

Timeline for Cold War-era tritium production at Hanford (1942 to 2012)

Peter Lobner, 12 January 2020

There were nine production reactors at Hanford built between 1943 – 1963 to produce weapons-grade plutonium Pu-239 and small quantities of other isotopes, including tritium and polonium-210, which is a neutron source used in a nuclear weapon's trigger / initiator. All of these reactors were located in the 100 Area, adjacent to the Columbia River, which served as the cooling water source for the reactors.

- The eight dedicated production reactors were designated 105-B (the prototype), D, F, H, DR, C, KW, and KE. These were built between 1943 and 1955. By the early 1960s, B, D, F, H, DR and C were operating at maximum power levels in the range from 2,040 to 2,500 MWt. The larger KW and KE reactors had maximum power ratings of 4,000 MWt.
- The ninth Hanford reactor, designated N, was a unique dual-use design that also produced electric power that could be sold to the commercial power grid. This reactor was designed for a maximum power of 4,800 MWt, and at least once it operated at this power level. In practice, N Reactor was limited to 4,000 MWt. Tritium was produced in N Reactor from 1965 to 1967, with the irradiated targets being shipped offsite and tritium extraction handled at Savannah River Site.

Tritium extraction operations at Hanford were performed intermittently between August 1949 and 1955 at the 108-B facility (also known as P-10 Plant and the Mint Works) located in the 100-B Area, near B Reactor.

Tritium produced in B and H Reactors and extracted in 108-B provided the nation's initial tritium production capability from 1949 to 1955. The tritium produced between 1949 and 1952 was used in the first U.S. thermonuclear weapons test explosion conducted at the Pacific Proving Grounds in late 1952.

The tritium process line at the 108-B building was shut down in 1955. Tritium target irradiation in the Hanford production reactors continued until 1967 with transportation to an offsite facility for tritium extraction. DOE reported that a total of 10.6 kg (23.4 pounds) of tritium was produced at Hanford.

1942: DuPont was contracted in December 1942 to design, build and operate the Manhattan Project's plutonium production plant.

1943:

- The Hanford site was selected for the Manhattan Project plutonium production plant.
- Construction of B Reactor started in June 1943. It would become the world's first large-scale nuclear reactor.



Hanford B Reactor. Source: <https://b-reactor.org>

1944:

- B Reactor initial criticality in September 1944. Used later for tritium production in Project P-10-X.
- D Reactor initial criticality in December 1944. Not used for tritium production.

1945:

- F Reactor initial criticality in February 1945. It was the third Hanford production reactor completed during WW II. Not used for tritium production.
- WW II ended on 2 September 1945

1949 to 1954: Project P-10-X tritium production in B and H Reactors

1949:

- February 1949: A pilot process line for producing large quantities of tritium was transferred from Argonne National Laboratory to Hanford and installed in the Building 108-B, located near the B Reactor. Building 108-B (also known as the P-10 Plant, the Chemical Pump House and the Mint Works) housed the first operational tritium extraction process line in the DOE nuclear weapons complex.
 - The process used vacuum extraction to recover gaseous tritium from the irradiated targets.
 - Palladium thimbles were used to isolate and purify the tritium gas, which was collected by Toepler pumps (a type of mercury piston pump).
 - The produced tritium was placed in flasks and shipped to Los Alamos for further processing and use.
- Early 1949: Irradiation of the earliest targets, lithium fluoride slugs, was conducted in B Reactor.
- May 1949: Use of lithium fluoride targets was terminated as a result of “pile irradiation difficulties,” likely related to the production of hydrogen fluoride in the reactor core.
- August 1949: Lithium-aluminum alloy target rods were introduced and tested successfully at B Reactor.
- August 1949: Tritium extraction in 108-B started.
- October 1949: H Reactor initial criticality was in October 1949. H Reactor was the first post-war Hanford production reactor. It was used for tritium production in Project P-10-X.

1950: DR Reactor initial criticality in October 1950. Not used for tritium production.

1952:

- 1 Nov 1952: Ivy Mike was the world’s first test of a thermonuclear device, using tritium produced at Hanford.
- November 1952: C Reactor initial criticality. Not used for tritium production.

1953: SRP R Reactor initial criticality in December 1953. Not used for tritium production.

1954: Project P-10-X ended in August 1954.

- Building 108-B tritium operations ended.
- All subsequent tritium extraction was done at the Savannah River Plant.

1955: KW Reactor initial criticality in January 1955 and KE Reactor initial criticality in April 1955. Neither used for tritium production.

1956: A bill introduced by Senator Henry M. Jackson proposed allowing the Atomic Energy Commission (AEC) to sell electric power produced at Hanford to private utilities. Bill was killed in the House. A decade later, N Reactor would finally operate in a dual-use role.

1958: Funding for new production reactor at Hanford approved. The reactor would be convertible to power production at a future time only with the approval of Congress.

1963:

- September 1963: President Kennedy broke ground for the N Reactor power conversion system.
- December 1963: N Reactor initial criticality.

1966: Dual-use operation of the N Reactor started in April 1966, with electric power being sold to the Washington Public Power Supply System (WPPSS). N Reactor had been operating for three years without the power conversion system.

1963 to 1967: Coproduct Program for tritium production in N Reactor

- October 1965: Mark II coproduct fuel and target element design was selected.
- December 1965: Confirmatory testing and preparation for the in-reactor demonstration were authorized.
- 13 May 1966: Fuel and target manufacturing was authorized.
- 27 January 1967: Full-reactor irradiation test was authorized
- Summer 1967: In-reactor coproduction

1964 to 1971: Hanford's eight dedicated production reactors were shutdown after an average operating life 18 years:

- B (Feb 1968)
- D (Jun 1967)
- F (Jun 1965)
- H (Apr 1965)
- DR (Dec 1964)
- C (Apr 1969)
- KW (Feb 1970)
- KE (Jan 1971)
- Only the dual-use N Reactor continued operating after 1971.

1985: Building 108-B tritium extraction facility was demolished.

1987: The last Hanford production reactor, N Reactor, was shutdown in January 1987.

2012: N Reactor cocooned.