied air respiratory protection are at risk of inhaling these toxic chemical vapors. Workers exposed to the tank vapors have suffered serious long-term health effects including brain damage, lung disease, nervous system disorders, and cancer.

**Q: What is the plan for cleaning up the tank waste?**

The plan for tank waste has a few stages. The least exciting stage involves babysitting the tanks by monitoring them, looking for leaks, and figuring out what to do when they leak.

The more active tank waste cleanup started in early 2022 and involves removing the liquid portion of the tank waste, running it through filters to remove Cesium-137, and storing the treated waste in a staging tank. This process prepares the tank waste for vitrification—the immobilization of the waste in glass. In August 2025, vitrification of the low-activity tank waste is scheduled to begin. This date was recently delayed from September 2023. The low-activity waste is expected to be buried at the Hanford Site in a shallow landfill with a leachate collection system to catch and treat liquids. This treatment process will redefine the waste from high-level to low-activity waste. The remaining high-level waste must be buried in a deep geologic repository.

The high-level portion of the tank waste—about 10 percent of the total volume of tank waste—would be immobilized in glass at Hanford and stored temporarily on site until the federal government picks a deep geological repository. There is a lot of uncertainty about when this will happen. The timeline for high-level waste has been delayed many times due to technical issues with the treatment facilities that were built to do this work.

**Q: Are there different kinds of tank waste?**

Tank waste can take three different forms. At the top of the tank, there's supernate, which is the liquid portion of the tank waste. This liquid sits on top of the saltcake layer, which is a solid block of salt. The liquid can also pass through holes in the saltcake layer and drop down towards the bottom of the tank. At the very bottom of the tank is a sludge layer, which is the consistency of peanut butter.

The tanks are sampled by inserting a long, narrow, straw-like contraption into a narrow pipe—called a riser—that hangs down on the inside, at the top of the tank. The tanks are 75 feet across, but the risers are only about 2 inches in diameter. So, it's difficult to determine if samples accurately show all the waste contents.

Those samples are then characterized, which is the process of identifying the physical and chemical properties of the waste. The waste characterization process considers the historical records (if available) of what was put in the tank, personal accounts from workers, past waste sampling results (if available), and ongoing waste sampling results.

This information is compiled for each of the 177 tanks at Hanford to provide a rough idea of what is inside each tank. There are limitations to characterization because historical records and sampling results are limited.

**Q: What is reclassification of high-level waste?**

The classification—or labeling—of nuclear waste determines what rules or restrictions apply to the final form the waste is in and where the waste can ultimately be disposed of. For example, if waste is classified as “high-level” waste, it must be immobilized in glass and buried deep underground in a geological repository. However, if waste is classified as “low-level”, then it could be immobilized in glass or grout (cement) and buried in a shallow landfill.

The rules regarding low-level waste treatment and disposal are easier to follow. USDOE wants to reclassify (relabel) high-level waste as “other than HLW.” If the waste is reclassified as “other than HLW,” then USDOE no longer needs to immobilize the waste in glass and bury the waste deep underground. For example, to close the tank farms where the high-level waste is stored, USDOE wants to reclassify any waste remaining in the Hanford tanks and leave the waste in the tanks forever, rather than removing and treating it.

**Q: What does grouting tank waste mean?**

Grout is similar to concrete. USDOE is considering using grout for two purposes. One is for tank closure where grout would be used to fill mostly emptied tanks, and then the tanks would be left in place forever. The other would be to use grout as an alternative to the current plan of immobilizing treated tank waste in glass. The treated tank waste would instead be immobilized in grout and disposed of in a near-surface landfill. USDOE believes it could save time and money by grouting tank waste.

**Q: Are there any concerns with using grout to immobilize Hanford's tank waste?**

Grout is being pushed by USDOE as a "faster, better, and cheaper" option. However, Hanford Challenge is concerned that grout will be more expensive, technically complicated, and less protective than USDOE is claiming. We are concerned that USDOE's oversimplification is painting a misleading picture of grout that could lead to more taxpayer-funded cleanup dollars being wasted, further delays to tank waste cleanup, and more risks to future generations if or when the tank waste leaches out of the grout form.

USDOE exhaustively considered using grout to immobilize tank waste at Hanford in the 1980s and 90s. USDOE eventually abandoned the plan because it couldn't effectively and efficiently produce a solid grout waste form due to the complexities of Hanford tank waste and escalating costs. Much is still unknown about what has changed in USDOE plans that indicate grouting will now be successful.

Despite improvements in the sampling of Hanford tanks, we still don't have a complete picture of exactly what concentrations and types of radioactive and chemical wastes each tank contains. Also, the tank waste is not all mixed together like a freshly blended smoothie. Each tank has layers of waste, so one sample of waste from a tank will only show part of what is in the tank, not a complete picture of everything within. In addition, not all tanks have been fully sampled. For grout, that means each batch of tank waste must be tested to develop the correct grout recipe. This may be a time-consuming process, rather than the fast, cheap solution that USDOE is promoting.

Lifecycle cost estimates show glass is competitive or cheaper than grout. In addition, grout produces more waste by volume than vitrification—resulting in between 4 and 4.4 times as much waste as vitrification. Grouting radioactive tank waste does not provide long-term protection of human health and the environment, because radionuclides don't stay immobilized in grout over time and can leach out into the environment—threatening drinking water and wildlife. Vitrifying Hanford's tank waste is still the most protective strategy to safeguard future generations.

**Q: Are there circumstances under which Hanford Challenge would not object to using grout?**

Yes. The criteria under which high-level waste (HLW) is treated and reclassified would determine whether Hanford Challenge objects to the use of grout. For USDOE to use grout as an immobilization option at Hanford, the tank waste would need to be reclassified from high-level waste to low-level waste (LLW). There are circumstances and scenarios where reclassification of HLW may be appropriate. In fact, the law currently allows only the Nuclear Regulatory Commission to reclassify HLW at Hanford and only in certain circumstances.

Hanford Challenge believes that HLW that has been treated and reclassified as LLW using the following criteria may be appropriate for a grouted waste form:

- There is a presumption that HLW (which include long-lived radionuclides and chemicals) will be vitrified and buried in a deep, geological repository;
- There is an agreed-upon understanding that long-lived radionuclides presumptively require disposal in a geological repository;

- The use of reclassification is used in “special and unusual” circumstances – not wholesale to reclassify substantial portions of HLW and never for expediency or economic cost-savings reasons;
- The HLW has been treated and key radionuclides have been removed;
- An independent entity (such as a new agency or commission created for the purpose of nuclear waste disposition) makes the determination to reclassify the waste;
- There has been an open, transparent, and inclusive process involving interested stakeholders;
- The State of Washington and the affected Tribal nations concur;
- There is a comprehensive report specifying what waste volumes/concentrations are being left at Hanford, for how long, and why;
- An assessment of the cumulative impact on the environment and future generations is prepared and made publicly available; and
- There is a judicial process available for aggrieved parties to challenge a determination in federal court.

**Q: What are the key takeaways?**

Hanford’s tank waste is a toxic stew of radioactivity and chemicals. There are many questions still outstanding about what elements are present in the waste and in what concentrations. It is difficult to know a tank’s overall contents based on only a few samples.

Hanford’s tank waste is incredibly dangerous to human health and the environment. Exposure to the waste can cause serious long-term health effects. A release of the waste into the environment could contaminate food, air, and drinking water. Instead of trying to safely and thoroughly clean up this nuclear mess, USDOE is attempting to cut corners on cleanup by relabeling high-level waste as “other than HLW”. Reclassifying the waste could allow USDOE to use less protective treatment and disposal methods for the waste. USDOE’s main goal is to take shortcuts to save time and money—in effect, shortchanging future generations out of a thorough cleanup. Hanford Challenge's main goal is to ensure USDOE safely and effectively treats and disposes of tank waste now.

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