

Hanford Nuclear Site Cleanup in the Age of Nuclear Uncertainty

A REPORT BY COLUMBIA RIVERKEEPER





Contents

Starting Where Plutonium
Production Began4

Down by the River, Hanford
Impacts the Water

300 Area5

618-11 Burial Ground.....10

324 Building.....13

Conclusion15

Endnotes16

INTRODUCTION

North of Richland, Washington, the Columbia River flows freely through sagebrush-steppe on the lands of the Confederated Tribes and Bands of the Yakama Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Nez Perce Tribe, and the Wanapum Tribe. Known today as the Hanford Reach, the 51-mile river corridor is the last undammed, non-tidal stretch of the Columbia River in the U.S., an ecological haven that provides some of the most vital spawning habitat in the world, supporting an estimated 80 percent of the Columbia’s fall Chinook salmon.

Tragically, it is now also known as the Hanford Nuclear Site, where the pursuit of plutonium has left an indelible mark on this irreplaceable landscape. Hanford is a result of the nuclear arms race that started with World War II and played out through the Cold War. For decades, the federal government stored highly radioactive and toxic waste in 177 underground tanks and dumped pollution directly into the ground. Now, the U.S. Department of Energy (DOE) is responsible for one of the largest nuclear cleanup efforts in history.

The future of the Columbia River and the people who rely on it depends in large part on the success of the Hanford cleanup. Maintaining a long-term and safe cleanup is essential to protecting clean, cold water and all who depend on it—even more pressing in an era where water scarcity is a reality rather than an existential threat.

Today, Hanford cleanup is at a crossroads, with increased pressure for nuclear development threatening to derail a thorough and protective cleanup. Under the Trump administration, government restraint around nuclear energy and weapons has rapidly dissolved, raising new threats to Hanford cleanup and the possibility of more nuclear energy facilities along the Columbia River.

Currently, there is an acceleration of federal deregulation around safety and oversight of nuclear energy, from lowering radiation standards to exempting advanced nuclear reactors from federal environmental review.¹ In

regard to nuclear weapons, the U.S. has pulled out of key nuclear-weapons treaties and joined the only nuclear-armed country in the Middle East to wage another dangerous war, threatening to drop nuclear bombs on civilian populations.²

Federally managed DOE sites like Hanford have been caught in the crosshairs, as developers and Big Tech seek to develop nuclear energy and other AI infrastructure to support both the energy and war pursuits of the Trump administration.

The Hanford Nuclear Site’s Uncertain Future

This report prepared by Columbia Riverkeeper probes a weighty question: Are current decisions regarding Hanford cleanup truly an effort to achieve a long-term safe and effective cleanup, or instead to demonstrate short-term progress to sooner invite nuclear and other development on site? Our analysis begins where plutonium production began: the Hanford Site’s 300 Area, located less than two miles north of the city of Richland and adjacent to the Columbia River.³ In the following pages, we’ll examine three key cleanup challenges there: groundwater contamination, the 618-11 Burial Ground, and the 324 Building. Discussion questions in each section ask readers to consider how pollution challenges and active cleanup intersect with current nuclear policy and development.

In light of Columbia Riverkeeper’s experience with Hanford, we believe that the cleanup must come first. It should not be distracted or undermined by new nuclear development and the attendant pollution storage issues. Hanford must not become an experimentation ground for producing new forms of “advanced” nuclear energy and fuels. Altering the cleanup mission of Hanford would not only negate nearly three decades of remediation work, it would bring even more radioactive pollutants to the site.

Starting Where Plutonium Production Began

The Big Picture

“Cleanup” (probably a misnomer) is a very, very long road and should more accurately be called “long-term nuclear waste management.” From 1943 to 1989, DOE and its contractors generated unprecedented volumes of hazardous and radioactive waste.⁴ In 1979 alone, a failed Cold War-era test at Hanford known as the Green Run produced more than 30 times the total radiation released during the Three Mile Island accident in Pennsylvania,⁵ which is often considered the worst nuclear accident in American history.⁶

In addition, Hanford’s reactors produced irradiated fuel that contained radioactive iodine, and the processing plants themselves released radioactive iodine—sometimes at very high levels—in the manufacture of plutonium for nuclear weapons.⁷ **Between 1944 and 1957, Hanford released approximately 725,000 curies of radioactive iodine-131.**⁸ By comparison, the accident at Three Mile Island released between 15 and 24 curies.⁹

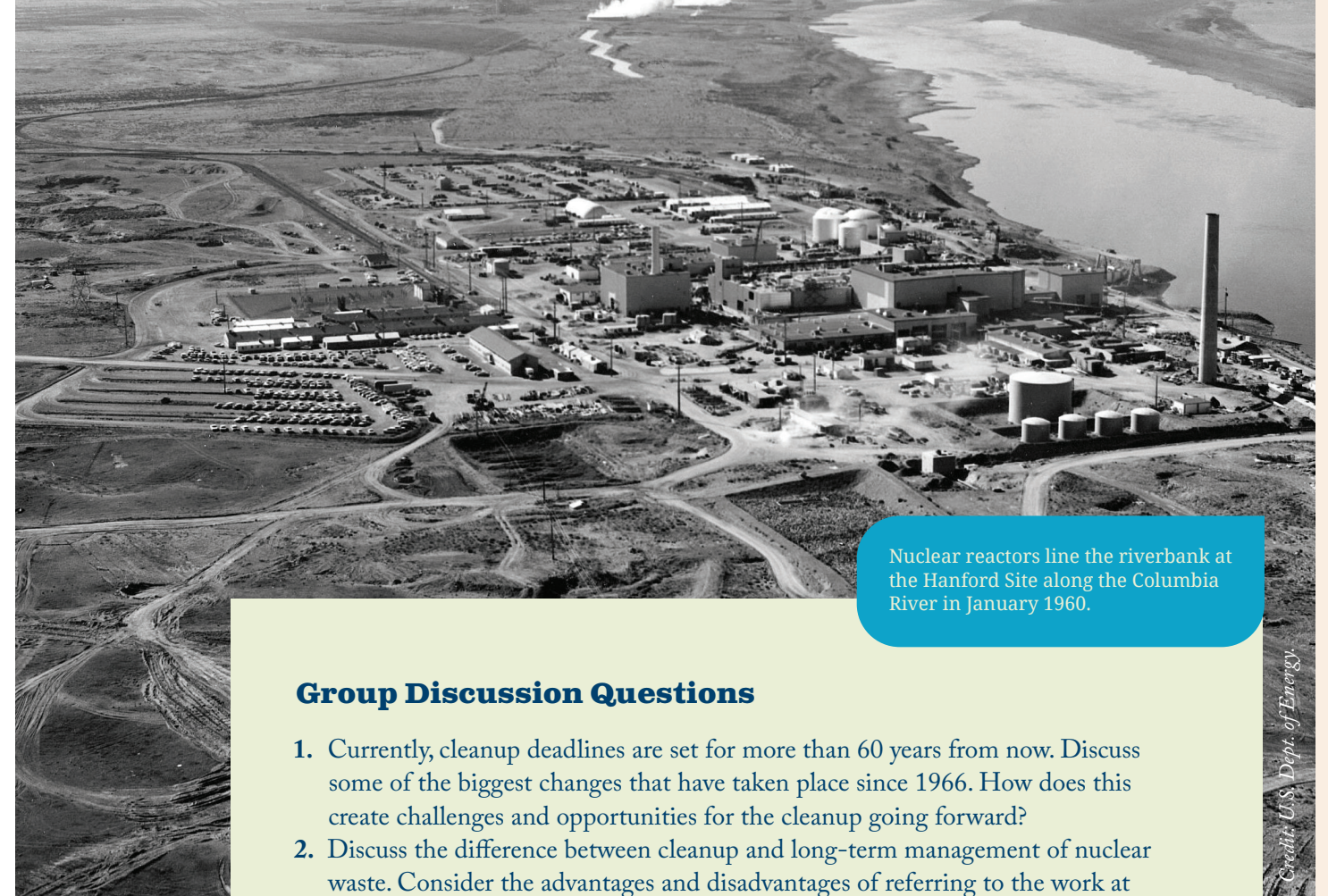
Hanford operations have polluted the earth, the water, and the air. In less than 50 years, the federal government deposited hundreds of millions of gallons of radioactive waste directly into the ground in injection wells, trenches, buried drums, and 177 large underground tanks. It discharged contaminated cooling water from the reactors—containing about 110 million curies of mostly short-lived radionuclides—directly into the Columbia River.¹⁰ Hanford operations released approximately 20 million curies of iodine-131 into the air from 1944 to 1972.¹¹ In the years since, people downwind of the radioactive emissions report increased rates of thyroid cancer and other illnesses they believe are a result of the iodine releases.¹²

In 1989, DOE, the State of Washington, and the U.S. Environmental Protection Agency (EPA) signed the Tri-Party Agreement, a legally binding pact that set a 30-year timetable for Hanford cleanup.¹³ **DOE has not complied with the agreement.** Despite two decades of cleanup activity, Hanford

is still the most contaminated site in the Western Hemisphere and one of the largest cleanup sites in the world. Due to the slow progress, Washington and the federal agencies amended the binding agreement, pushing back the cleanup deadline to at least 2090.¹⁴

“It’s like an intergenerational human rights abuse. We’ve already hurt human beings that we can’t even begin to know or think about yet.”

—**Dr. Holly Barker**, *Professor of Sociocultural Anthropology at the University of Washington.*¹⁵



Group Discussion Questions

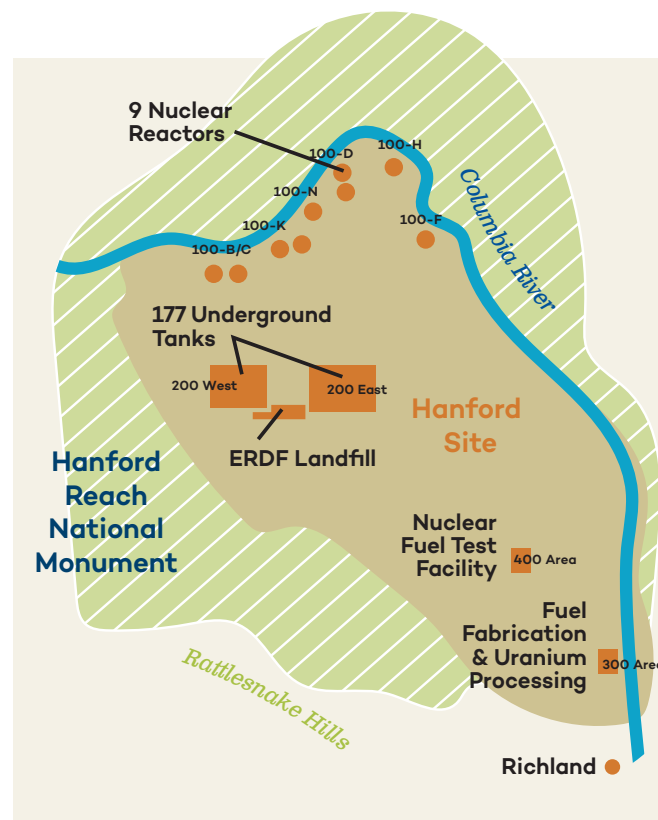
1. Currently, cleanup deadlines are set for more than 60 years from now. Discuss some of the biggest changes that have taken place since 1966. How does this create challenges and opportunities for the cleanup going forward?
2. Discuss the difference between cleanup and long-term management of nuclear waste. Consider the advantages and disadvantages of referring to the work at Hanford as a cleanup versus long-term nuclear waste management.
3. Discuss how nuclear policy has changed in the U.S. over time. What did it look like in 1980, 2010, 2026? Consider how policy influences action.

Down by the River, Hanford Impacts the Water

300 Area

Assembling fuel and experiments with material from highly radioactive fuel left an indelible mark on groundwater, soil, and hard-to-address cleanup sites. Close to Richland, the 300 Area remains one of the most important areas for focused cleanup along the entire Hanford Reach.

During operations, engineers used the 300 Area to prepare nuclear fuel for reactors, and manufacture the precise graphite shapes required to construct and operate the reactors.¹⁶ Years later, high-level materials derived from irradiated and processed nuclear fuel came back to the 300 Area in the form of fission products, where experiments to condense and solidify contaminants like cesium and strontium released astounding amounts of radioactive material into the ground very close to the Columbia River.¹⁷ Even today steam often rises from the Columbia Generating



Key Locations

Hanford's former operational areas were given numerical names. These include the 100-B/C, 100-K, 100-N, 100-D, 100-H, and 100-F Areas, which housed the nuclear reactors, and the 200 West and 200 East Areas, where chemical separation occurred. This also included the 300 Area, home to the fuel manufacturing operations and experimental and laboratory facilities, and the 400 Area, which housed a research nuclear reactor.¹⁸

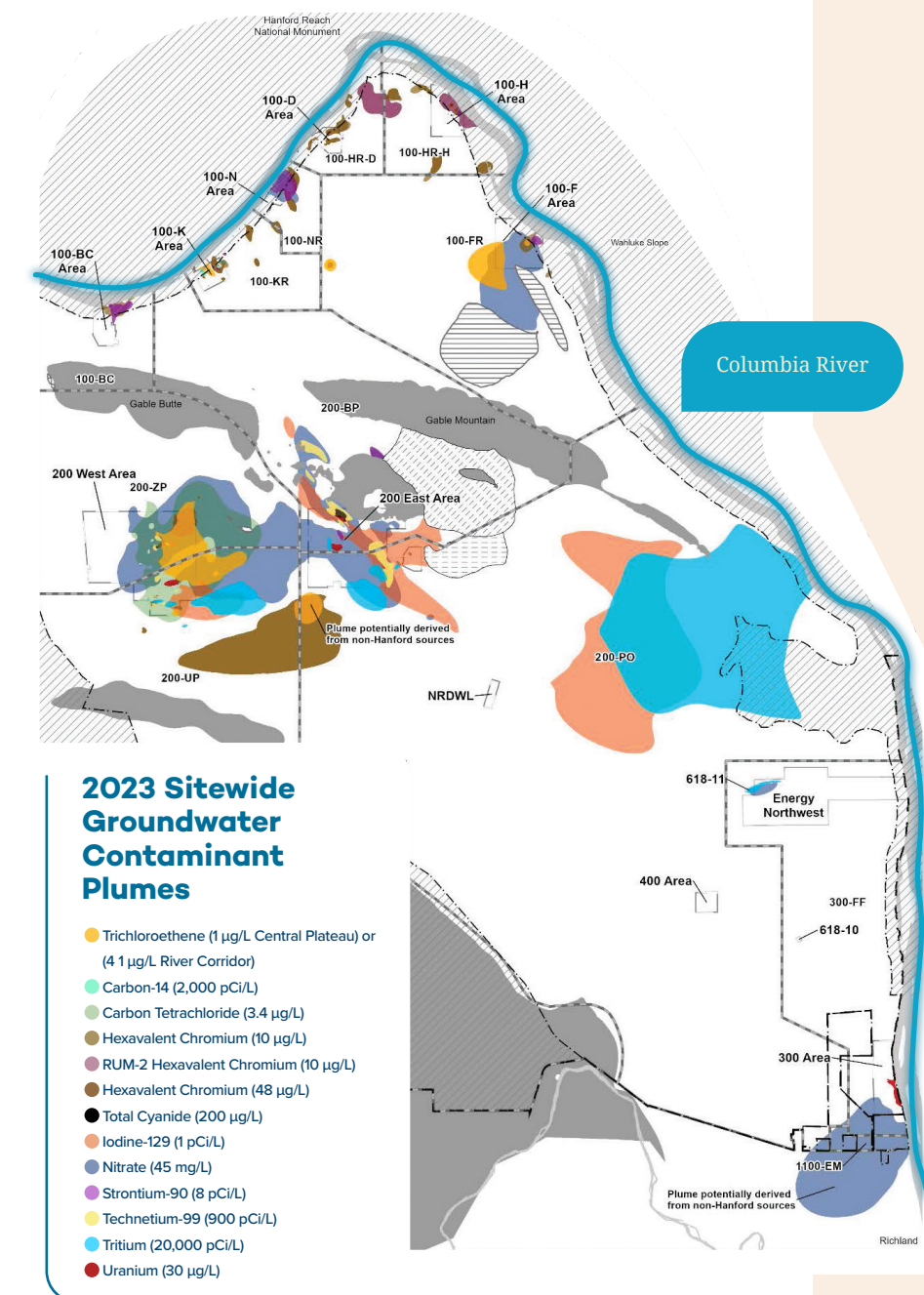
Station (Washington's only producing nuclear power plant), which is adjacent to the 618-11 Burial Ground, one of Hanford's most polluted burial grounds.¹⁹

Below, groundwater is contaminated with uranium, tritium, nitrate, and other pollutants that have the potential to cause cancer, immune disorders, and kidney disease.²⁰ The stretch of the Columbia River flowing by the 300 Area is abundant in sturgeon, bass, salmon, and pikeminnow (a bounty fish), and frequented by fisher folk.²¹

Key Cleanup Challenges in the 300 Area

Groundwater

A zone of groundwater pollution at Hanford is referred to as a "plume." Unlike their one-dimensional depiction in flat maps, plumes at Hanford are both broad and deep, moving downward toward groundwater and horizontally, sometimes toward the Columbia River. During production years, more than 400 billion gallons of contaminated water were discharged directly into soils and groundwater at Hanford, resulting in a plume that stretches almost 60 square miles.



Close to the shoreline of the Columbia River, uranium levels in the 300 Area groundwater still approach or exceed drinking water standards.²²

Group Discussion Question

As you learn a little more about some of the cleanup challenges in the 300 Area, consider how the area's close location to both Richland and the Columbia River should impact cleanup decisions. For example, should cleanup be more stringent the closer an area is to population centers or aquatic resources?



THE CONTAMINANT Uranium

All forms of uranium are radioactive. Uranium-238 (U-238) is the most common naturally occurring isotope of uranium and has a half-life of 4.5 billion years. EPA sets the drinking water standard for Uranium-238 at 30 micrograms per liter. As a metal toxin in the human body, uranium endangers kidneys and other organs. As an emitter of alpha radiation, it causes damage to living cells.²³

In the 300 Area uranium pollutes the groundwater, reaching the Columbia River

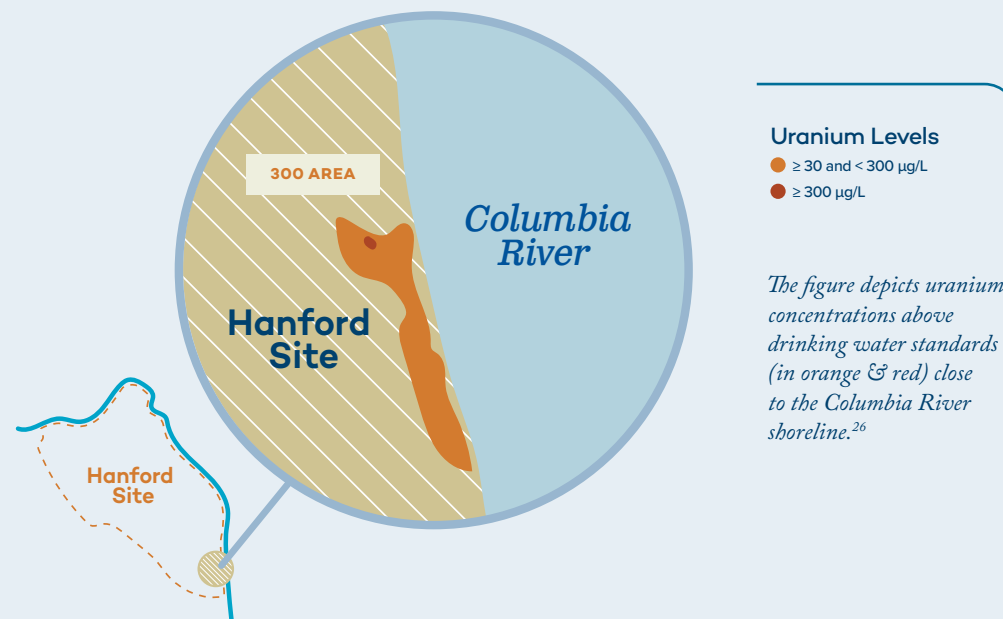
The cleanup challenge

DOE has attempted to sequester uranium by adding a chemical treatment intended to bind the uranium to the soil so it isn't flushed out into groundwater. It is unclear whether the treatment works.²⁴ The Columbia River rises and falls dynamically in the 300 Area: affected by dam operations upstream, the river may push more water onto the landscape and then drain it away during lower river stages. This impacts groundwater and pollutant concentrations, and can cause uranium levels to exceed the drinking water standard.

What comes next?

It's not yet clear how the persistent uranium challenge in 300 Area groundwater can be resolved. So far, methods to monitor, immobilize, or treat uranium have not succeeded as hoped when DOE finalized the 300 Area cleanup plan.²⁵ This raises questions about the efficacy of cleanup decisions over time.

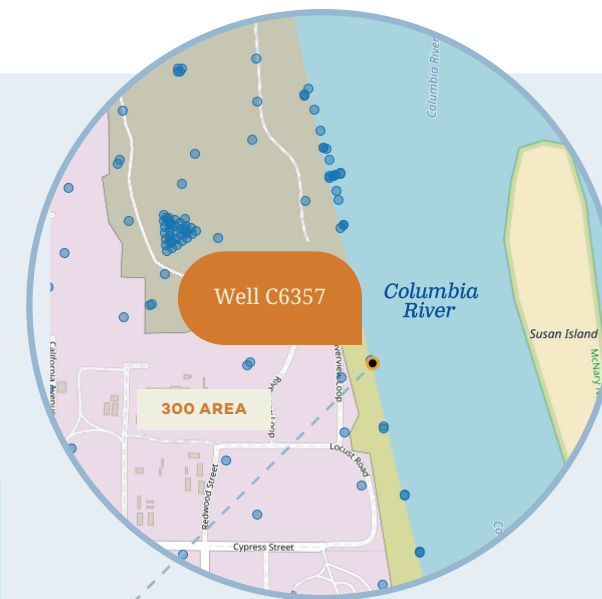
Uranium Plumes in Relation to the Columbia River



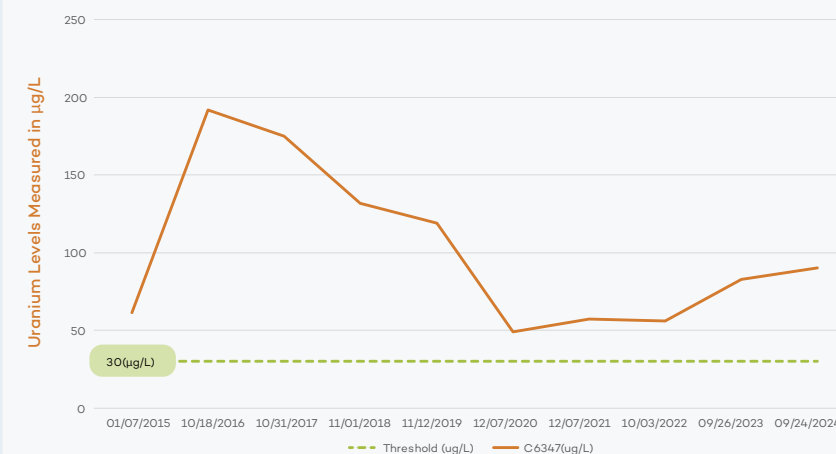
Uranium Wells in the 300 Area

● Uranium Wells

An interactive website houses groundwater well data from DOE and Pacific Northwest National Labs. Browse the data yourself at [Phoenix.pnnl.gov/phx/dds](https://phoenix.pnnl.gov/phx/dds)



Uranium Levels for Well C6347



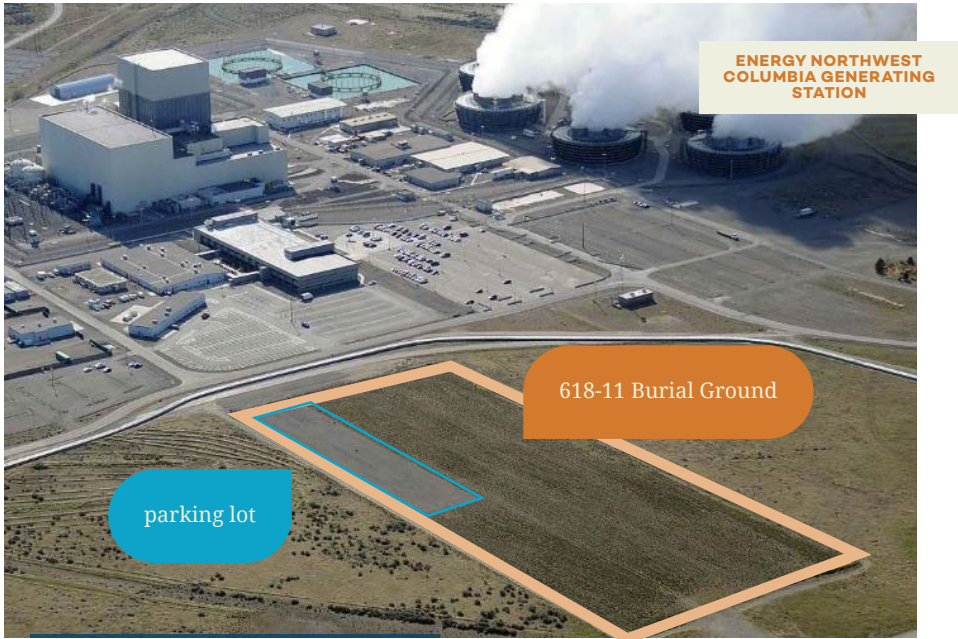
The orange line represents the uranium levels in sampling sites close to the river, illustrating how they can change as water levels go up and down. Data accessed 6/24/2026.

Group Discussion Questions

1. DOE repeatedly has said it will be “off the river” within the next five years, at which time it projects to have all river corridor cleanup plans finalized. How does the 300 Area’s uranium contamination show that even once a cleanup plan is finalized, it doesn’t mean cleanup is complete? Does DOE’s “off the river” language create confusion about the status of cleanup on site?
2. What’s the difference between having a cleanup plan and finishing cleanup?
3. How can contaminated groundwater affect or be affected by development?

618-11 Burial Ground

Tritium and nitrate plumes seep from 618-11, one of Hanford’s most dangerous burial grounds.



The parking lot for Energy Northwest Columbia Generating Station lies on top of the 618-11 Burial Ground.



Tritium

THE CONTAMINANTS

Both tritium and nitrate plumes emanate from the 618-11 Burial Ground. Tritium is a radioactive isotope that reacts with oxygen, forming “tritiated water.” Tritium moves easily through the environment just like water. Humans and animals may ingest tritium through contaminated water, absorb it through skin contact, or inhale contaminated steam. In the body, tritium goes directly to soft tissue and organs. It has a half-life of 12.3 years and is a beta particle emitter.²⁷ The EPA drinking water standard is set at 20,000 picocuries per liter.



Nitrate

A large nitrate plume also emanates from 618-11. Nitrates are toxic chemical compounds that are very soluble, don’t bind to soils, don’t evaporate, and travel very easily in groundwater. Nitrates can interfere with the blood’s ability to carry oxygen. Excessive levels of nitrates in drinking water have caused serious illness and sometimes death. The EPA drinking water standard is set at 10 milligrams nitrate-nitrogen per liter.

618-11 Burial Ground



Groundwater Contamination Exceeding EPA Standards in the Area Operated by Energy Northwest

Tritium
Nitrate

The cleanup challenge

For decades the 618-11 Burial Ground received highly radioactive materials. Now, with unknown contents buried in the soil, the burial ground acts as a source for groundwater contamination. The burial ground is located partially under the parking lot of the Columbia Generating Station (CGS), which has made understanding and addressing the waste a challenge. The nearby 618-10 Burial Ground, likely containing similar waste to 618-11, posed serious risk when remediated because the contents caught fire when exposed to oxygen. An eight-year effort resulted in remediation of the 618-10 site, which was less complicated than 618-11 in terms of proximity to unshielded workers and high-activity waste.²⁸

In the last decade, tritium has remained a persistent and spreading pollutant, spreading from the burial ground into the CGS operational area, close to a proposed site for new Small Modular Nuclear Reactors (SMNRs).²⁹ Given tritium’s relatively short half-life, cleanup plans focused on allowing the pollutant to diminish prior to remediation.³⁰ However, rather than diminishing over time, tritium levels instead spiked to over one million picocuries per liter in 2023.³¹ This likely means that something within the burial ground broke down and released large amounts of tritium.³² It’s unknown if there will be additional releases to groundwater over time.

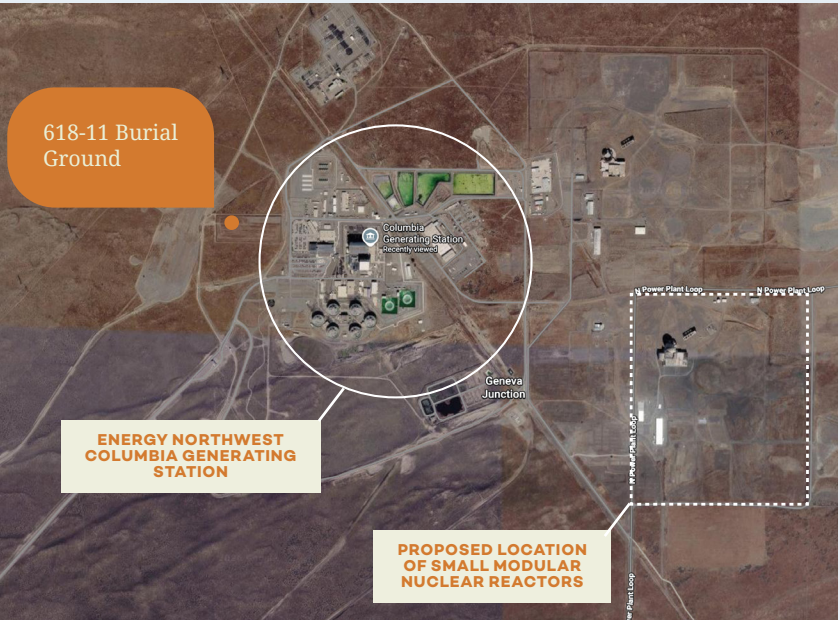
What comes next?

The EPA is expected to issue new goals and measures in 2027 that specify plans for cleanup at the 618-11 Burial Ground. Columbia Riverkeeper will advocate for cleanup that reduces the spread of tritium and nitrate as much as possible. In recent years, EPA led a successful effort to install new monitoring wells in the area.³³ Data from these wells underscore the importance of cleanup, and allow the public and agencies to understand the pollution trends over time. Additionally, as developments such as SMNRs are proposed for this area, Columbia Riverkeeper will continue to push for environmental reviews that take into account impacts to groundwater, mobilization of groundwater plumes and contaminants from construction activities, and safety risks to those working near active remediation.

Tritium Concentrations in Wells near 618-11 Burial Ground



Hanford Groundwater Report for 2024, illustrating that tritium levels continue to exceed drinking water standards.



The proposed location of Small Modular Nuclear Reactors in relation to both the Columbia Generating Station and the 618-11 Burial Ground.³⁴

Group Discussion Questions

1. How could proposals to build new nuclear fission reactors (creating additional radioactive waste) complicate cleanup efforts at 618-11?
2. Consider the impacts of bringing more workers to an area under active cleanup.
3. Knowing that groundwater at Hanford moves, consider how construction activities could affect movement of groundwater and the contaminants it carries.



Washington Dept. of Ecology

324 Building

Lethal radioactive material lies underneath Hanford's 324 Building.

One of Hanford's most intense cleanup areas involves radioactive soil beneath a facility called the 324 Building, where DOE conducted experiments with highly concentrated nuclear materials.³⁵ In October 1986, DOE was creating highly concentrated radiation sources by glassifying material from irradiated nuclear fuel and concentrated cesium taken from Hanford's N Reactor and the Waste Encapsulation Storage Facility.³⁶ In an enclosed area of the 324 Building called a "hot cell," the project sought to make vitrified (glass) logs as a test for a German waste repository.³⁷ In the process of vitrifying highly radioactive material, DOE caused a tremendous leak of approximately 1.3 million curies of concentrated cesium, strontium, and other contaminants, which escaped through the damaged floor of the hot cell and into the soil below.³⁸ Even today, levels of radioactivity in the soil are so intense, just a few minutes of unshielded exposure could cause serious harm or even death to workers.³⁹ Without a doubt, cleanup of the 324 Building remains one of the most pressing issues in coming years.



Strontium-90



Cesium-137

THE CONTAMINANTS

Cesium-137 and strontium-90 are the major pollutants of concern in the intensely radioactive soil beneath the 324 Building. Strontium-90 is a radioactive isotope that emits beta particles and has a half-life of 29.1 years. It is considered one of the more hazardous components of nuclear waste. Strontium-90 can be inhaled or ingested through food and water. Once in the body, it attaches to bones, often causing cancer in bones and blood-forming organs. The EPA drinking water standard is set at 8 picocuries per liter.

Cesium-137 is also a radioactive isotope with a half-life of 30 years. It emits energetic gamma particles.⁴⁰ Exposure can occur through ingestion or inhalation, and is then distributed throughout the body. Plants growing in soil contaminated with cesium-137 can also absorb the contaminate. The EPA drinking water standard is set at 200 picocuries per liter.⁴¹

The Cleanup Challenge

Over the decades, the understanding of the contamination present at the 324 Building has changed. This means that cleanup plans once considered safe and effective need to be changed. In 2010, as workers prepared the building for demolition, they discovered that soil impacted by the spill remained tremendously radioactive.⁴² Sampling under the hot cell revealed hotspots in the soil that would generate a dose of radiation 8,900 R/hr and above, which is a lethal level.⁴³ That hot cell sits 42 feet above groundwater destined for the Columbia River, a mere 1,000 feet away.

In light of this, DOE's mission at the 324 Building turned from demolition to excavation. DOE devised a new plan using remotely controlled equipment to cut away the concrete in the hot cell and excavate the contaminated soil. The plan first required injecting horizontal building supports into the soil to stabilize the structure. Careful planning and slow progress continued for more than a decade, when workers unexpectedly encountered contaminated soil beyond the hot cell area. DOE immediately halted work to test the soil. The sampling results revealed a disturbing new reality: additional contamination capable of generating a radiation dose of 984 R/hr. Because the location of the newly discovered soil contamination raises new questions on the extent of the remediation area, excavation work at the 324 Building has ceased completely.

What Comes Next?

DOE is amending the final cleanup plan for the 300 Area to include new plans for removing the 324 Building and addressing the soils underneath, now known as the 300-296 Waste Site. We know cleanup here is complicated and highly radioactive, yet the public is being left in the dark. At public meetings with DOE many voiced concerns and questions about the 324 Building demolition and the impacts to groundwater.⁴⁴

Modeling conducted by Pacific Northwest National Laboratory (PNNL) at DOE's request concluded that if the 324 Building were removed, it would take 150 years (assuming normal precipitation rates) for the radioactive contamination to reach groundwater.⁴⁵ However, the conclusions reached by PNNL used out-of-date data from 2013 and did not account for climate change variables. It also appears that DOE and PNNL failed to model for water intrusion caused by the use of dust suppression methods during building demolition. What's more, DOE received this modeling report from PNNL before the Record of Decision Amendment public meeting in August 2025, but failed to make this information known at the time. Now, draft documents suggest that open-air demolition of the 324 Building is in the works,⁴⁶ posing a real risk for an airborne radioactive release that could have devastating effects on workers, residents of Richland and the Columbia River.

The 300-296 Waste Site poses another set of problems when it comes to classifying the soils below, which determines where and in what form they must be managed long-term. Contaminated material from the 324 Building is likely to be high-level waste, and may contain transuranic or other waste.⁴⁷ This type of waste is unsuitable for disposal at Hanford's onsite landfill, the Environmental Restoration Disposal Facility (ERDF); by law, it must be vitrified and disposed of in a deep geological repository. DOE has made clear that they do not believe the soils need to be classified as high-level waste.

The 324 Building is a prime example of why river corridor cleanup remains far from complete. The 324 Building sits above groundwater and less than 300 yards from the Columbia River. Surprise hotspots, radiation at risk of spreading in the environment, and unknown radioactivity pose long-term threats to the river and people in nearby Richland.

CONCLUSION

From the original production of plutonium to the contamination and cleanup challenges it left behind, Hanford reminds us that every curie of radioactivity created is here to stay. Observing the Hanford cleanup from this perspective puts the priority on a safe, effective, and long-term cleanup in order to protect the people and a place that matters. A cleanup that veers from this grounding principle could have dire implications for generations to come.

We know cleanup here is complicated and highly radioactive, yet the public is being left in the dark.

Group Discussion Questions

1. Consider how the high amounts of radioactive waste present at the 324 Building could be a problem for the larger 300 Area if cleanup does not go according to plan.
2. What does the 324 Building tell us about the certainty of finalized cleanup plans?
3. Discuss the problem with PNNL failing to account for climate change and using data from 2013. How could that affect the modeling and conclusions about when contaminants could reach groundwater?

ENDNOTES

- 1 See Francisco A.J. Camancho, *DOE Kills Radiation Safety Standard*, E & E NEWS BY POLITICO (Jan. 13, 2026) (stating that DOE has removed ALARA from its regulations and there would be a subsequent process to decide on new safety standards, while specifically mentioning how the end of the ALARA principle can affect cleanup at places like Hanford. However, the article notes that this change does not directly affect the NRC, and nuclear reactor developers will still need to satisfy NRC standards before connecting to the grid.): see also U.S. Department of Energy’s Federal Register notice regarding “Categorical Exclusions for Advanced Nuclear Reactors,” 90 Fed. Reg. 4550 (Feb. 2, 2026).
- 2 See Geoff Brumfiel & Charles Maynes, For The First Time In Decades, The U.S. And Russia Have No Limits On Nuclear Weapons, NPR ILLINOIS, (Feb. 5, 2026): see also Amy Goodman & Trita Parsi, *He Is Increasingly Desperate: Trita Parsi on Trump’s Expletive-Laced Threats Against Iran*, DEMOCRACY NOW, (Apr. 6, 2026), https://www.democracynow.org/2026/4/6/us_israel_war_on_iran_trita: see generally ICAN, Which countries have nuclear weapons?, https://www.icanw.org/nuclear_arsenals.
- 3 Hanford Challenge, *Your Guide to 324 Building Cleanup*, (last updated Aug 19, 2025) <https://www.hanfordchallenge.org/324-building>. See generally Washington Dept. of Ecology, *Hanford Overview*, <https://ecology.wa.gov/waste-toxics/nuclear-waste/hanford-cleanup/hanford-overview>.
- 4 See generally U.S. DEP’T OF ENERGY, Hanford Mission. 2026 <https://www.hanford.gov/page.cfm/HanfordMission> (explaining that “[n]owhere in the DOE Complex is cleanup more challenging than at the Hanford Site in southeastern Washington. Hanford made more than 20 million pieces of uranium metal fuel for nine nuclear reactors along the Columbia River. Five huge plants in the center of the Hanford Site processed 110,000 tons of fuel from the reactors, discharging an estimated 450 billion gallons of liquids to soil disposal sites and 56 million gallons of radioactive waste to 177 large underground tanks. Plutonium production took place between 1943 and 1989.”).
- 5 NATIONAL PARK SERVICE, *The Green Run*, 2026 <https://www.nps.gov/articles/000/the-green-run.htm>. (estimating that “[t]he amount of iodine-131 released during the Green Run is estimated to be around 8,000 curies. Compare this to the approximately 15 curies of radiation released from the Three Mile Island accident in Pennsylvania in 1979. A resident of Walla Walla at the time later pointed out that in the Three Mile Island incident, people were evacuated, but not only was no one evacuated during the Green Run, they were not even made aware that it happened.”).
- 6 Chana Gazit, AMERICAN EXPERIENCE: *Meltdown at Three Mile Island*, (PBS, aired Feb. 22, 1999) <https://www.pbs.org/wgbh/americanexperience/films/three/>.
- 7 U.S. DEPARTMENT OF ENERGY, *The Hanford Site: 100 Area*. (last visited Apr. 2026) <https://www.hanford.gov/page.cfm/100Area>.
- 8 R.E. GEPHART, *A Short History of Hanford*, 11, (PNNL, Oct. 2003). https://www.pnnl.gov/main/publications/external/technical_reports/pnnl-13605rev4.pdf.
- 9 See footnote 5.
- 10 GEPHART, *supra* note 9 at 12.
- 11 *Id.* at 14.
- 12 NATIONAL PARK SERVICE. *Downwinders*, (2026). <https://www.nps.gov/mapr/learn/historyculture/downwinders.htm>: see also NATIONAL PARK SERVICE, *Chief William Burke: Working with Tribal Partners*, (Tamástslíkt Institute, Confederated Tribes of the Umatilla Indian Reservation ed., original interview June 17, 1999) https://www.nps.gov/articles/000/chief-william-burke-working-with-tribal-partners.htm?utm_source=article&utm_medium=website&utm_campaign=experience_more&utm_content=large: see generally WASH. DEP’T OF ECOLOGY, Environmental Health Disparities Map <https://experience.arcgis.com/experience/d133fa97a3854f8eac905ec152f16b05/page/Measures>.
- 13 KEN NILES, *Hanford Cleanup: The First 25 Years*, (Or. Dep’t of Energy’s, Sept. 2014) <https://www.oregon.gov/energy/safety-resiliency/Documents/Hanford%2025%20Year%20Report.pdf>.
- 14 U.S. DEP’T OF ENERGY, *2025 Hanford Lifecycle Scope, Schedule and Cost Report*, at iv figs. ES-1 & ES-2, (Mar. 2025), https://www.hanford.gov/files.cfm/HMIS_LCR_2025_Compiled_2-27-25_Public.pdf.
- 15 Delaney Dorsey, The Hanford Site’s Cleanup Shows the Lingering Repercussions of American Nuclear Production at Home, INK STICK MEDIA, (Aug. 19, 2024) <https://inkstickmedia.com/the-hanford-sites-protracted-cleanup-shows-the-lingering-repercussions-of-american-nuclear-production-at-home/>.
- 16 See U.S. DEP’T OF ENERGY, *Hanford Site: 300 Area*, <https://www.hanford.gov/page.cfm/300area>.
- 17 See *Id.*
- 18 U.S. DEP’T OF ENERGY, Introduction, in HANFORD SITE GROUNDWATER MONITORING FOR 2011, at 1-2 (Aug. 2012), <https://www.hanford.gov/c.cfm/sgrp/GWRep11/html/start11.htm>.
- 19 U.S. DEP’T OF ENERGY and CPCCO, 618-11 *Qualitative Alternative Analysis*, SGW-69455, Rev. 0, at 1, (Sept 2023) <https://pdw.hanford.gov/document/AR-26516> (writing that he 618-11 Burial Ground is a 3.5 ha (8.6 ac) disposal site that contains waste in unlined trenches, vertical pipe units (VPUs), and caissons. Transuranic waste and mixed solid waste received from March 9, 1962 through October 2, 1962 were placed into 3 unlined trenches, 50 VPUs, and several 2.4 m (8 ft) diameter caissons. Intermediate and high-activity wastes were disposed in the VPUs and caissons, collectively referred to as containerized disposal units (CDUs). The 114 m by 305 m (375 ft by 1,000 ft) rectangular site is delineated by a perimeter chain-link fence and concrete marker posts and is currently overlain with cover soil and wheatgrass.”).
- 20 U.S. DEP’T OF ENERGY, *Hanford Groundwater Monitoring Report for 2024*, (Sept. 2025) https://www.hanford.gov/files.cfm/DOE-HFO-2024-41_-_Rev_00.pdf.
- 21 See WASH. DEP’T OF FISH AND WILDLIFE, *Ringold Springs*, <https://wdfw.wa.gov/places-to-go/water-access/sites/ringold-springs-1037>
- 22 See U.S. DEP’T OF ENERGY, *Hanford Site Groundwater Monitoring Report for 2024*: fig. 4-80. 300-FF *Shoreline Uranium Plume*, at 4-125, (Sept. 2025) https://www.hanford.gov/files.cfm/DOE-HFO-2024-41_-_Rev_00.pdf.
- 23 Alpha radiation is very harmful if inhaled, swallowed or gets into the body through a cut. It is unable to penetrate skin. Once inside the body alpha emitters will damage living tissue and cause severe damage to cells and DNA. Alpha particles come from the decay of the heaviest radioactive elements and are made up of two protons and two neutrons from the atom’s nucleus.
- 24 U.S. DEP’T OF ENERGY, *HANFORD SITE Fifth CERCLA Five-Year Review*, at ES-11 tbl. FYRSF-2, (Mar. 2022) <https://www.hanford.gov/files.cfm/DOE-RL-2021-01-00.pdf>. (DOE writes, “Protectiveness Statement: The remedy for the 300-FF-5 groundwater OU is protective of human health and the environment. The RAO to restore groundwater in the 300-FF-5 OU to cleanup levels that include drinking water standards within a timeframe that is reasonable, given the particular circumstances of the site (i.e., by 2041), is being met by implementation of remedy components involving MNA, groundwater monitoring, and enhanced attenuation of uranium. Construction of the remedy component involving enhanced attenuation of uranium was completed in 2018 and documented in 2020; this is expected to reduce the timeframe for achieving uranium cleanup levels. MNA and groundwater monitoring have been implemented and are ongoing. The RAO of preventing human exposure to groundwater containing COC concentrations above cleanup levels is being met by the implementation and the continued management of ICs.”).
- 25 See generally U.S. Department of Energy and CPCCo. 2023. SGW-69455. 618-11 *Qualitative Alternative Analysis*. Rev 0. <https://pdw.hanford.gov/document/AR-26516>.

- 26 U.S. DEPT OF ENERGY, *Hanford Site Groundwater Monitoring Report for 2024: fig. 4-80*. 300-FF Shoreline Uranium Plume, (Sept. 2025), https://www.hanford.gov/files.cfm/DOE-HFO-2024-41_-_Rev_00.pdf
- 27 Beta particles are small and fast-moving, with a negative electrical charge that are emitted from an atom's nucleus during radioactive decay. Beta particles produce widely spaced ionizations, travel farther than alpha particles, and some beta particles can penetrate skin and cause burns. Some of these particles can be stopped by a layer of clothing or a thin layer of aluminum. Beta particles are most hazardous when ingested or inhaled.
- 28 DEAN LAUF & BEN BUCHHEISTER, *Cleaning Up America's Nuclear Weapons Complex: 2019 Update for Governors: Washington: Final Cleanup of Hanford Hazardous Waste Burial Ground During the Cold War*, (National Governors Association, 2019) <https://www.nga.org/wp-content/uploads/2019/07/weapons-complex-050919-final.pdf> (writing that "DOE developed and manufactured reactor fuel for plutonium production at the 300 Area of the Hanford site in eastern Washington. Hazardous waste from the 300 Area was buried in the 618-10 burial grounds in pipes, drums, boxes and bottomless tanks, and much of the soil surrounding the grounds was highly contaminated. In mid-2018, DOE EM, the Washington State Department of Ecology and the U.S. Environmental Protection Agency (EPA) certified cleanup at the 618-10 area complete. This intense, eight-year effort involved removal of more than 512,000 tons of contaminated soil and waste debris. DOE EM contractors will work on returning the 618-10 site to a natural state, including planting native species.").
- 29 See Letter from U.S. Dept. of Energy to U.S. Env. Protection Agency, COMPLETION OF HANFORD FEDERAL FACILITY AGREEMENT AND CONSENT ORDER MILESTONE M-016-88, (Sep. 15, 2025), <https://www.google.com/url?q=https://pdw.hanford.gov/document/AR-36945&sa=D&source=docs&ust=1779401885722545&usg=AOvVaw0Ou2-m7k160OUui71uLUUy>.
- 30 *Id.* at 9.
- 31 *Id.* at 10-11.
- 32 *Id.* at 13.
- 33 U.S. DEPT OF ENERGY, *300-FF-5 Operable Unit Remedy Implementation Sampling and Analysis Plan Addendum 2 for Enhanced Groundwater Monitoring for the 618-11 Burial Ground*, at 2-5, (Sept. 2023) <https://pdw.hanford.gov/document/AR-35584>.
- 34 U.S. DEPT OF ENERGY, *Completion of Hanford Federal Facility Agreement and Consent Order Milestone M-016-88*, Handford Field Office, (Sept. 2025), <https://pdw.hanford.gov/document/AR-36945>.
- 35 U.S. DEPT OF ENERGY, *Fact Sheet: Proposed Plan for Amending the Record of Decision for the 300 Area*, The Handford Site, (2025) https://www.energy.gov/sites/default/files/2025-06/300_296_Proposed_Plan_Fact_Sheet_5-27-25_FINAL.pdf.
- 36 U.S. DEPT OF ENERGY, *324 Building B-Cell Contamination*, 1, (Nov. 2010) https://www.hanford.gov/health/news.cfm/DOE/E1011025_2.pdf.
- 37 *Id.* See also Letter from June M. Hennig, Director Waste Program Division to T.K. Teynor, Director Waste Program Division U.S. Dept. of Energy, *Acceptance of the Federal Republic of Germany Isotopic Sources of Radiation and Heat* (Aug. 7 1997). https://www.google.com/url?q=https://drive.google.com/file/d/14fO-nBNmDqwpKiGZfC5gSmqtbQUVi6yv/view?usp%3Ddrive_link&sa=D&source=docs&ust=1779405409854516&usg=AOvVaw16NqHELZ0dGs_nDixW7Ss
- 38 U.S. DEPT OF ENERGY, *324 Building B-Cell Contamination*, 1, (Nov. 2010) https://www.hanford.gov/health/news.cfm/DOE/E1011025_2.pdf.
- 39 U.S. DEPT OF ENERGY, *Proposed Plan to Amend the Hanford Site 300 Area Record of Decision for 300-FF-2 To Address Changed Field Conditions at the 300-296 Waste Site*, 7, (May 2025). "Direct radiological measurements at the failed sump location in the bottom of the cell measured approximately 8,900 R/hr."
- 40 Gamma particles are pure energy, similar to visible light. They can easily penetrate barriers like clothes and skin. Thick, dense materials like lead or concrete may be required to stop this type of radiation. Gamma particles are a radiation hazard for the entire body and cause ionizations that damage tissue and DNA. Gamma particles are often emitted along with both alpha and beta particles during radioactive decay.
- 41 See WASH. DEPT. OF ECOLOGY, *Groundwater Contaminants*, <https://ecology.wa.gov/waste-toxics/nuclear-waste/hanford-cleanup/protecting-air-water/groundwater-monitoring/groundwater-contaminants>: see also U.S. EPA, *Radiation Basics: Cesium-137*, <https://www.epa.gov/radiation/radionuclide-basics-cesium-137#cesiumenvironment>.
- 42 ANNETTE CAREY, *Highly contaminated soil found at Hanford*, The Spokesman-Review, Nov. 18, 2010. <https://www.spokesman.com/stories/2010/nov/18/highly-contaminated-soil-found-hanford/>.
- 43 See generally, NUCLEAR REGULATORY COMMISSION, *High Radiation Dose*, <https://www.nrc.gov/about-nrc/radiation/health-effects/high-rad-doses.html>.
- 44 See COLUMBIA RIVERKEEPER, *Hanford Worker & Community Safety Questioned at Public Meeting*, (July 23, 2025) <https://www.columbiariverkeeper.org/2025/hanford-worker-community-safety-questioned-at-public-meeting/>.
- 45 PACIFIC NORTHWEST NATIONAL LABS, *Modeling for Risk Evaluation and Remedy Design*, (Nov. 5th, 2025) <https://www.pnnl.gov/projects/remplex/2025-summit/technical-sessions/modeling>.
- 46 U.S. DEPT OF ENERGY and CPCCO, *Total Effective Dose Equivalent Calculation for D4 of the 324 Facility*, (Sept. 2025).
- 47 See generally, Letter from Tom Zeilman to Nick Vedargas, *High-Level Waste in Soils at the Hanford 324 Building* (Waste Site 300-296) (Oct. 18, 2022) (Setting out the legal framework for classifying the soils below the 324 building). https://www.google.com/url?q=https://drive.google.com/file/d/1k5d6m_nPArzCZk9IB_mKkUHqYCv44vLD/view?usp%3Ddrive_link&sa=D&source=docs&ust=1779405787780286&usg=AOvVaw0YGvj14ITIAUHRKQm7eIs4. See also Letter from June M. Hennig, Director Waste Program Division to T.K. Teynor, Director Waste Program Division U.S. Dept. of Energy, *Acceptance of the Federal Republic of Germany Isotopic Sources of Radiation and Heat* (Aug. 7 1997).



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