What's in the Water at the Hanford Nuclear Site?

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At Hanford a zone of groundwater pollution is referred to as a "plume." Although often shown in flat maps, plumes at Hanford are both broad and deep, moving downward towards groundwater and horizontally, sometimes meandering towards the Columbia River. Almost 60 square miles of Hanford sits on top of groundwater plumes that don't meet safe drinking water standards. The pollution is a result of ongoing releases and historic discharges of more than 400 billion gallons of contaminated water directly into soils and groundwater at Hanford.

Background

Operations at Hanford resulted in the intentional and unintentional releases of toxic and radioactive contaminants into the soils, groundwater, and the Columbia River. Today, much of the cleanup involves activities such as soil flushing, operating pump-and-treat systems to remove contamination from groundwater, soil remediation, and clean up of contaminated structures (such as the 177 underground tanks) which can pollute the soil and groundwater.

Why Do We Care?

The water falling on Hanford that travels through soils ultimately descends to groundwater, which can flow downwards and sideways to the Columbia River. This part of the River provides drinking water to downstream communities, irrigation water for nearby farms, and prime habitat for salmon. Some water at Hanford is taken up by plants or animals that can then become radioactive if the water is polluted. Existing contaminant plumes pose a risk of reaching the Columbia River if not cleaned up.

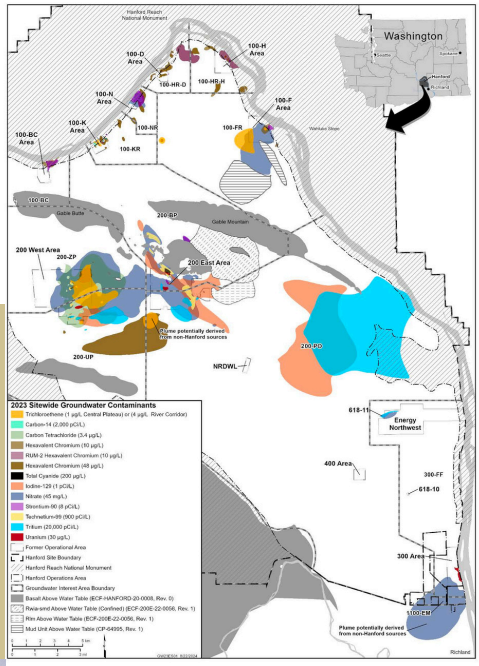

Figure ES-1. Hanford Site Groundwater Contaminant Plumes

Photo of a map at Hanford depicting different colored groundwater plumes on site. Source; USDOE[ii]

What are some Contaminant Plumes that Impact the Columbia River?

Strontium-90, Hexavalent Chromium, Tritium, Uranium, and Nitrate are some of the contaminants that reach the River (or are present in groundwater very close to the Columbia where the River rises and falls and mingles with groundwater). Other contaminants such as Iodine-129 and Technetium-99 pose a long-term risk, originating from the Central Plateau.

Photo of the Hanford Reach

Photo of Water coming into contact with Cesium and Strontium

Pollutants of Concern

Strontium-90 (Sr-90)

Recent groundwater data from PHOENIX for the 100-N Area shows a continued, very high level of cancer-causing Sr-90 pollution very close to the Columbia River shoreline. The standard for drinking water is 8 pCi/L. In 2020, the Sr-90 concentration in groundwater rose to 15,700 pCi/L in a well close to the Columbia River. The latest reading in the well is just below 12,000 pCi/L—still almost 1,500 times higher than the safe drinking water standard. In June 2024 at the River's shoreline, one aquifer tube registered 576 pCi/L, 720 times the legal standard for drinking water.

Photo of canoes on the Hanford Reach, source: Ben Herndon

Iodine-129 (I-129)

Radioactive I-129 was released from processing plutonium. Today, the long-lived radioactive isotope I-129 approaches the Columbia River through an extensive groundwater plume originating in Hanford's 200 Area, where the tank farms are located.

I-129 leaches into groundwater from polluted soils and is considered a "mobile" contaminant because it travels with the groundwater and flows at the same velocity as it. Currently, I-129 levels exceed drinking water standards across almost 25 square miles at Hanford. In 2020, the maximum concentration of I-129 reached more than 16 times higher than the drinking water standard. There is no known treatment to remove or treat I-129 at Hanford.

Hexavalent Chromium (Cr(VI))

Cr(VI) contamination can increase cancer risks in people, and it is very toxic to juvenile salmon and other aquatic life. For decades, Cr(VI) was added to the billions of gallons of cooling water used to keep the K Area nuclear reactors cool, and some of the contamination was discharged to the area soils. As a result, Cr(VI) contamination in the K Area groundwater is persistent despite cleanup efforts, and the full impact of Cr(VI) soil contamination remains unknown. Energy is attempting an approach known as "soil flushing," also called "active pump-and-treat." This process adds water to the soil to push Cr(VI) into the groundwater. There, wells capture the groundwater, treat the water to remove Cr(VI), and aims to reduce Cr(VI) contamination to levels that are safe for human health and juvenile fish.

In August 2024, the U.S. The Environmental Protection Agency (EPA) published an updated assessment for Cr(VI) recognizing it as a mutagenic carcinogen, specifically carcinogenic to humans by the oral route of exposure. At Hanford, previous cleanup studies and plans dealing with Cr(VI) did not incorporate an oral slope factor for Cr(VI) in developing cleanup levels. EPA's findings and the change alone in cancer risk for Cr(VI) creates large areas of the Hanford site that Riverkeeper believes need to be re-analyzed and will likely be above standards for Cr(VI).

Photo of the Whitebluffs

Tritium

From 1943-1963, nine nuclear reactors were built at Hanford along with extensive processing and research facilities to produce plutonium for nuclear weapons. Hanford operated until the mid-1980s to produce plutonium. To this day, contaminated soil and structures act as a source of tritium pollution for groundwater. Tritium is a radioactive form of hydrogen. One plume stretches from the Central Plateau all the way to the Columbia River. Additionally, groundwater near the 618-11 Burial Ground contains a high-concentration tritium plume, likely originating from irradiated material in the burial ground.

This problem exists close to proposed locations of Small Modular Nuclear Reactors and the existing nuclear power plant, the Columbia Generating Station. In this part of the 300 Area, Tritium levels are 50 times above the standards. The presence of the Columbia Generating Station is an obstacle to tritium cleanup, and tritium concentrations in groundwater are not diminishing as quickly as the U.S. government once assumed. This is an unsolved cleanup challenge. Adding more development, such as SMNRs to the area, could pose additional risks in delaying or complicating cleanup.

Technetium-99 (TC-99)

Like I-129, Tc-99 is a long-lived radioactive material that is mobile in groundwater.

Columbia Riverkeeper's mission is to protect and restore the water quality of the Columbia River and all life connected to it, from the headwaters to the Pacific Ocean.

Clean Water
Healthy Rivers
Our Future

Interested in digging deeper? Watch a tutorial on how to ground truth at Hanford and see what's beneath the surface.

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