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Mismanagement at the Hanford Site

During World War II it became a primary mission of the United States Government to create a weapon that no other nation could compete with. With this aspiration in mind the US Army Corps of Engineers created the Hanford nuclear site, 586 square miles in southeastern Washington, directly upstream from the Tri-Cities of Richland, Pasco, and Kennewick where plutonium was for the first time produced and processed.

The Manhattan Project, which started Hanford in 1943, was completed in 1945 and atomic bombs were dropped on Hiroshima and Nagasaki to end the War, but that did not stop the production of radioactive materials at the Hanford site. After World War II the United States became involved in what we now call the Cold War Era. This was a time in which there was a clamor for weapons of mass destruction with the main players being the United States and the Soviet Union. Although no weapons were actually deployed outside of testing procedures during this era, there were massive amounts of plutonium and other materials produced at the Hanford site. Production of radioactive materials continued through 1988, when the last reactor on site was decommissioned.

As is the case with all nuclear sites, there was a large amount of hazardous waste that needed to be disposed of. The original plan for the Hanford site was to simply contain the radioactive waste in large underground holding tanks while it waited to be treated. Currently 177 such tanks exist under the Hanford site. These tanks however

only provide a temporary solution to the problem. Currently, CH2M Hill is the contractor charged with the removal of the 57 million gallons of waste held in these tanks. Bechtel National, Inc is the contractor charged with the design and construction of a waste treatment facility on the Hanford site to convert the waste to a stable state to then be disposed of. Overseeing the safety and management of the whole project since 1996 is Fluor Hanford, Inc. The current goals are for all of the waste to be treated by year 2028 and for the tanks to all be closed permanently by 2033. Although there have been attempts at cleanup and management of waste on the Hanford site, they have historically been minimal, even in the face of knowledge about the hazards to human health of the waste.

I recommend that an in-depth reclassification of the subsurface and levels of contaminants in the groundwater around the site be conducted. This would allow managers of the process to more effectively choose cleanup methods. A technology-based standard should be implemented at the site in conjunction with a containment policy for unreachable or untreatable waste in the groundwater. Finally the management responsibility should be allocated to a consistent manager that stays with the project for the duration.

World War II was a very trying war for everyone involved, and the United States' wartime program desired a weapon that could change the course of it, the atomic bomb. The Manhattan Project was started to create this new weaponry. It soon became clear that a site to produce the radioactive materials for the bombs was necessary. So in February 1943 more than 600 square miles of riverfront land in southeastern Washington State was condemned and 1,500 residents ordered to leave within 30 days, creating the

Hanford site. By September of 1944 the first plutonium was being produced on site. Less than a year later the Manhattan Project succeeded and the first atomic bombs containing Hanford plutonium were tested. In August 1945 atomic weapons were dropped on the Japanese cities of Hiroshima and Nagasaki. This horrific display of total destruction brought the war to a close. Although nuclear warheads stopped the war, they didn't create total peace. A few years later the Cold War Era brought the fear of nuclear proliferation and the deployment of weapons against the United States. Hanford continued to produce plutonium with the purpose of defense until 1986, when the site's charge changed from military production to cleanup of the by then heavily contaminated site. The last nuclear reactor on site was decommissioned in 1988.

Over the years since the first nuclear reactor was made operational in 1944, what to do with all of the waste created in the plutonium manufacturing process has been an issue. The waste comes in solid, liquid, and gaseous forms, with high-, intermediate-, and low-levels of radioactivity groups within each state. Solid wastes, the cleanup of which involved simply burying them, were not sorted and dealt with based on the material until 1970. The high-level liquid wastes were stored in large underground tanks. Currently there are 177 such tanks under the Hanford site containing around 57 million gallons of radioactive waste. Intermediate-level liquid wastes were generally placed in less sturdy storage facilities called "cribs," although occasionally they were dumped into a trench and covered with soil once they had soaked in. The low-level liquid waste was simply stored in waste ponds or ditches. Although this seems ludicrously irresponsible, the progression towards effective mitigation of pollutants was a slow one through history.

The decade following World War II saw a large expansion of the facilities at Hanford, including the creation of a waste treatment plant and 81 underground storage tanks for waste. These were the beginnings of the attempts to lessen the environmental and human health impacts of the radioactive waste created at Hanford. In 1948 the first filters were installed in the smoke stacks at Hanford, the same year that a waste pond's dike broke, spilling 28 pounds of uranium into the Columbia River. 1946 saw the passage of the Atomic Energy Act that allowed weapons material production plants to continue to operate without independent supervision; this act was reaffirmed in 1954. There are documented historical releases of large amounts of radioactive waste such as the 28 pounds of uranium, many of which were perpetrated with attempts at secrecy. Through the 1950's to the mid-1960's the nuclear reactors at Hanford were all running at full capacity, so this was the period of the highest contamination of the Columbia River. Battelle became the first contractor on the site to be purely responsible for monitoring the environmental effects of Hanford operations in 1964. In that same year President Johnson ordered the gradual closure of the Hanford site. He began by shutting down three of the original eight reactors. The last of the original reactors were closed in 1971 and the last plutonium-uranium extraction plant was closed in 1972. Just a year later the management at Hanford announced the detection of an 115,000 gallon leak from one of the storage tanks. Similar spills and releases of contaminants litter the timeline of the Hanford Site from 1943 to the present. The biggest year for the cleanup activists was 1986. Simultaneously that year the U.S. Department of Energy made public thousands of documents showing the full extent of contamination dumped on and off-site, the Chernobyl disaster in the Soviet Union raised awareness, Washington voters rejected

making Hanford a high-level radioactive waste repository, Congress clarified the State's authority to regulate hazardous wastes at Hanford, and the U.S. Department of Energy published the Hanford defense Waste Environmental Impact Statement. After this year the focus of the contractors at Hanford switched from defense to mitigation of contamination. The last of the nuclear reactors and plants closed in 1988. The following year Hanford was placed on the Superfund National Priority List and the Department of Energy, the Environmental Protection Agency, and the State of Washington Department of Ecology signed the Tri-Party Agreement, which established a 30-year schedule for cleanup of the site. The standards for cleanup stated in the agreement were based upon eliminating the threat to human health. In the years since the agreement was signed much has been done to deal with the waste on the Hanford site, however the current prediction for the treatment and closure of just the underground liquid waste storage tanks is for 2033. As is the case with many similar projects and sites, many things went wrong at the Hanford site, the majority of which boil down to short-term solutions and goals.

The mismanagement of the Hanford site started right from the outset. The haste with which the site was created and made operational caused the planners to think very little about the disposal of the byproduct waste created in the process. With the singular goal in mind of obtaining nuclear weaponry, the government cared very little about the adverse effects of this radioactive waste on the environment, and in particular the Columbia River running along the site. Looking through the documents that did not begin to be declassified until 1986, one will find a wealth of information in letters, handwritten accounts, and typed reports from as early as 1947 that discuss the hazardous nature of the nuclear waste at Hanford to human health. A study done in 1952 points out

the dangers of eating fish and waterfowl from the Hanford area, and one from 1956 found high levels of plutonium in the blood of the residents of nearby Richland, WA. In one report from 1974 it was estimated that Hanford released 441,700 curies of radioactive iodine-131 between the years of 1944 and 1947. Even with all of this knowledge about the dangers of the waste being produced at Hanford and the proliferation of it occurring throughout the region because of inadequate containment and treatment, not much was seriously done until Johnson's order to shut down the site in 1964. Even then nuclear reactors were operational on site for 24 more years and the goals of the site did not change from defense production to mitigation of pollution until 1986. This large delay in the cleanup or even control of the nuclear waste is on account of economics. It was cheaper for those in charge of the site to simply dump or bury the waste than to effectively treat it. The "Green Run" that occurred on December 2nd and 3rd, 1949 was top secret planned release of 8,000 curies of iodine-131. This is not a stand-alone offense, top secret dumps and emissions occurred frequently in the first 30 years that Hanford was operating. This shows that short-term productivity was deemed more important than the long-term environmental and human health repercussions of mismanaging the dangerous waste material.

However many of the biggest injections of radioactive material into the environment and the Columbia were unintentional. For example, in 1962 there was a "criticality accident," meaning that there was a self-sustaining nuclear reaction, which released 1,200 curies of radioactive gases. This was not a planned release of waste; however it still had a profound environmental impact. Although there are these accidental discharges of radioactive material that spatter Hanford's history, many of them

were not unforeseeable. Inadequate precautions played a part in a lot of the pollution that came from the Hanford site. Managerial changes often were at the root of these slip ups.

Since its inception Hanford has had 13 different independent contractors. This is not to mention the varied governmental agencies that have some jurisdiction at the site. Currently there are six contractors, all responsible for a part of the cleanup process, with Fluor Daniel Hanford overseeing the others. Each time the management of the site is changed there is an adjustment period where the new contractor has to figure out what the status of the site is and where they should go from there. This often sets back the progress of the site. Changing management also served another purpose for the U.S. Department of Energy in that each time you get rid of people who know some about the shortcomings and the deceit at Hanford but they don't know it all since they've only been there a little while, and you gain fresh blood that doesn't have the facts yet to blow the whistle. Each new organization that comes in on contract brings something different and may have different aims. This also has hindered the progress of the Hanford site because they each tend to push or pull the projects in the direction that they think it should go, even if a previous contractor had been making progress in a different avenue. The current situation is also shaky. Although there is an overseeing organization, it is not entirely clear what tasks each of the six contractors are responsible for and there is a lot of overlap in the language of each of their different charges. The last thing about bringing in new contractors often is that it improves the morale of everyone involved. This is especially true when the goal of the project is cleanup since every new contractor seems to bring new life and promise to the situation, however they are never really that

much different from each other when in place. The approach to delegating leadership of the site has played a large role in the historical mismanagement at Hanford.

The goals of the management of the Hanford site have changed over time, as have many other things about the site and its level of environmental detriment. From a gung-ho attitude about the successful creation of nuclear weaponry at the outset, to a full-steam-ahead cleanup process in recent years, the site has seen just about the full gamut of bureaucratic functions and aims. The three main governmental agencies that have some claim to the jurisdiction at Hanford, The Department of Energy, the Environmental Protection Agency, and the Washington State Department of Ecology, all signed the Tri-Party agreement in 1989. This document has two parts: the legal agreement that defines the roles of each organization and dispute resolution processes, and the action plan that lays out the cleanup process with milestones along the way and the specific work that each of the agencies will do. Since just before the decommissioning of the site and the switch to cleanup, many non-governmental organizations sprung up to help with the cleanup effort and to keep the people in charge of site management accountable for their actions. One such group was the Hanford Education Action League, or HEAL, that was formed in 1984 and operated until 1999 as a Hanford watchdog organization. Many other companies were hired to do historical radioactive dose reconstructions, or to study thyroid disease in the areas heavily inundated with pollutants in the 1950's and 1960's. These groups all play a role in the current goings on at the Hanford nuclear site; however they do not directly deal with the reclamation, treatment, and disposal of the massive amount of radioactive waste still present on the dormant production facility's land.

Contractors do this, although they are not given free rein to complete the project in any fashion they desire, there is a governing action plan set by the Department of Energy.

Titled the "Corrective Action Program Description," this document lays out some boundaries for what the current contractor must do and what they cannot do. Contractor authority is fairly limited by this document, the purpose of which is to enforce the compliance of the contractor through the loss of profits in noncompliance. Every aspect of the Department of Energy-contractor relationship is laid out in this document. The standards for the cleanup of the Hanford site are also explained in this document. Current standards at the Hanford site and surrounding area are "Safety Basis Requirements," or essentially health-based standards. An Immediate Actions clause reserves the authority to mandate that the contractors immediately cleanup those areas that pose an immediate threat to human health. These are the conditions under which the current contractors must operate.

Presently, Fluor Daniel Hanford is the contractor in charge of overseeing the cleanup at Hanford and was hired in 1996 along with five other subcontractors. CH2M Hill is responsible for the removal of the waste stored in the 177 underground tanks on site. Bechtel National, Inc. has the task of erecting a more effective and universally functional waste treatment plant on the premises. There are also groundwater cleanup efforts in place in the key areas of the site, although much of what is known to be left has been deemed untreatable waste. These three main contractors give quarterly reports on the progress of the cleanup efforts, all of which are available publicly through the Hanford website. When the tasks that need to be done on the road to cleanup are laid out and then checked off eventually it gives the impression that things are getting

accomplished, that progress is being made by this set of contractors. However not all of the goals are met. The estimate for when all of the waste will be removed and treated is the year 2028, and the estimate for when all of the tanks can be sealed permanently is 2033. Although these estimates push back the original timeframe specified in the Tri-Party Agreement by about ten years, this is the nature of a cleanup effort involving such a complexity of issues.

Cleanup efforts, especially when it involves groundwater can be very difficult. Many different things can work against getting the job done. The first and most likely most important complicating factor in groundwater cleanup is the sheer complexity of the subsurface environment. The directional flow of groundwater, presence of solid rock, sorption of contaminants, heterogeneity of the subsurface, and presence of non-aqueous-phase liquids are among the factors that play into the complexity of a groundwater cleanup effort. Another consideration that the current contractors must make is whether or not they are helping the situation. There is always the chance that the pollution situation might be exacerbated during a cleanup effort. This could happen if there are contaminants contained in the soil that will be released if aggravated or if while dealing with one of the underground storage tanks it ruptures, spilling hundreds to millions of gallons of waste. Finally, much of the waste in the groundwater at the Hanford site is currently either untreatable or unreachable or both. These barriers to the effective cleanup of the Hanford site exist mostly because there are limits to what our technology can do and limits to what level of commitment governmental agencies are willing to have, none of which are set in stone.

The first step towards the effective management of the future cleanup at the Hanford nuclear site is the re-classification of the subsurface environment around the site. When pollutants get into the groundwater they spread in what is called a plume around the area of original contamination, so the classification of the entire area of the plume which could spread for miles outside the boundaries of the Hanford property is also necessary. An accurate reading on the levels of radioactive material in the groundwater would enhance the ability of the management team to make informed decisions about key areas to clean first and how to do it. With reliable and state of the art information on the nature of the subsurface as well as the spread and density of the problem pollutants, appropriate methods for the mitigation of the area can be determined. To properly categorize the subsurface environment this way will require the top of the line technology, maybe even some that is yet to be discovered. Being able to do this requires a change in the standards for cleanup.

Currently the standards for cleanup of the Hanford site are tied to human health issues, as long as it is safe for humans then that is all the further the cleanup has to go. This, however, disobeys the old camper's rule that you leave the place cleaner than when you found it. A certain amount of contamination will still be present in the environment because of this and many species could potentially be adversely affected by it. The morally sound standard to have is one that is technology-based. This means that the cleanup will be done to the maximum extent of the technology available. Standards like this hold at their core the values of human and natural health, and abandon any considerations of the expense, unlike health-based standards. Having set standards for

what the goal is of the cleanup is important, but if the managing contractor is changing, then everything can come crumbling back down.

Management of Hanford must be solidified and held constant for the long-term. This way a single organization or grouping of organizations can create, employ, and refine a method that gets the job done. Setbacks and contradictions are also reduced if the contractor is held constant. Choosing the proper consultant for the long term can be a difficult task. The essential ingredient for any lead consultant at Hanford is that their organization's goals are aligned with the goals of the Environmental Protection Agency, the Department of Energy, the Washington State Department of Ecology, and the on site staff including the Hanford Advisory Board. If a consultant comes in with goals that are different from the governing agencies', major problems could arise and progress towards the project's ultimate goal could be hindered greatly.

Mismanagement at the Hanford site started early on. The original dumping of waste directly into the river was eventually put to a stop, however many intentional secret releases of radioactive waste still occurred for decades. The Atomic Energy Act, changing managers often, and not being totally truthful allowed the Department of Energy to continue running Hanford as it wished. Once things got turned around in 1986, over forty years after the site opened, much of the behind the scenes dealings and waste emissions became common knowledge. The creation of many civilian-led groups and the signing of the Tri-Party Agreement were the first steps towards the cleanup of a site in desperate need.

Progress is currently being made towards a cleaner Hanford, but an in-depth categorization of the subsurface may highlight some new areas to focus the efforts on. If

this is the case then cleanup of these newly found areas should ensue. However if the categorization shows that there is little to no possibility of cleaning up the waste with the technology that currently exists, a containment effort should be made until it does exist. Underground barriers between the pollutants and the Columbia River as well as around the other sides of the Hanford nuclear site land should be erected to prevent the future contamination of water sources, produce, or animals, which are all consumed daily by humans. This could only be effectively done if there was an accurate re-classification of the subsurface, the standards for treatment were changed, and the management group had the structure in place to implement it.

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