# NUCLEAR ENERGY AND WATER USE IN THE COLUMBIA RIVER BASIN

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Bridging the Food-Energy-Water Nexus

NSF

# Introduction:

The use of nuclear materials within the Columbia River Basin (CRB) has a long history, continuing legacy, and further future. The Energy-Water Nexus is useful to frame the issue of nuclear energy, water use and water quality in the CRB. Energy production has been a driving factor in the development of the CRB throughout the 20th and 21st centuries. This is especially true of the areas within Washington State. The CRB is also home to cultural sites and natural resources important to many Native American Tribes. The friction between industrial development and preserving natural landscapes impacts decision making at all levels within the CRB.

While controversial at many levels nuclear energy has brought benefits to the CRB and the country as a whole. These include the creation of the US Department of Energy (DOE), the National Laboratory system, which advances scientific innovations in creating a resilient energy portfolio for the United States. In the CRB, the nuclear industry provides a reliable source of electricity and brings jobs and federal dollars to remote areas of Washington State.

# Three Things You Need to Know:

## *Separation of Nuclear Energy and Weapons*

The manufacturing processes to create nuclear weapons and the nuclear fuel that is used to generate electricity have many distinct differences. Nuclear weapons require much higher concentrations of highly radioactive material when compared to the nuclear fuel. The conversion of fuel from a nuclear power plant into a weapon is typically not realistic.

## *Nuclear Energy is Responsible for Considerable Effects on Water Quantity and Quality*

While the generation of electricity at a nuclear power plant typically does not result in the release of greenhouse gases into the environment, there are still important environmental impacts associated with nuclear power generation (Figure 1) For example, Energy Northwest's Columbia Generating Station withdraws 20 million gallons of water per day from the Columbia river while only 2 million gallons per day are returned (Energy Northwest).

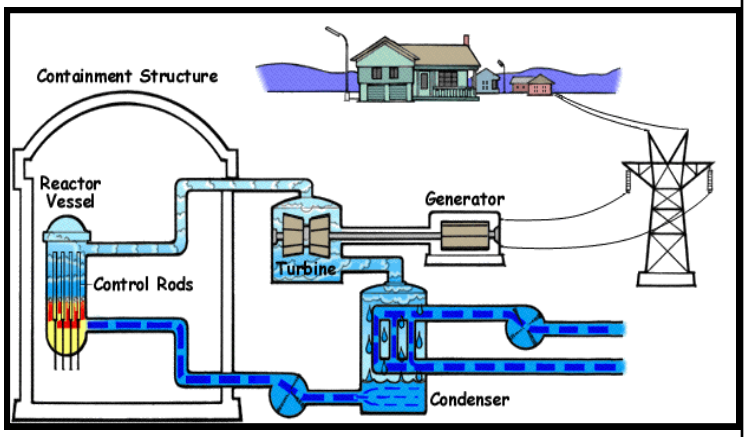


Figure 1: Cartoon depiction of a boiling water Reactor, similar to reactor found at Columbia Generating Station (Union of Concerned Scientists)

## *We Still Lack a Long-Term Solution for the Disposal of Nuclear Waste*

Long-term disposal of nuclear waste from weapons and energy production is an active area of debate and research across the world. Waste from nuclear power plants operating in the United States is currently stored on site at the plant waiting for permanent and long-term disposal. Progress has been made in the scientific realm towards finding a permanent storage solution, however implementation at a government level has not been successful.

# Research Findings Summary:

## *Nuclear Energy and Water*

Nuclear energy production is among the most water-intensive energy production systems used in modern society (e.g. Meldrum, 2013). The primary water uses by a nuclear power plant are to cool the reactors and isolate used nuclear fuel that remains highly radioactive and at a high temperature. Distinct to other power plants that use alternative resources to make energy (e.g. coal), nuclear power plants require a temporally constant and high volume of water for cooling purposes (Peck and Smith, 2016). While nuclear power plants have varying degrees of water efficiency based whether they implement once-through, recirculating, or dry cooling methods (United States Government Accountability Office, 2009), they all share an attribute of being in close proximity to large supplies of water. The actual energy production stage that occurs at a power plant is only one of the many steps that make up the nuclear fuel cycle. The mining, processing, and enrichment of natural resources into nuclear fuels is also water intensive.

Water systems provide a pathway for the harmful byproducts that are produced during the nuclear fuel cycle to reach and spread throughout the biosphere. Among the major concerns are the direct release of contaminants to surface waters and groundwater. While much of the water that is withdrawn by a nuclear power plant makes it back to a surface water body, the discharged water temperature is often elevated. This is a water quality concern and has ecological implications in places such as the CRB that have Salmon who are sensitive to water temperature.

## *The Hanford Site*

The Hanford Engineer Works, also sometimes known as Hanford Nuclear Reservation or the Hanford site, is adjacent to the Columbia River near Richland in Southwestern Washington. The site was developed as part of the Manhattan Project in 1943 when the federal government used the War Powers Act to obtain more than 600 square miles of land intended to serve as a location for developing and manufacturing nuclear weapons. The site was chosen for its remote location, access to water and the electricity provided by hydroelectric dams on the Columbia River (PNNL). The Hanford site produced nuclear bombs that were used at the end of WWII. The site continued producing weapons through the cold war, the last reactor was shut down in 1987 (Hanford.gov).

The story of the Hanford site following the decommissioning of its reactors and the end of weapons development has been of environmental remediation. In the rush to develop weapons to be used in WWII and the Cold War, little attention was paid on how to manage hazardous nuclear waste. Minimal precautions were taken when low level waste was disposed of by burial or discharged into the Columbia River. High level waste was stored in tanks meant to last only 10 years. Eventual corrosion damage and leakage from these tanks has led to contamination of soil and groundwater in the area. Additionally, the storage methods used were poorly documented, making it difficult to assess the extent contamination on the site. In 1991, the Federal Department of Energy (DOE) began the process of cleaning up the site. More than 20 years later, the site has not been successfully remediated. Current plans call for a state of the art waste treatment plant to encase the high level waste in glass for storage offsite and eventual long-term disposal.

## *Columbia Generating Station*

In 1984 the Columbia Generating Station nuclear power plant came online just downstream of the Hanford Nuclear Reservation. The plant is publicly owned through Energy Northwest and produces 1190 MW of electricity that is sold at cost to public utilities in Washington. **The Columbia Generating Station Power Plant is not associated with the weapons production or the ongoing remediation work at the Hanford site (Energy-Northwest).** The power plant is cooled by 20 million gallons of water per day from the Columbia river (Energy-Northwest). Spent nuclear fuel is stored onsite at the powerplant in casks constructed from concrete and steel designed to last until a more permanent storage site is developed.

# Research Findings Summary continued:

***Public Perceptions***

General public views on nuclear issues are complicated. There is a range of understanding about what nuclear energy is, how it is different from weapons production and what the environmental and health impacts can be. There has also been a consistent problem with misinformation. Several organizations put considerable effort in debunking myths and common misconceptions about nuclear energy. Examples include:

The Department of Energy:

www.energy.gov/ne/articles/7-things-simpsons-got-wrong-about-nuclear

Energy-Northwest:

www.energy-northwest.com/ourenergyprojects/Columbia/Pages/Myths.aspx

Argonne National Laboratory:

https://www.anl.gov/articles/10-myths-about-nuclear-energy

***Tribal Issues***

With an increase of Native American participation and stakeholder involvement in decision making for the cleanup of DOE sites comes along with the need for clearer definition of terms. Considering the diversity of stakeholders involved in constructing and regulating environmental assessment, all parties involved should use the same terminology and have thorough understanding of the same laws, regulations, and procedures. The lack of information and understanding of federal regulations and oversight hinders progress for low-income minorities and Tribal communities who are not included early or prepared adequately to allow for informed and meaningful public participation (Burger, Powers, & Gochfeld 2010).

Tribes have expressed interest in the cleanup and future land use at the Hanford site. Further, Nations are responsive to decrease contamination effects on human health and the environment, and understand the effects of contamination and clean up on their usual and accustomed treaty rights (Burger, Powers, & Gochfeld 2010).

# Stakeholders:

***U.S. Environmental Protection Agency (EPA)***
The EPA is tasked with setting environmental standards to help preserve the environment. Their primarily authority to set limits on the amount of radioactive material released during the nuclear fuel cycle comes from the Clean Air and Clean Water Act.

***U.S. Department of Energy (DOE)***
The DOE manages and is responsible for the clean-up of numerous legacy nuclear power, weapons, and nuclear material generation sites. This includes the former Hanford weapons production site located within the Washington's Columbia River Basin.

***U.S. Nuclear Regulatory Commission (NRC)***
The NRC issues the licenses required to operate a nuclear reactor. They are also responsible for creating the rules and regulations that legally must be met to operate a nuclear reactor.

***State of Washington Department of Ecology***
Washington State has an abundance of nuclear waste contamination that can cause detrimental health effects to virtually all biota. Washington State's Department of Ecology has regulatory power to enforce compliance and cleanup at Hanford in efforts to protect and preserve the State's environment.

# Stakeholders continued:

***Nez Perce***
Previous cleanup efforts have inadvertently disturbed burial sites, destroyed natural vegetation, and vital native cultural resources. The Nez Perce tribe is involved in the DOE site cleanup to ensure tribal interest are protected. Through the Treaty of 1855, the Nez Perce retain rights to take fish and hunt at "usual and accustomed" places in areas ceded to the U.S. government. Lands and waters include Washington, Idaho, and Oregon, which include the Columbia, Snake, and Salmon River Regions. All areas have been impacted by DOE activities (Nez Perce Tribe).

***Umatilla***
Increasing the diversity of plant species used to replant hundreds of acres of land is one of the goals of a new field research station of the Confederated Tribes of the Umatilla Indian Reservation. Through the Treaty of 1855, the Umatilla Tribe retain rights to take fish and hunt at "usual and accustomed" places in areas ceded to the U.S. government (Cary 2012).

***Yakama***
The Hanford Site is approximately 20 miles from the Yakama Reservation. The tribe has been advocating for cleanup for years since waste began to be stored "temporarily" between 1960 and 1965 (Indian Country Media Network 2017). Similar the Umatilla and Nez Perce, the Treaty of 1855 allows the Yakama Nation retain rights to take fish and hunt at "usual and accustomed" places in areas ceded to the U.S. government (Cary 2012).

***Residents of Columbia River Basin***
The Hanford site continues to release radioactive material into the Columbia River. People who depend on the river for their livelihoods or simply to recreate in are at a risk for exposure to these radionuclides.

# Sample Interview Questions:

1. Have you or anyone close to you suffered negative health effects as a result of exposure to nuclear waste or its by byproducts in the Columbia River Basin?
2. Has activity on the Hanford Site or at the Columbia Generating Station improved (or made worse) your economic situation?
3. Are you worried about the risks of living close to a nuclear facility? Do these outweigh the possible economic benefits?
4. How would you like to see the Hanford site used following remediation?
5. Due to the necessity of year-round high volumes of water to operate a nuclear power plant, how resilient is the Columbia River Generating Station to potential climatic shifts of water availability in the CRB?

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