

## History and Development of Hanford Reservation, Washington

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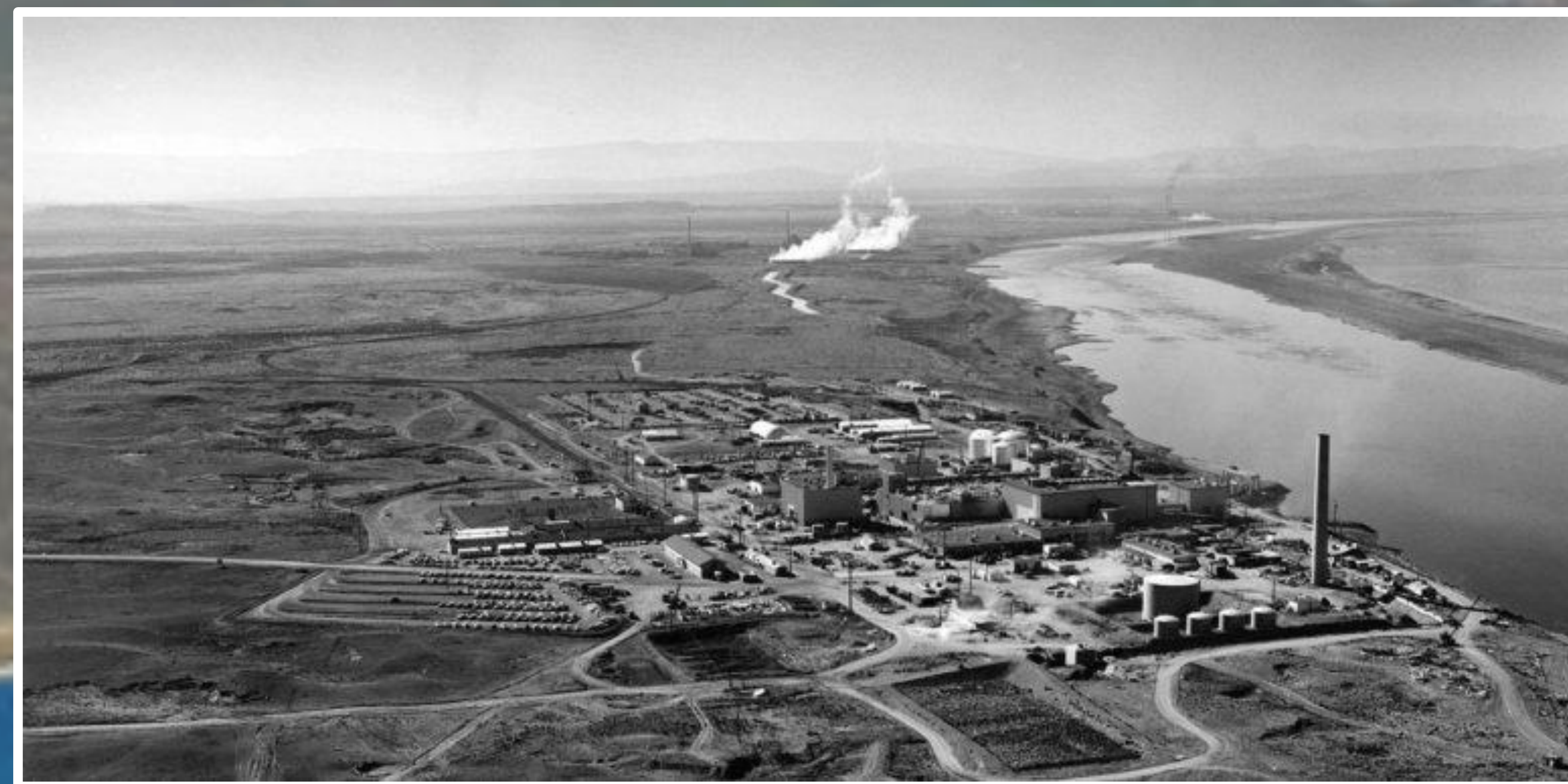
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## 1. Abstract

At the height of World War II, the United States government created the Manhattan Project in a race against Germany to develop the first atomic bomb. In search of remote areas to produce the necessary plutonium, the US government established a nuclear facility at Hanford, WA, which met all the criteria needed to develop and power the site. The Columbia River was vital to powering the plant and providing much-needed cooling water for the Manhattan B Reactor. The site created plutonium for the second bomb dropped on Japan, then it continued plutonium production into the Cold War. By the 1980s, production of plutonium was halted, and in 1989, the Tri-Party Agreement was signed to mitigate nuclear waste and protect the Columbia River to comply with federal regulations. Over 30 years later, cleanup has led to growth and development of the Tri-Cities (including Pacific Northwest National Labs), creating thousands of jobs in the region. And cleanup will continue for many more decades to come.



Map of Hanford Site on the Columbia River in the 1960s (Transcend Media Service, 2018)

## 2. Introduction

The Hanford site is located in southwestern Washington in Benton County and took up about 580 square miles of desert land. The location for the plant was established in 1942 for the purpose of creating plutonium for an atomic bomb in a secluded location close to a bountiful water supply. Starting off as project to learn how to build and operate a nuclear plant meant to create plutonium from uranium, during and after World War II, the plant became more research intensive to perfect and create new processes of creating and extracting plutonium faster and more efficiently. Research also went into how nuclear power could be used commercially. After the Chernobyl disaster in 1986 and the end of the Cold War in 1989, all plants and operations were closed permanently, which lead immediately into the Tri-Party Agreement to cleanup all the radioactive material and other types of waste left behind from poor waste management and burial.



Figure 1: Map of Hanford Site (SJSU, 2022)



Figure 2: B Reactor (B Reactor Tours)

## 3. World War II

- The Manhattan Project created in 1939 and lasted until 1947
- 1942 - General Leslie R. Groves put in charge of the Manhattan Project and E. I. Du Pont de Nemours and Company (Du Pont) put in charge of constructing the plutonium production site
- 1942 - Hanford located as best site for plutonium production site and Richland for housing the Hanford Engineer Works Village
  - Columbia River was vital in the cooling of the reactors
- 1944 - B Reactor finished, the world's first nuclear reactor
- 1944-45 - D and F Reactors and T, B, and U Plants finished
- 1945 - Trinity Test successful, the world's first atomic bomb which used Hanford plutonium
- August 9, 1945 - "Fat Man" plutonium bomb is dropped on Nagasaki, Japan
- August 15, 1945 - End of WWII with Japan

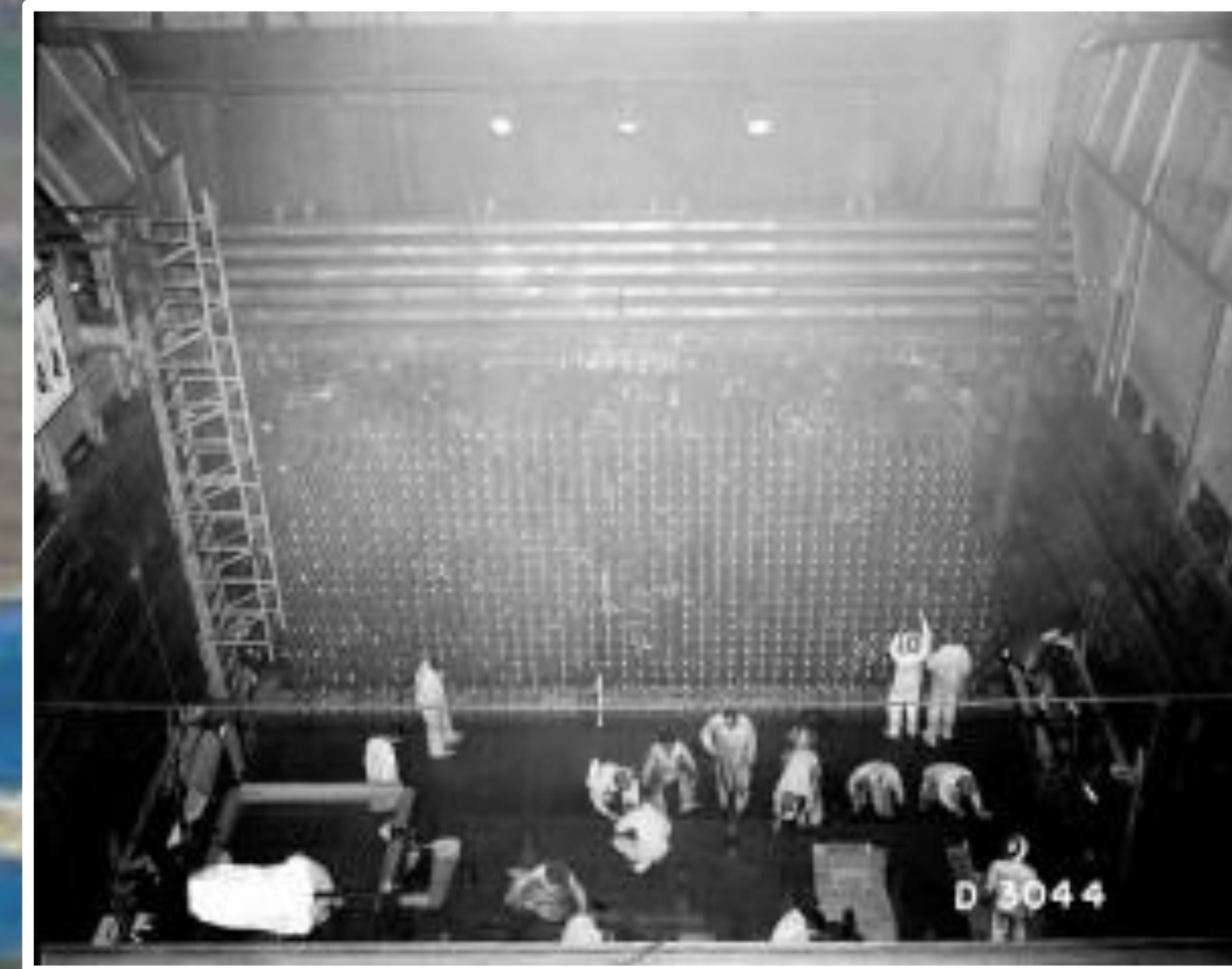


Figure 3: B-Reactor and workers (Trish T. Pritikin, 2021)

## 4. Cold War

After the end of World War Two, relations between the United States and the Soviet Union had started to deteriorate, leading to a greater need for nuclear bombs and plutonium to defend against potential nuclear warfare.

- 1947 - General Electric Company takes over operations of Hanford from Du Pont
- 1947-1947 - Plutonium Finishing Plant created that converted plutonium-nitrate solution into plutonium metal used for nuclear weapons, more research and development facilities "to handle the increase in defense and energy research" (Harvey, p. 19)
- 1950-1952 - Korean War started, C Reactor created and creation of REDOX (Reduction-Oxidation) plant, meant to recover uranium and plutonium, Nike missiles systems put in place until the mid 1970s
- 1953-1955 - PUREX (Plutonium-Uranium Extraction) Plant that was Hanford's most advanced separation facility, then the "Atoms for Peace" program created and Atomic Energy Act of 1954 that allowed for "commercial atomic application" that lead to non-defense programs
- 1956-1964 - N Reactor created which was a combination of plutonium production and steam for commercial electric power, excess of plutonium caused decreased plutonium production and closure of some reactors
- 1969 - All reactors except the N Reactor shut down
- 1989 - N Reactor shut down; all plutonium production ceased



Figure 4: Nike Missiles (SLDinfo)

## 5. Clean Up

With end of the Cold War and closure of Hanford in 1989, the Tri-Party Agreement was made between the Washington State Department of Ecology, U.S. Department of Energy, and U.S. Environmental Protection Agency. The Agreement was created for the three state and federal organizations to take charge in the cleanup of all toxic chemical and radioactive waste within the site before destroying most of the buildings. Some types of harmful materials are:

- Plumes - underground rivers where contaminants have mixed with groundwater that move toward the Columbia River
- Columbia River water that was used to cool the reactors dumped back into the river with no treatment
- Buildings made of harmful materials like asbestos

Several processes have been used and created to help get rid of the waste safely. Vitrification that makes radioactive material into stable glass that is placed in another site for permanent burial. Solid waste, contaminated soil, and building debris are place in protective landfills on site. More harmful materials that will remain radioactive for thousands of years are shipped to the Waste Isolation Pilot Plant in New Mexico for permanent burial. For plumes, some strategies used to stop it from reaching the Columbia River are barriers that don't allow contaminated water through and different water treatments in and out of the ground.



Figure 5: Cleanup workers replacing a pump where nuclear waste is placed before treatment and vitrification (Hanford Site)

## 6. Conclusions

- Hanford Reservation played a major role in American History, including in winning World War II and discovering a new means of electric power
- But due to lack of regulation throughout the project's history, it has caused serious harm to the environment around the site that will take around 70 years and "\$300 billion to \$640 billion" (Tri-Cities Herald, 2022) to complete
- Even for how costly the cleanup will be, it is also responsible for the development of the Tri-Cities and around 10,000 jobs for the surrounding counties

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