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Week 9

Research Paper

Final

Hanford

Executive Summary

Found in Richland Washington is the remnants of one of the largest nuclear weapon producing plants that has ever been built in the United States. Hanford nuclear facilities were used in the Manhattan project as well as in the Cold War to help combat threats of nuclear weapons from foreign countries. But since its decommissioning after the final days of the Cold War- Hanford has been a painstakingly slow and serious clean up process for the state of Washington. Not only has there been typical hurdles with handling such toxic waste, but the deterioration of the overall remaining facilities which hold high level nuclear waste has also been a terrifying and complicated issue. Due to the close proximity Hanford has with the Columbia river, there is only a matter of time before the water as well as the wildlife is contaminated and jeopardized by the waste.

The typical American citizen does not ponder the possibility of nuclear contamination in their day to day lives. Nor do news stations keep play by play updates on issues pertaining to residual waste found here in the United States; does this mean that we all should turn a blind eye and pretend as if there is no problem at all and continue with business as usual? No, especially not in regards to massive and extremely toxic nuclear waste sites such as Hanford in Richland Washington. Not only should we be acknowledging the presence of facilities such as Hanford but citizen of Washington as well as citizens of neighboring states need to be educated on not only the history of this facility but also what we need to do to assist in the cleanup and proper disposal of all contaminated materials from this site.

Hanford facilities seen off in the far distance- speculated to be the remnants of one of the larger rectors.

The Hanford plutonium facility located in Richland Washington has not only a lengthy but also a rather dramatic history. Hanford was originally constructed in 1943 as a major contributor in The Manhattan Project- Hanford was successful in supplying nuclear weapon grade plutonium for many bombs; including those tested in New Mexico in addition to the Nagasaki bombs. Hanford then continued to grow in plutonium production alongside other facilities such as Oak Ridge and a handful of smaller plants; by 1949- Hanford became the largest plutonium based facility in the United States and rivaled in size next to the new age uranium based nuclear weapon facilities (The Tri-City Herald 2014).

As the Manhattan Project came to a close- Hanford slowed in growth and remained dormant for just two years before the Soviet Union ushered in a new age of nuclear war in the form of the Cold War. Driven by fear and uncertainty; The executive branch as well as congress ordered major additions to the Hanford site which ultimately resulted in a shift from 3 nuclear reactors in 1946 up to an astounding 8 total in 1955 dispersed along the Columbia River. These 8 were soon rounded off with the production of the 9th notorious N-Reactor which was added in 1963 as a frantic attempt to “close the missile gap”, (Power 2008) between the United States and

the Soviet Union. Finally at the end of the Cold War in the late 1980s and early 1990s- the Hanford site was no longer necessary for the protection of the United States. This was the beginning of the now over 90 billion dollar effort to clean up not only the Hanford site but as well as over 144 other sites in the US (PSR 2015).

After the threat of the Soviet Union faded into the background- we were then left with the remnants of this substantial arms race. The residue that remains comes in the form of radioactive waste leftover from these facilities as well as the facilities themselves that are considered "hot" (meaning that they have radioactive exposure and then in turn are toxic and potentially harmful). The nuclear waste itself that we are faced with comes in varying levels of severity:

Spent Fuel: Spent or used fuel elements from nuclear reactors. The spent fuel is highly radioactive and must be stored in special facilities that shield and cool the material. In the United States the spent fuel is primarily from commercial power plants; or are left from weapons construction such as at Hanford's facility-

High Level Waste: Material generated by the chemical reprocessing of spent fuel. The waste is highly radioactive and must be isolated from the environment for thousands of years.

Transuranic Waste: Waste generated primarily during the research, development, and production of nuclear weapons. Most of the waste consists of such things as laboratory clothing, tools, gloveboxes and air filters contaminated with small amounts of plutonium. Some of these will remain radioactive for tens of thousands of years.

Low Level Waste: Any waste that does not fall into any of the other categories. Most low-level waste contains small amounts of radioactive waste in large volumes. Some low level waste however- contains significant levels of radioactivity. Low level waste is categorized by their amount of radioactivity in an alphabet system A, B and C being lower levels of radioactivity in which this material can be stored in shallow land burial- whereas the 4th category which is "greater than C" contains such hot waste that there is no current treatment plan for it (Power 2008).

And it has been properly dealing with all of these levels of waste in a cost efficient and safe manner that has been proven to be not only extremely difficult but also highly time consuming.

Mistakes in the past of disposal especially in regard to the Hanford facility has also led to major complications with cleanup.

Warning signs lining the entire perimeter that encases the Hanford site warning trespassers.

Currently at the Hanford site progress is being made- all 17 of the "hot" facilities and reactors are either completely in a status of ISS (Interim Safe Storage), Cocooned, Decommissioned or in the process of those 3- and plans for a Museum in the N-Reactor are even on the table (The Tri-City Herald 2014). But even with these progressions being made above ground; there are major complications and severe contamination happening below the soil of Richland. And it is these complications that pose the most immediate and severe repercussions for the environment as well as to the health of humans in the area and along the Columbia. One of the main issues is caused by ignorance and optimistic thinking of engineers at the beginning of the plutonium production in the 1950s. In the very early stages of Hanford's operation, the nuclear low level waste product that resulted from the production of plutonium was thought to have a significantly weaker potency and shorter half life then we have come to know today. Given these false assertions regarding the plutonium waste- scientists originally developed open ditches and ponds in which the waste would dissipate into soil and deteriorate safely. This very

abruptly was realized to be a horrendously dangerous option due to wind, birds, rain and various other natural conditions that spread this radioactive waste outside of the ponds and out into the ecosystem. Upon this discovery- the next development were “Cribs”- cribs were constructed to act similarly to a domestic septic system in which the waste material would drain into the soil and would ultimately dissipate down into giant gravel-filled underground boxes where they could remain until the shorter-life nucleotides could decay (Power 2008). Over time radiation protection officials decided to develop monitoring devices to test the soil to ensure that these contaminants were indeed decaying according to plan. But upon extensive testing: it was found that more potent and mobile contaminants such as uranium were actually seeping below the cribs and moving towards the ground water. The second large and slightly more dangerous issues is in regards to the high level waste that is still present within the ground in Richland. Hanford currently has 177 underground tanks filled to the brim with radioactive high level waste. Among these tanks 149 consist of a single shell of protection between the waste and the soil- and the remaining 28 were constructed with double shell. Of all these tanks- 77 have already leaked in the past and 152 are at risk still of leaking (DOE 2015). This risk is due to the life span of the tanks: all of the tanks were designed to withstand the effects of the high level waste for up to 30 years- but since all of the tanks were constructed between 1944- 1980 (Power 2008), the projection for their stability is bleak. Due to the depth of the tanks in the soil (7 feet) leaks are even more detrimental to the Columbia because the waste is closer to the ground water. The past leaks from these tanks as well as the possibility for more in the future prove to be one of the largest areas of public concern- with very good reason.

Clean up tactics for all areas of concern at Hanford for the most part completely devised. But even with the plans being fairly well developed, issues occur within the actual execution of clean up. The majority of the buildings have been properly demolished and treated for their radioactivity, but the waste that was addressed before is the hindering factor within Hanford currently. One of the biggest and most time sensitive plans is in regards to the Vitrification Plant that is currently under construction to deal with the problems revolving the high level waste underneath Hanford. A Vitrification plant takes these extremely dangerous high level wastes and

processes them in a way to take them from their liquid form into a more stable glass form. And upon this change of state they then are stored in a much more secure facility where the possibilities for leaks are alleviated. The main issue concerning the VIT plant comes from the financial backing that is needed to construct and run this facility. In 1989 a VIT plant was projected to start processing waste in 1999 with a price tag of an estimated 4.3 billion dollars. Which has since turned into a more realistic 11.3 billion dollars. The main speed bump occurred in 2005 during the stock market crash- this economic fluctuation put all construction to a screeching halt and progression since then has been rather slow. Along with these financial hurdles; there is also the ever growing health and safety concern that is associated with these high level wastes. Not only do the deteriorating tanks pose a safety concern but the construction of the plant itself deals with many highly combustible gases and materials that if not given the proper protocol and time- will combust and produce harmful gases that will affect the entire area of Richland and much more. An opposing field of thought is that because the new projected completion date of the VIT plant is 2018- which may be overly optimistic. Then these tanks need to be attended to as soon as possible. But this brings forth the issue of money once again, because not only do tanks cost astronomical amounts of funding; but they also take away large quantities of time and resources from them VIT plant and its final stretches of construction.

With the plan on the high level waste being dealt with as best as possible- there then still remains the immediate problem of million of tons of contaminated soil found in Richland left from the seeping of low level waste into the ground. The hurdles found with this waste is not only found in the fact that some of these contaminants are currently stored 200 feet deep into the soil but also that the projected financial burden of retrieving all the tainted soil, loading the soil onto trucks to then transport it down to a safe facility down in New Mexico is a substantial 1.7 billion dollars. This price is optimistic at best if not slightly foolish given the fact that scientists also admit that they do not know the true extent of the contamination found at Hanford- meaning not only the scope of how deep or how far the toxins have leaked in circumference but also that they do not truly know what contaminants are in the soil nor how potent and hot they are. This

means that obstacles and surprises are essentially guaranteed and expensive adjustments will need to be made (Power 2008).

The authority in the clean up effort of Hanford is the US Department of Energy. The DOE took over command upon the completion of nuclear activities for not only Hanford but also at all other nuclear sites in the United States. And within this process of clean up the DOE has encountered opposition and resistance every step of the way, some with good reason. The DOE is at best reluctant to take the steps needed to properly dispose of waste- before federal and state intervention with activities regarding clean up led by the DOE; the amount of improperly treated waste as well as corners cut in reference to public and worker safety was insurmountable. This is what mainly led to the gigantic power struggle we now find revolving around all nuclear clean up in the United States. The main issue occurs in the fact that the DOE is legally responsible for all of the waste that remains and also burden of financially backing all of the cleaning efforts. But along with this there also has been great measures taken by the federal government to ensure the proper treatment of all of the wastes- this comes in the form of countless regulation and passed regarding acceptable disposal activities ex: Atomic Energy Act (1954), Energy Reorganization Act (1974), DOE organization Act (1977), Nuclear Waste Policy Act (1987), Federal Facilities Compliance Act (1992) and Executive Order 13392, Improving Disclosure of Information (2005) (Power 2008). But along with federal influence- state government also holds a stake in the ongoings (or lack thereof) at the Hanford plant and its progression towards clean up. One of the main roles that Washington state legislature as played is main through their right of veto, some of the main issues faced by the DOE is finding viable locations for high level waste to be buried and encapsulated deep within the earth. Originally when the hunt for a site first began- there were 3 top candidates: New Mexico, Hanford and Ohio. And upon inspection at all three sites Washington was approached by the DOE with desire to harbor this waste within the state. This proposal was finally resolved in 1994 and New Mexico was finally selected as the recipient for high level waste remnants from not only Hanford- but also from other large facilities such as the Oak Ridge National Laboratory, The Rocky Flats Plant and The Savannah River National Laboratory (The Tri-City Herald 2014). Amidst this shuffling of material and the

attempted influence of the state government during the work of the DOE there are a few more factors that play into the clean up effort of Hanford. This stems from the involvement of concerned Native American Tribes: Yakama Indian Nation and Native Americans in Idaho- who not only have rights to the land that nuclear waste is seeping into, but who also hold legal right to the wildlife in the Columbia river that is currently at risk of being contaminated. And finally on top of all of these forces there is also a slew of watchdog groups in place to even further insure the fair treatment of workers but also the proper treatment of waste; these groups include: Hanford Watch, Women Against Nuclear Armament, Alliance for Nuclear Accountability and much more at both a state and national level. And of course there is also the voice and concerns of the general population in Washington (Power 2008). Not only is there a level of distrust among citizens towards the DOE due to past accidents as well as poor protocol, but there is also the general dread and fear that is associated with nuclear power and its waste. Due to the aftermath of the Soviet Union and various incidents that occurred on their land harming citizens as well as incidents that have occurred in United states soil (The 3 mile Island incident), there is an even larger fear for the possible damage regarding nuclear power. That is why it is not only crucial for the DOE to rebuild trust among citizens as well as within Washington State legislature so that they can take steps necessary in not only treating the varying nuclear waste left over at Hanford- but also dispose of it properly whether it be onsite or at controlled facilities such as New Mexico.

One of the main concerns of the public is in regards to government spending and confusion over the legitimacy of the urgency that's revolving the cleanup of Hanford. Which is wrapped into a general feeling of: “What is the worst that can happen?” or “Will this really impact me?”; this is a thought that is almost as toxic as the nuclear waste itself. We have seen the adverse effects that can take place in humans when exposed to nuclear radiation in various circumstances; The most relevant for the United States being the “down winder effect”. The downwinder effect is an overall trend found overtime in the health of those who live close to radioactive facilities such as power plants; these trends have yet to completely accepted in the medical field but include a speculated increase for cancer rates (most frequently thyroid cancer)

as well as an increase of birth defects over time in those regions (9). But due to the relatively low exposure- these health implications develop over the course of lifetimes and have not been test enough to have a definitive scientific correlation drawn. The more intense and alarming health effects have been recorded from nuclear exposure introduced through the use of nuclear weapons when decimating communities. Hiroshima and Nagasaki are the most drastic instances where the true destructive ability of nuclear radiation on the the human body has been seen- nuclear exposure can occur mainly in two forms: Direct exposure- which is when the tissues of the human body absorb the radiation through the atmosphere and it directly seeps into the cells in the body, the second is through Indirect Exposure- which is through humans consuming natural substances that contain radiation such as water, birds, fish and other wildlife that is directly affected. The impacts of direct exposure seen in Hiroshima and Nagasaki are vast:

Rapid Hair loss

Rapid deterioration of thyroid glands

Loss of brain cells and cells in the heart causing seizures and possible death

Long term exposure leading to citizen becoming sterile

Increased long-term risk for leukemia and lymphoma

Varying levels of radiation sickness (flu like symptoms that can include vomiting/ coughing blood) (4).

And although it is extreme to compare a nuclear waste facility to the rubble left from a massive atomic bomb being dropped- the radiation potential is still there. And due to the increased rate of nuclear waste seeping into the groundwater headed to Columbia River- there is no scientific certainty of the adverse effects we may see effecting humans from this exposure. And whither it is only slight “downwinder” symptoms or only a slight decimation of wildlife in the area, immediate clean up is still needed.

Unfortunately we are nowhere close to where we need to be in regard to Hanford's waste to feel comfortable. But the main takeaway in the end is that not only are we in much better place than we were initially at the end of the Cold War- but there are also major steps being taken to ensure the safety of individuals as well as the environment; we can only hope that it's not too

late. But one of the biggest things that is still required from everyday citizens is to put pressure and concern onto the DOE. Because if there is no outside forces insisting on a clean and radioactivity-free Washington; then there will never be one. So it is our jobs as residents of Washington to not only be educated on this issue- but to also voice our concern for the health of not only humans in the area- but also for the health of wildlife and for the Columbia River as a whole.

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