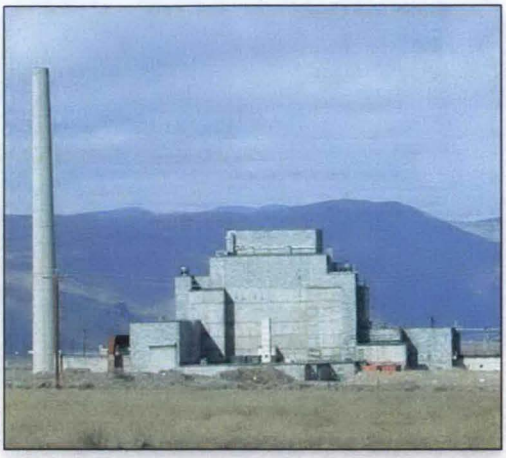


MANHATTAN PROJECT

B REACTOR

HANFORD, WASHINGTON

World's first full-scale nuclear reactor

U.S. DEPARTMENT OF ENERGY

A need

The Hanford Site began as part of the United States Manhattan Project to research, test and build atomic weapons during World War II.

The original 670-square mile Hanford Site, then known as the Hanford Engineer Works, was the last of three top-secret sites constructed in order to produce enriched uranium and plutonium for the world's first nuclear weapons.

A past

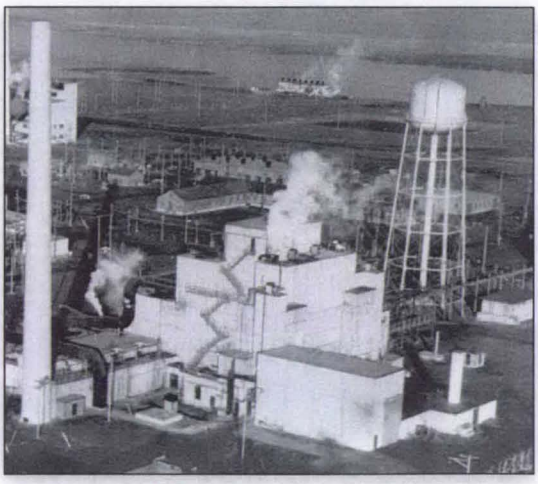
B Reactor, located about 45 miles northwest of Richland, Washington, is the world's first full-scale nuclear reactor. Not only was B Reactor a first-of-a-kind engineering structure, it was built and fully functional in just 11 months.

Eventually, the shoreline of the Columbia River in south-eastern Washington State held nine nuclear reactors at the height of Hanford's nuclear defense production during the Cold War era.

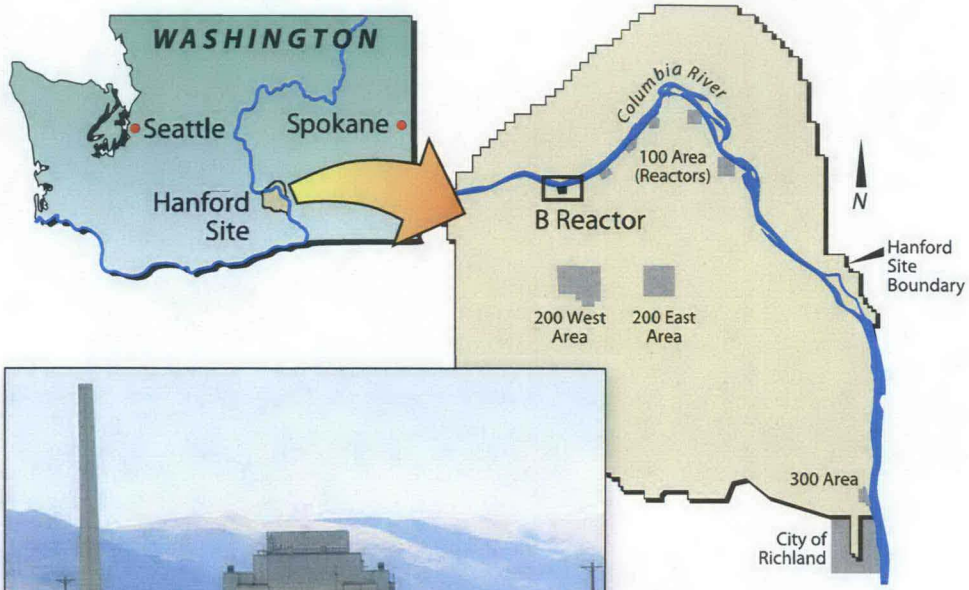
The B Reactor was shut down in 1968. During the 1980's, the U.S. Department of Energy began removing B Reactor's support facilities. The reactor building, the river pumphouse and the reactor stack are the only facilities that remain.

Today and the future

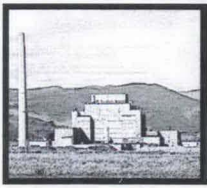
Today, the U.S. Department of Energy (DOE) Richland Operations Office offers escorted public access to B Reactor along a designated tour route. The National Park Service (NPS) is studying preservation and interpretation options for sites associated with the Manahattan Project. A draft is expected in summer 2009. A final report will recommend whether the B Reactor, along with other Manhattan Project facilities, should be preserved, and if so, what roles the DOE, the NPS and community partners will play in preservation and public education.



B Reactor operating in 1945



B Reactor today, looking west with Umtanum Ridge in the background



B REACTOR MANHATTAN PROJECT

HANFORD, WASHINGTON

In August 2008, the DOE announced plans to open B Reactor for additional public tours.

Potential hazards still exist within the building. However, the approved tour route is safe for visitors and workers.

DOE may open additional areas once it can assure public safety by mitigating hazards.

Ensuring a Safe Visit

- Follow the directions of your escort
- Stay with your escort on the designated tour route
- Do not reach across any posted radiological signs or barriers

B Reactor History

1942	December 28, President Franklin D. Roosevelt approves the Manhattan Project
1943	January, the government selects Hanford Engineer Works (Hanford Site) as the Manhattan Project's third top-secret location
	October, U.S. Army Corps of Engineers break ground to build B Reactor
1944	September 13, first uranium fuel slugs are loaded into B Reactor
	September 26, B Reactor operates for the first time
1945	February 3, B Reactor plutonium delivered to Los Alamos, New Mexico
	July 16, B Reactor plutonium used in world's first nuclear explosion at the Trinity Test in Alamogordo, New Mexico
	August 9, Fat Man bomb dropped on Nagasaki, Japan. The bomb contained B Reactor plutonium
	September 2, Japan officially surrenders and W.W.II comes to an end
1946	March 1946 - June 1948, B Reactor temporarily shutdown
1949	March, B Reactor begins irradiating lithium-aluminum slugs for tritium production
1952	November 1, B Reactor tritium used in world's first test detonation of a hydrogen bomb on Bikini Atoll in the South Pacific
1968	January 29, Atomic Energy Commission issues shutdown of B Reactor
	February 12, B Reactor permanently shutdown
1980	B Reactor declared excess property by U.S. Government
1999	B Reactor included in DOE's list of "Signature Properties of the Manhattan Project"
2001	August, Engineering Evaluation/Cost Analysis Action Memorandum signed by DOE and the U.S. Environmental Protection Agency provided for up to ten years of hazard mitigation and public access
2008	August, U.S. Department of the Interior names B Reactor a National Historic Landmark
	DOE announces expanded public access to begin in 2009

Specifications

- 40-feet deep, 46-feet wide, 46-feet high
- Core sits on a 23-foot thick concrete foundation
- Core and work area encased by 5-foot thick concrete walls
- 2,004 process tubes
- 32 fuel slugs per process tube
- 200 - 300 tons of uranium fuel slugs filled reactor
- 2,200 tons graphite for core
- Originally operated at 250 megawatts thermal
- Produced enough energy to heat 250,000 - 300,000 homes per year, but heat was not harnessed.
- Original cooling system: Treated river water entered core at 35,000 gpm; exited at 149 degrees Fahrenheit

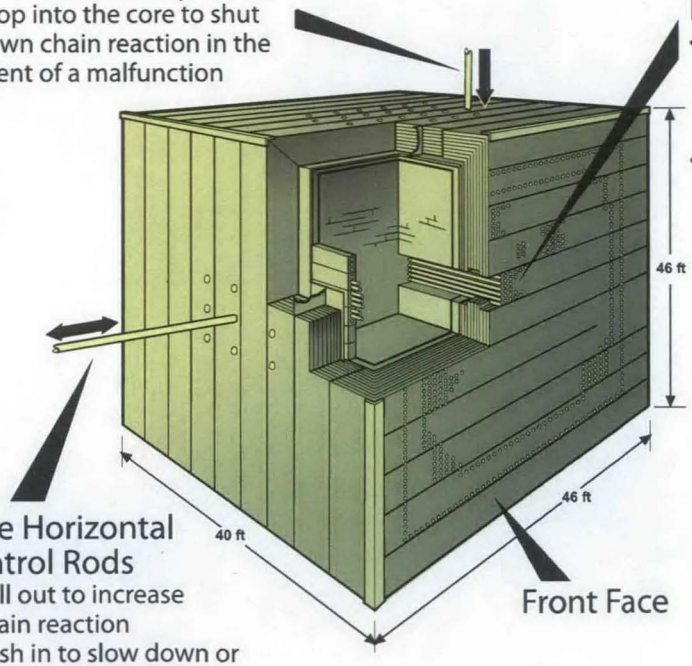
Reactor Block Details

29 Vertical Safety Rods

- Drop into the core to shut down chain reaction in the event of a malfunction

Process Tubes

- 2,004 process tubes penetrate the reactor front to rear
- Process tubes contain the uranium fuel and flowing cooling water



Nine Horizontal Control Rods

- Pull out to increase chain reaction
- Push in to slow down or shut down chain reaction

(A) Work Area

The work area faces the reactor core and provided the space needed to add fresh uranium fuel. Here, workers loaded 8.5-inch long by 1.5-inch diameter aluminum-clad uranium cylinders called slugs. The loading elevator ran across the reactor face and provided access to each row of process tubes for operation and maintenance. Fuel slugs were pushed out of the reactor rear face into a spent fuel storage basin as new fuel was added in front.

(B) Reactor Front Face

The front-face pipes held cooling water furnished from an original pair of 20-inch risers that were replaced by 36-inch risers in 1957. Water from the risers ran through 39 horizontal cross-headers into flexible process tubes and through couplings called pigtails.

(C) Reactor Control

Nine horizontal control rods on the left side of the reactor block were pulled out to increase the chain reaction, or inserted to slow down or shutdown the chain reaction. Twenty-nine vertical safety rods were suspended above the reactor from electromagnetic clutches. In the event of a malfunction, the rods would drop into the core and shutdown the chain reaction.

(D) Accumulators

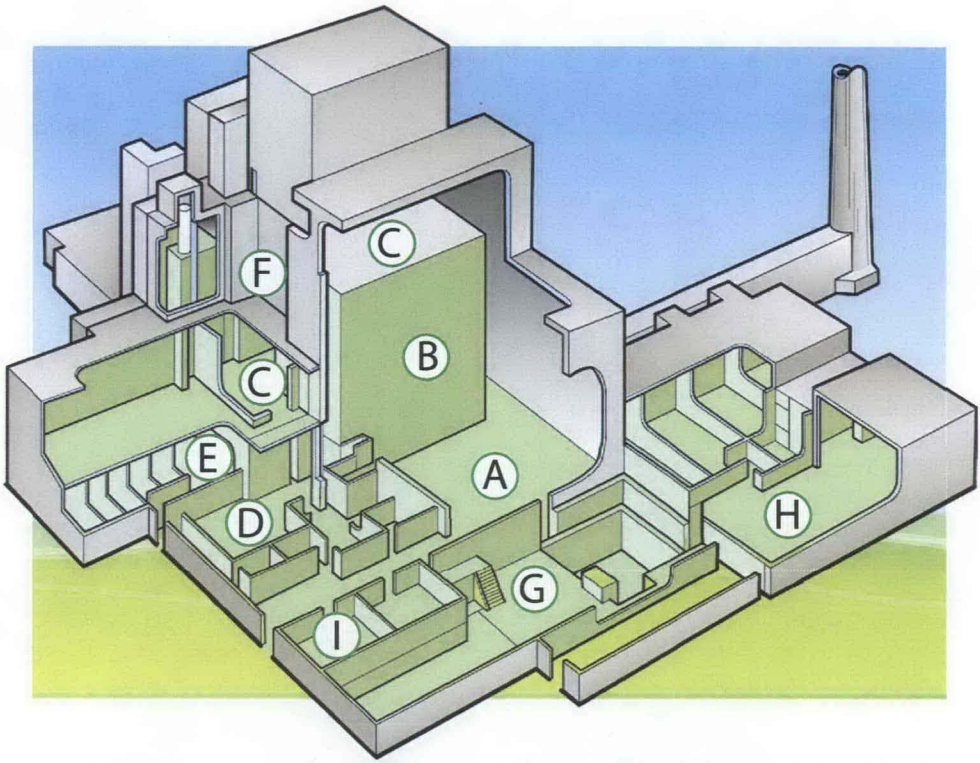
Three hydraulically-elevated tanks containing river rocks were suspended as a fail-safe backup in case of an electrical failure. The accumulators were locked into place when the reactor started. The tanks descended in a power failure while their hydraulic-pressure pushed seven control rods into the reactor, shutting down the chain reaction.

(E) Control Room

An operator monitored and controlled the reactor from the main control panel. The operator regulated the chain reaction by inserting or retracting one or more of the nine control rods and monitored various water-pressure gauges in each of the 2,004 process tubes.

(F) Fuel Basin Viewing Window

The fuel basin viewing window shows the wooden deck that suspended workers above a basin where irradiated fuel was stored in 20 feet of water. Spent fuel was stored in the basin for up to two months. The water shielded workers from radiation while the fuel cooled. Irradiated fuel slugs were



then moved to the fuel transfer bay and shipped by rail car to the 200 Areas where plutonium was extracted from the fuel.

(G) Valve Pit

The walkway looks down at the plumbing that supplied water to the reactor. By 1957, more than 70,000 gallons per minute (gpm) could be pumped through the reactor cooling system compared to the initial intake of 35,000 gpm. Several backup systems ensured cooling water would reach the reactor in an emergency.

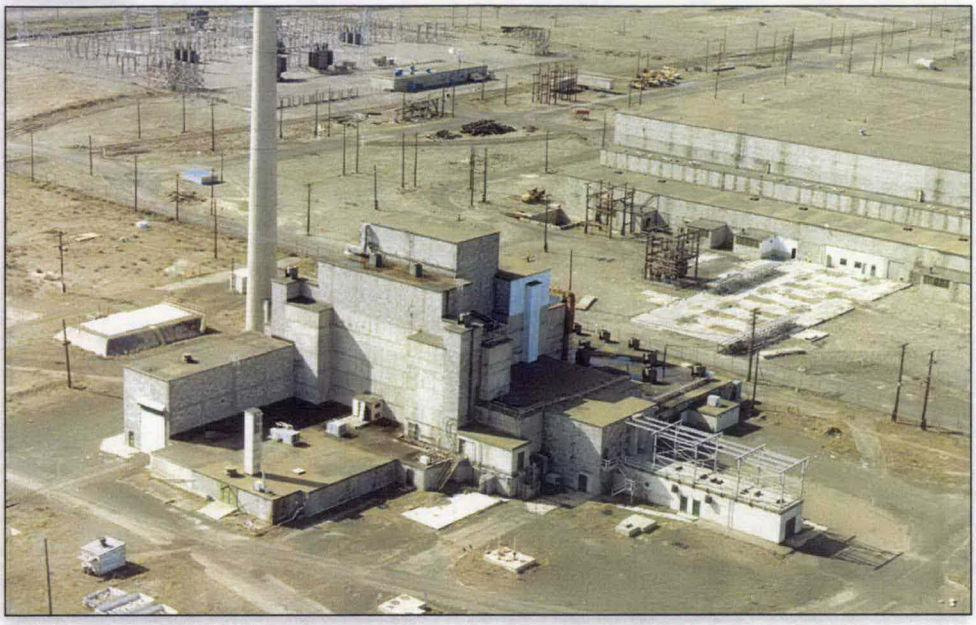
(H) Fan Rooms

The intake fan room supplied ventilation into B Reactor and allowed for pressurized zones. Air was released through a 200-foot stack at the building's south end.

(I) Instrument Shop

The room was originally used as a shop where B Reactor workers calibrated, fixed and maintained instruments. Currently, the room is used as a lunchroom for B Reactor staff.

Historical Recognition for B Reactor



Since the United States Bicentennial in 1976, Hanford's B Reactor has been recognized for its historical significance as one of the 20th Century's most important technological inventions.

1976 National Historic Mechanical Engineering Landmark
American Society of Mechanical Engineers

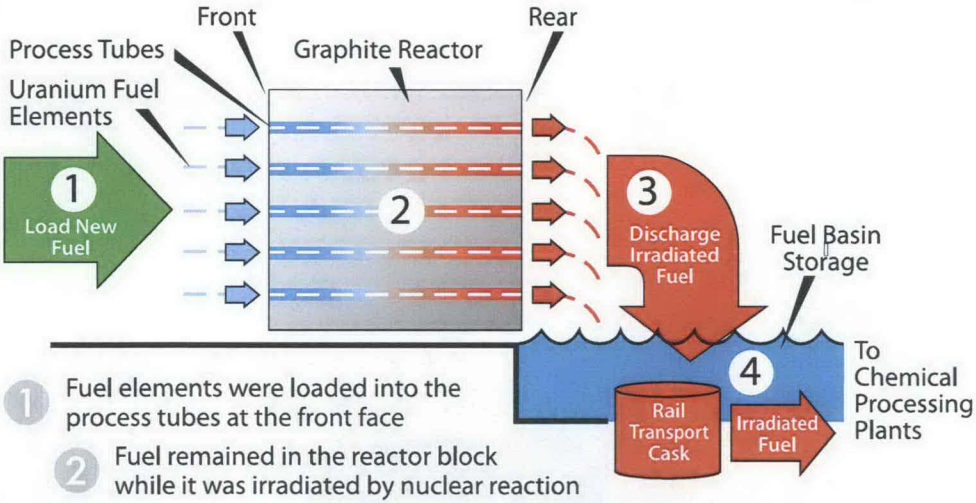
1992 National Register of Historic Places
National Park Service

1993 Nuclear Historic Landmark
American Nuclear Society

1994 National Civil Engineering Landmark
American Society of Civil Engineers

2008 National Historic Landmark
U.S. Department of the Interior, National Park Service

Simplified Reactor Operation



1. Fuel elements were loaded into the process tubes at the front face
2. Fuel remained in the reactor block while it was irradiated by nuclear reaction
3. Irradiated fuel was discharged from the rear face and stored in a water-filled basin
4. Fuel was transported in shielded casks to chemical processing plants in order to separate the plutonium

Control Room

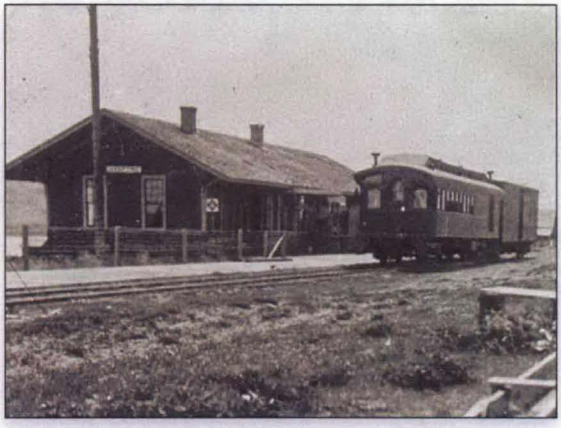
The world's first large-scale chain reaction was achieved from this room under the direction of Dr. Enrico Fermi a few minutes before midnight on September 26, 1944.

Before B Reactor

First settlers

Sahaptin-speaking Native Americans occupied the Hanford area for several thousand years before European-Americans settled southeastern Washington.

Agriculture



Hanford, Washington, circa 1915

The Europeon-American resettlement of the Hanford area transformed the region into farmland dependent upon irrigation. While Native Americans used the Columbia River's fish resources as a mainstay of their economy, the small communities of Hanford, White Bluffs and Richland used the lands for grazing, farming and mining until the Hanford Site was created in 1943.

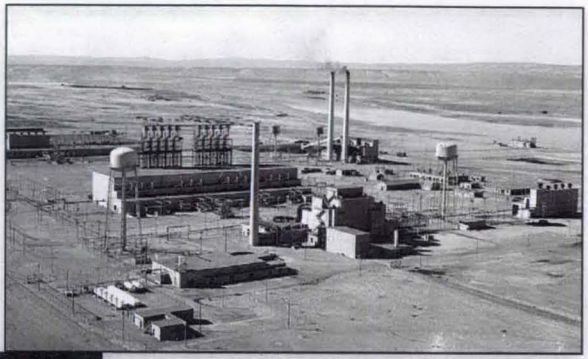
Notes :

Our Legacy

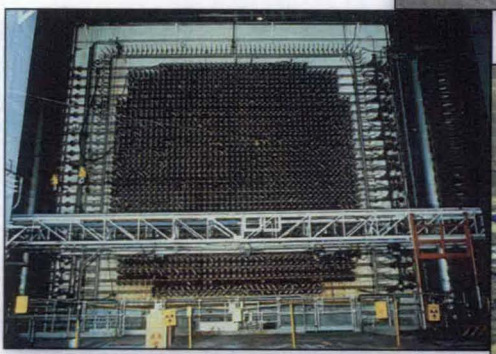
National Historic Landmark designation is the highest distinction for a historic property in the United States. Among other U.S. National Historic Landmarks are:

- The White House
- The U.S. Capitol
- The Alamo
- Fort Ticonderoga
- Lexington Green
- Mount Vernon
- The U.S.S. Arizona
- Monticello

and others.



B Reactor Area, 1950's



Front face of B Reactor

B Reactor Area, 1960's

B Reactor, 1983

Visitors enjoy B Reactor, 2005

For more information about B Reactor access these internet locations

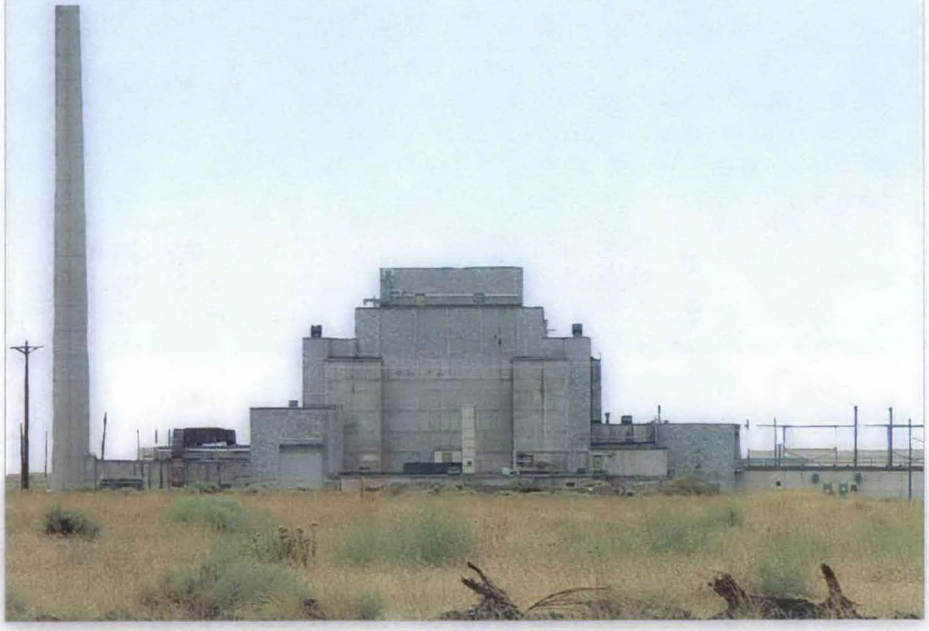
DOE Richland Operations Office
www.hanford.gov

Hanford Site Historic District
www.hanford.gov/docs/rl-97-1047

Tri-Cities Development Council
(TRIDEC)
www.tridec.org

Hanford Reach Interpretive Center
www.visitthereach.org

To arrange a B Reactor tour, visit:
www.hanford.gov/tours/index.cfm



April 2009