Consisting of a 28- by 36-foot, 1,200-ton graphite cylinder lying on its side, the reactor was penetrated through its entire length horizontally by 2,004 aluminum tubes. Two hundred tons of uranium slugs the size of rolls of quarters and sealed in aluminum cans went into the tubes. Cooling water from the Columbia River, which first had to be treated, was pumped through the aluminum tubes around the uranium slugs at the rate of 75,000 gallons per minute. Water consumption approached that of a city of a third-of-a-million people.

Plutonium was produced in the Hanford reactors when a uranium-238 atom in a fuel slug absorbed a neutron to form uranium-239. U-239 rapidly undergoes beta decay to form neptunium-239, which rapidly undergoes a second beta decay to form plutonium-239.

Only about one atom in every 4,000 within the uranium slugs was converted to plutonium in the three Hanford production reactors, and these atoms had to be separated from the remaining uranium and other fission products that had been created.

The highly radioactive uranium slugs were dropped into water pools behind the piles and then moved by remote-controlled rail cars to a storage facility five miles away. When short-lived radioactivity had sufficiently decayed, the slugs were transported by rail to one of the two chemical separation facilities, either T Plant or B Plant. The chemical separation buildings are massive canyon-like structures, 800 feet long, 65 feet wide, and 80 feet high, nicknamed "Queen Marys" because of their size and shape. Inside, a row of forty concrete cells, most of them about fifteen feet square and twenty feet deep, ran the length of the building. Each cell was separated by six feet of concrete and was covered by removable concrete blocks six feet thick and weighing thirty-five tons.

The slugs were dissolved at the start of the process and bismuth phosphate carried the plutonium through the long succession of process pools in the so-called PUREX process.

Process for the reprocessing of spent nuclear fuel to separate uranium and plutonium from the fission products and from one another. Following the dissolution of the irradiated fuel in aqueous nitric acid, uranium and plutonium are transferred to an organic phase by intensive mixing with an organic solvent extraction – 30 percent tributyl phosphate (TBP) in kerosene is used as organic solvent – while the fission products remain in the aqueous nitric phase. Further process steps enable the subsequent separation of uranium and plutonium from one another.

The entire area above the cells was enclosed by a single gallery sixty feet high and running the length of the building. Radiation levels in the gallery, or canyon, were too high to permit access by unprotected personnel. Along one side of the cell row and separated from it by seven feet of concrete were the operating galleries on three levels, the lowest for electrical controls, the intermediate for piping and remote lubrication equipment, and the upper for operating control boards that included specially designed periscopes and closed-circuit television sets. Due to the high radiation levels, the canyons were virtually inaccessible and had to be repaired by remote control or, when radiation levels were low enough, by personnel wearing full radiation protection gear. T Plant ceased chemical separation in 1956 but continues to be used for other activities.





