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The Hanford Nuclear Reservation as Southeastern Washington's Greatest Foe

"The health of a river is entirely dependent upon the land surrounding it" (Todd, pers. comm.). Various sources hinder the environment surrounding the Columbia River, from the construction of public and private dams that inhibit natural salmon runs, to individual and agricultural activity along the river, which contribute to the general pollution of the Northwest's water source. A majority of the contamination in the Columbia River watershed originates from non-point, unintentional sources, derived from an extensive list of routine activity: runoff from garbage-and-oil laden parking lots, deforestation, animal feces, and contaminated soil among others. However, one intentional point source of the river's contamination originates from over forty years of chemical and heavy metal manufacturing and results in groundwater and soil contamination in the inhabited areas nearby and miles downstream from the site.

Constructed in the early 1940s, the Hanford Nuclear Reservation produced the nation's supply of weapons-grade plutonium during a 46-year span of turmoil and foreign paranoia. During this period, a cluster of cities, namely Richland, Pasco, and Kennewick, grew in southeastern Washington where the Columbia River flows southward to the Oregon border. Despite the potential dangers posed by Hanford's dispersal of radioactive materials and heavy metals, the tri-cities' population appeared to be thriving through agriculture, industry, and recreation. Beneath the surface of economic prosperity, their "futures [were] tied literally to a bomb" (Wade 20) as "decades-long nuclear-fuel processing activities on the [Hanford] site generated an estimated 1.4 billion cubic meters of chemical and radioactive waste in liquid, gaseous, and solid forms" (Hanf and Kelly 44). The groundwater and soil contamination stemming from Hanford's inner workings and waste disposal both affected and still affect the agricultural, recreational, and industrial activities upon which the economy prospers, concerning the residents of southeastern Washington who come into direct or indirect contact with the polluted waters of the Columbia River.

The Importance of the Columbia River to the Tri-Cities Area and the Resulting Exposure to Hanford's Contamination of the Resource

Unlike the western portion of the state, southeastern Washington receives only seven to eight inches of precipitation annually (Wade 20). As a result, the region, which lies only twenty to thirty miles downstream from the Hanford site, relies heavily upon the Columbia River for its drinking water, as well as its agricultural, recreational, and industrial uses. The Tri-Cities area, particularly Pasco, has a rich agricultural history, and demonstrates this through its Farmers' Market being the largest open-air market in the state. The Columbia River supports the growth, processing, and distribution of crops ranging from dry land wheat and potatoes to grapes, one of the region's major agricultural products due to its attractive resources. Located in the heartland of Washington State's wine production, the beautiful climate and the exceptional soil of the Columbia Valley are ideal for growing premium wine grapes. Dozens of wineries, from the Northwest's largest production facility to small family-owned cellars, trace the landscape from Pasco to Yakima and attract thousands of tourists and wine connoisseurs from out-of-state and within the state as well. During the seven-month period from April to November, the wineries hold several barrel tasting sessions and even grape-crushing contests in the fall, appealing to an even more diverse population of families with young adults and children. For this faction of individuals, the city of Pasco additionally offers a myriad of water parks for swimming and jet-skiing; charter fishing for Steelhead, Sturgeon, Walleye, and Salmon; outdoor museums displaying history of the Hanford Nuclear Facilities, the Hanford Reach, and the Columbia Basin; and jet boat tours touring up to the Hanford Reach, famous for its pristine, free-flowing waters, and abundant wildlife (featuring coyotes, elk, mule deer, white pelicans, and Bald and Golden Eagles among other native area wildlife) (Greater Pasco Area Chamber of Commerce). However, if these activities are not enticing enough, the 120,000 plus residents (Greater Pasco Area Chamber of Commerce) of Pasco, Kennewick and West Richland can lure sightseers to their golf courses designed for amateurs and professionals alike with the same intensity as to the Ice Harbor and Lower Monumental Dams, considered by some to be national attractions. In addition, the leisure pursuit of camping is also one of many favorite pastimes for Tri-Citians, illustrated by numerous campgrounds equipped with swimming, RV facilities, and tent sites, and located right on the banks of the Columbia.

With a significant proportion of its agricultural and tourism industries dependent upon the Columbia River as both a water source and of much aesthetic environmental value, it is difficult to fathom that the ramifications of the Hanford Nuclear Reservation put both the Tri-Cities region and its population at risk with potential environmental and health hazards. In fact, “for forty years, scientists knew that radionuclides from [Hanford’s nuclear] reactors along the Columbia River accumulated in body tissue. They decided to keep it to themselves” (Stenehjem 6). The defense industry and United States government, utilizing the site for manufacturing plutonium used in nuclear bombs while attempting to out-produce the Soviets, knew the potential risks of radioactive materials and heavy metal remnants released into the river, but believed the public cared little about the proper disposal. Unknown to the general populace, “Hanford [was contributing] 95 percent of all low and intermediate level radioactive wastes released by nuclear energy operations in the United States [at the time]…discharging several thousand curies per day directly into the river” (Toombs). As long as those upstream, including the Tri-Cities population, were aware that national security was of paramount importance, they would worry less about their own security from the plant providing an economic boost to their communities (with much-needed jobs and subsequent industry).

Over fifty years later, one realizes the inner operations at Hanford and the ways in which their grandparents, parents, and him or herself were and presently are affected by the chemicals and radionuclides leaking into Hanford’s groundwater. As the site is gradually being decontaminated, the Tri-Cities are grappling with the knowledge that, 20 to 30 miles upstream, Hanford’s groundwater is migrating toward their primary water source, the Columbia River. The pollutants have the potential to contaminate the growth of native vegetation and/or crops sustaining the region’s economy, as well as to halt the tourism industry that brings vitality to Pasco, Kennewick, and Richland. Nonetheless, much of the damage may have already been done.

> Today [as of the year 1998], Hanford ‘contains more than two-thirds by volume of the Department of Energy’s (DOE) highly radioactive waste and one-third of all radioactivity created in the nuclear complex,’ according to the DOE. ‘It’s probably the most contaminated soil and groundwater site in the United States,’ says Suzanne Dahl, project manager for the Washington State Department of Ecology, the regulatory agency for Hanford’s storage tank cleanup. (Wade 22).

Radioactivity, or the “spontaneous emission of radiant energy” (Stenehjem 11), is a normal property of some elements, such as uranium and plutonium, that are found naturally in the environment. Generally, the amounts of radioactivity one might encounter and the risk of harmful exposure are relatively small and minimal, but exceptional circumstances, for instance, living in a home with the foundation built over radium-or-uranium-bearing rocks and working underground or with soil enriched by such elements, may lead to hazardous exposure. Yet when radioactive materials are produced in quantity for use in weapons or energy plants, or when new radioactive elements are created by nuclear manipulation, they may contaminate the environment and threaten the health of plants, animals, and even humans. When released into the air or water, radioactive materials may settle on plants and soil, or descend to the bottom of ponds, lakes, and streams. Some contaminants may sink deep enough to pollute the groundwater with which residents come into close contact to water crops and the like.

During the production process at Hanford, uranium metal, or a fuel rod, was enclosed in cladding and placed in one of nine nuclear reactors in the 100 Area along the Columbia River. The uranium was irradiated within the reactor and then transported to chemical processing plants, where the cladding and uranium were dissolved and plutonium was recovered and purified. High-level waste resulting from the separation process was stored in underground tanks while “less radioactive waste” (Wade 21) was released to the soil through cribs and trenches, all within the 200 Area, or the central plateau located in the greater Richland area. The waste beneath the cribs and trenches bound to the soil, which provided a buffer to the groundwater. However, as production increased and more liquid waste was pumped through the site, the water table rose, and contaminants were pushed through the soil.

The environmental impact was, in some cases, immediate and expected. Approximately 440 billion gallons of liquid were discharged to the ground at the central plateau (Wade 21) and only about 200 to 300 feet of soil lies between the surface and the groundwater to act as a type of filtering mechanism for contaminants. As David Shafer, DOE's vadose, or shallow water, zone manager for Hanford's high-level waste program, states, "(The soil) certainly has some capacity to do that, but it doesn't have an unlimited capacity, so there were contaminants from those liquid disposal sites that went straight to the groundwater" (Wade 21).

Direct element disposal was not the sole source for contamination of groundwater. There are 177 underground storage tanks at Hanford, in which the containment of waste is maintained and disposed (Office of Safety Regulation). The surplus amount of radioactive waste—that which was not dumped discretely into the river—was kept initially in single-shell tanks, designed to maintain materials safely underground for only twenty to thirty years maximum. After thirty years, the tanks began a rapid process of deterioration in which the waste seeped out of the tanks and into the groundwater through natural cracks and holes. Officials at the Department of Energy then put forth efforts to transfer the waste to double-shelled tanks buried underground in order to buy them another 30 years, more or less, to devise a long-term plan for eliminating the waste altogether. As of this year, they are still in the relocation process. Currently, approximately sixty percent (by volume) of the nation's high-level radioactive waste is still stored at Hanford in the aging tanks (Department of Energy: Office of River Protection). Lying within such a close proximity to the Columbia poses an undeniable health risk, not only to human health, but to the environmental health as well. Both the river water and nearby soil are subject to contamination and hazardous to those handling them on a regular basis.

As of 1998, more than 100 square miles of groundwater within Hanford were contaminated above drinking water standards (Department of Energy: Office of River Standards). The DOE has identified plumes, or trails, in the water containing chemicals such as chromium, carbon tetrachloride, and nitrate, in addition to radioactive contaminants like technetium 99, cobalt 60, uranium, plutonium, strontium 90, cesium 137, iodine 129 and 131, and tritium. According to the DOE, groundwater migration from the 200 Area east to the Columbia River is projected to take until 2018, while migration from the 200 Area West could take more than 100 years, until approximately the twenty-second century.

The ultimate effects of heavy metal contamination on plants and animals, including humans, depend upon the specific characteristics of the radioactive element. Some bind tightly to soil and are not easily transferable by water or even wind. Others are transported more freely through the environment. Several elements tend to concentrate in particular body tissues, as does cesium-137 in muscles, strontium-90 in bones, and iodine-131 in the thyroid gland (Stenehjem 11). Such bioaccumulation, as it is known, is the result of the physical and chemical properties of the particular element and the biological characteristics of the exposed tissue.

At Hanford, the chief contaminant of consequence to the residents of southeastern Washington was iodine-131 (I-131), released between 1944 and 1966, a twenty-two year period of peak productivity for the plant (Stenehjem 11). The fuel rods containing uranium and plutonium were dissolved in the separation process, releasing vaporized iodine into the atmosphere before the installation of filters and control devices. I-131, with a half-life of eight days (during which time half of the element decays and releases its radioactivity), was carried by the wind until it settled on soil and vegetation, and into the water. Although some of the iodine could have been inhaled by those working and living nearby the Hanford stretch of the Columbia, “the real concern was entry into the food chain through plants contaminated by groundwater” (Stenehjem 12). The iodine ingested by dairy cattle on pastures with such contaminated plants came to rest in their thyroid glands, but a large amount was excreted in their milk. The level of exposure for the local individuals drinking the milk depended on whether it came from a backyard cow or was processed alongside other, uncontaminated milk. Drinking undiluted milk from a backyard cow with no elapsed time between collection and consumption would have resulted in a higher exposure to the element and the thyroid cancer associated with it. Dairy milk processed and diluted with uncontaminated milk from outside the exposed area probably produced somewhat lower exposures.

The younger the individual who drank the milk, the greater the potential health risk. Because infants have smaller bodies, lesser developed immune systems, and drink greater amounts of milk as part of their diets, their exposure to I-131 was substantially greater than that of adults. When I-131 is absorbed and deposited in the thyroid, its radioactivity damages the gland, leading to possible cases of severe hypothyroidism or thyroid cancer. Hence, not only were the younger factions of the population at a higher risk for these ailments, but so were the over 13,000 southeastern Washington residents involved in agribusiness and farming (Greater Pasco Area Chamber of Commerce).

The current Hanford Environmental Dose Reconstruction Project (HEDRP) will attempt to determine the amount of exposure and to whom, when, and where it occurred as the result of Hanford operations over the past fifty years. Preliminary exposure assessments indicate that "the releases of iodine-131 during the decade from 1945 to 1954 were the largest and potentially most likely to produce adverse health effects" (Stenehjem 13). Further epidemiologic studies should show whether exposure to radionuclides from food and water also contributed to these effects. These future studies could likely determine if those with high levels of groundwater contact and those working directly with the Hanford stretch of the river will face an increased risk of certain types of cancers and the like.

Are Current Cleanup Efforts Enough to Protect the Region from Further Contamination?

In 1988, the United States Government declared the Hanford Nuclear Reservation site as a national priority for cleanup efforts, which officially began a year later as 1989 was the year in which the last of the site's reactors was shut down. That same year, the DOE, Ecology, and the United States Environmental Protection Agency signed the Tri-Party Agreement, which set forth a thirty-year plan for bringing the site into environmental compliance. Along with containing and treating the groundwater, DOE must decommission all of Hanford's facilities; decontaminate and/or dispose of surface structures; remediate contaminated soil; and remove and store waste. All of the above processes have the potential to release further pollutants into the soil and groundwater, but for the past seven years, groundwater project managers have focused primarily on three goals: pumping and treating the existing contamination in the Hanford stretch of the river; removing and storing liquid waste from the underground storage tanks; and removing and storing depleted fuel rods.

In 1998, Congress established the Office of River Protection (ORP) in order to handle the DOE's largest cleanup project: the 53 million gallons of tank waste at the Hanford site, as well as other former nuclear weapons production sites stretching across the country from Washington to South Carolina. Previously, the DOE, which had been handling the Hanford site for the past six decades, did not have the resources or structure required to deal with the complexity of the tank waste treatment and disposal. With the hopes of getting rid of cost overruns and delays, the ORP was created to complete the cleanup sooner, improve the environment for contractor performance, look more deeply into possible risks and vulnerabilities, minimize impacts of construction on the community, and to create opportunities for regional small businesses.

The expedited cleanup is moving ahead of schedule, even though major projects are planned through 2006 (Department of Energy: Office of River Protection). As of the year 2000, officials had pumped over three million gallons of liquid waste from aging and damaged single-shell tanks, moving the waste to newer, safer double-shell tanks at Hanford as to prevent further groundwater contamination. Regrettably, a highly significant amount of waste still exists underground, awaiting the move to safer containment and eventual eradication

Protecting the Columbia River will require containment and treatment of Hanford's existing groundwater contamination and prevention of additional contamination from stored wastes. Cleanup is under way, but decades will pass before the

Department of Energy, which owns Hanford, can raise the fund necessary to thoroughly complete those efforts.

In the meantime, the Tri-City officials of Pasco, Kennewick, and Richland are raising funds for the cleanup, actively monitoring its progress and looking ahead to land use plans and future economic development. In addition to the immediate risks to human health and to the area's economy concealed at Hanford, officials are battling the threat of perceived risk, which could hinder their efforts to sustain sales of the area's crops, expand tourism, and attract new industry. These officials know that the 500 square mile complex called Hanford was a "historical monument" during World War II, the Cold War, and beyond, but they stubbornly refuse to allow that piece of history ruin the futures of their families, friends, and neighbors. The Tri-Cities region of southeastern Washington will continue to be known as a booming area of tourism, industry, and agriculture, and hopefully never again as the place where hazardous Hanford took over and destroyed the native inhabitants.

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