The Hanford story began early in 1943 when residents of a sparsely populated area of Eastern Washington were evacuated and the Manhattan Project moved in. Its mission: to produce plutonium for a new weapon that promised to bring a swift end to World War II.

The Hanford Site was chosen for its remote location, the Columbia River's abundant flow for cooling nuclear reactors, and ample electricity from the recently completed Grand Coulee Dam. By September 1944, the first nuclear reactor was running at Hanford. The world's first atomic blast, the Trinity Test at Alamogordo, New Mexico, in July 1945, used Hanford plutonium. A few weeks later, another plutonium bomb was exploded over Nagasaki, Japan, ending World War II.

Hanford then played a key role in the Cold War. By 1964, nine reactors were operating at Hanford. Plutonium production wound down in the late 1960s and 1970s as the U.S. pursued détente with the Soviet Union. It underwent a resurgence during the Reagan Administration and then halted with the fall of the Iron Curtain in 1989. But the un-precedented job of cleaning up the nuclear waste from nearly 50 years of weapons production remains.

Cold War-era tank farm construction at Hanford

A complex problem

The 50-mile stretch of the Columbia River known as the Hanford Reach is the last free-flowing section of the river in the U.S. This natural wonder is now a National Monument.

A few miles west of the river, there remains a deadly legacy of the Cold War: 53 million gallons of radioactive and chemical wastes stored in 177 underground tanks. At least a million gallons of radioactive waste has leaked from 67 of Hanford's tanks and is contaminating the groundwater, threatening the Columbia River and millions of people downstream.

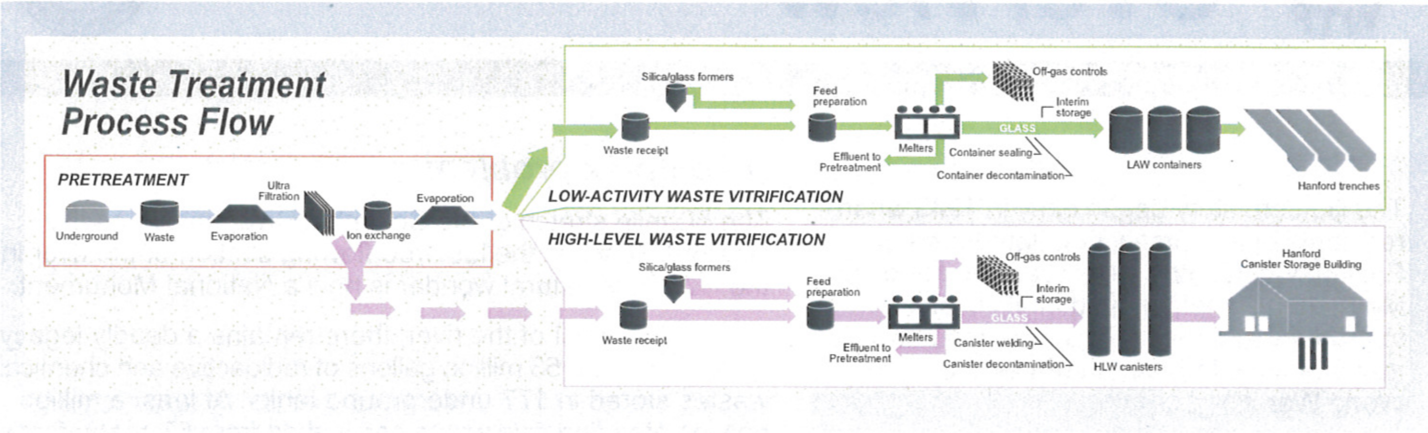
Turning most of this waste into a sturdy glass, a process known as vitrification, is an unprecedented engineering and construction challenge.

A permanent solution

To meet this challenge, the Department of Energy awarded Bechtel National, Inc. a contract in December 2000 to design and construct the world's largest radioactive waste treatment plant.

Bechtel National, Inc. is designing and building the Waste Treatment Plant to vitrify Hanford's tank waste by blending it with molten glass and placing it in stainless steel canisters. The waste will remain stable and impervious to the environment while its radioactivity dissipates over hundreds to thousands of years. Vitrification is a waste stabilization method that has been proven in Europe and in the U.S. at DOE sites.

The Waste Treatment Plant will cover 65 acres with three major nuclear facilities – Pretreatment, Low-Activity Waste Vitrification and High-Level Waste Vitrification – as well as a large Analytical Lab, operations and maintenance buildings, utilities and office space. Site preparation began in October 2001, and the concrete for the first nuclear facility's foundation was placed in July 2002. The Vit Plant is scheduled to be completed and commissioned by November 2019.



Pretreatment

The first treatment step in the waste treatment process is pumping the waste from the underground storage tanks through a buried pipeline to the Pretreatment Facility. Pretreatment separates the low-activity radioactive waste from the high-level radioactive waste.

Low-activity waste is the liquid portion of the tank waste. It contains a relatively small amount of radioactivity in a large volume of material.

High-level waste is primarily in the solids of the tank waste. It contains most of the radioactivity in a relatively small volume of material.

HLW and LAW stainless steel canisters

During pretreatment, the waste is concentrated by removing water in an evaporator. Solids are filtered out, and remaining soluble highly radioactive isotopes are removed by ion exchange units.

Low-Activity Waste Vitrification

The pretreated wastes go to separate Low-Activity Waste and High-Level Waste Vitrification Facilities. Handling the wastes separately speeds treatment because high volumes of low-activity waste can be processed faster than the high-level waste.

The waste goes into a melter preparation vessel where silica and other glass-forming materials are added and the mixture is fed into one of two melters. The mixture is heated to 2,100 degrees Fahrenheit by passing electricity through it, a process known as joule heating. The molten mixture is then poured into large stainless steel containers.

The filled low-activity waste containers are four feet in diameter, seven feet tall and weigh more than seven tons. The containers will be stored at Hanford in permitted trenches covered with soil.

High-Level Waste Vitrification

High-level waste from the Pretreatment Facility is mixed with glass-forming materials and vitrified in two melters of similar design to the low-activity waste melters.

High-level vitrified waste is poured into stainless steel canisters that are two feet in diameter and about 14 feet tall. The filled high-level waste canisters, each weighing more than four tons, will be temporarily stored at Hanford. Eventually, the high-level waste containers will be shipped to a federal geological repository deep underground for permanent disposal.

High-Level Waste (HLW) Vitrification Facility

Waste Treatment Plant Project www.bechtelvitplant.com

Overview

A few miles west of the Columbia River, 53 million gallons of radioactive and chemical waste is stored in 177 underground tanks, a deadly legacy of the Cold War era. An estimated one million gallons of this waste has leaked from at least 67 of the tanks, threatening the Columbia River and millions of residents downstream.

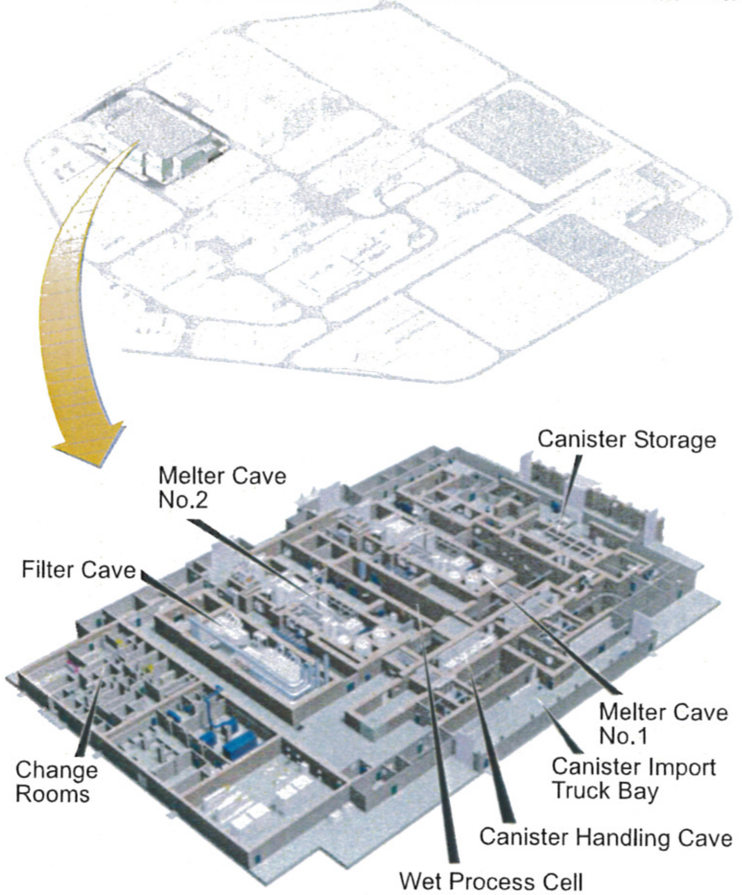
Bechtel National, Inc. is designing and building a Waste Treatment Plant to vitrify Hanford's tank waste. Vitrification is a process of blending the tank waste with molten glass and placing the product in stainless steel canisters. The waste will become stable and impervious to the environment while its radioactivity dissipates over hundreds to thousands of years.

High-Level Waste Vitrification Facility

The High-Level Waste Facility immobilizes high-level radioactive waste in a glass matrix for long-term storage. The facility will house two 90-ton melters that will vitrify the most radioactive waste from Hanford's tanks by combining it with glass forming agents and heating the mixture to 2,100 degrees Fahrenheit. The vitrified waste is poured into stainless steel canisters that are approximately two feet in diameter, 14.5 feet tall and weigh more than four tons. The canisters will be temporarily stored at Hanford's 200 Area Canister Storage Building. Eventually, the canisters will be shipped to a federal geological repository at Yucca Mountain in Nevada for permanent disposal.

In full operation, the HLW facility will annually produce an average of 480 canisters.

The High-Level Waste Facility building is three football fields wide, one football field long and six stories tall.



High-Level Waste Vitrification Building
(Plan at Elevation 0'-0")

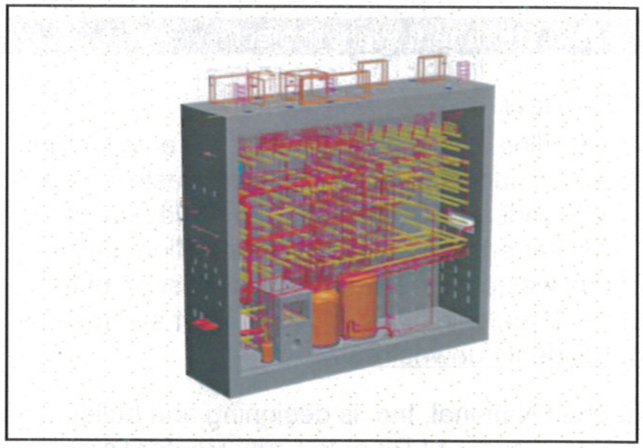
High-Level Waste Construction

- **Building Volume:** 8,600,000 cubic feet
- **Concrete:** 87,632 cubic yards
- **Structural Steel:** 9,695 tons
- **Heating and Ventilation Ductwork:** 1,141,773 pounds (571 tons)
- **Piping:** 164,459 feet (31 miles)
- **Electrical Raceway:** 261,507 feet (50 miles)
- **Electrical Cable:** 1,595,078 feet (302 miles)
- **Craft Hours to Build:** 5,200,000 hours
- **Building Size:** 275 feet by 440 feet by 95 feet tall (21 feet below ground level)
- **Plant Output:** Two melters producing 6.6 tons of glass daily

A closer look inside the High-Level Waste Facility

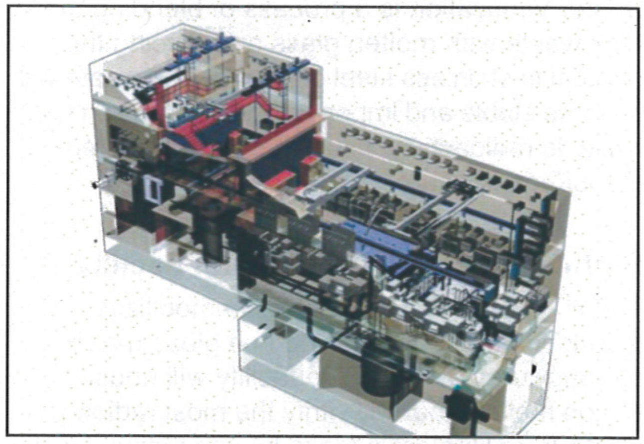
The wet cell

High-level waste arrives from the Pretreatment Facility in the wet cell. The cell rests inside a facility black-cell area, behind steel-laced, high-strength concrete walls, and is inaccessible to workers. Once inside the HLW Facility, the pretreated waste is transferred through shielded pipes into a series of melter preparation and feed vessels before reaching the melters. Liquids from various facility processes also return to the wet cell for interim storage before recycling back to the Pretreatment Facility.



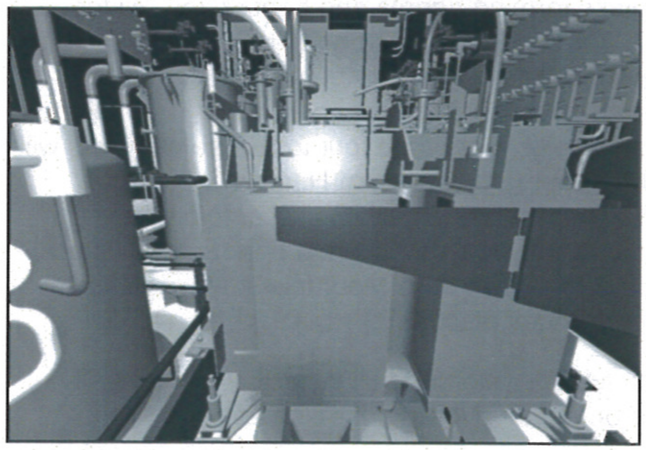
The melter cell

The facility contains two identical, remotely-operated melter caves. Due to potential high levels of radioactivity in the caves, all operations and maintenance activities are performed using remote-handled large overhead cranes and manipulators. Each cave contains a series of complex utilities to support two high-level waste vitrification melters. The melters are supported by offgas cleaning systems that include a submerged bed scrubber vessel and two high-efficiency mist eliminators.



Production and operations

Two identical 90-ton melters, each 14 feet x 14 feet and 11 feet high, will produce a sturdy glass product that consists of about 30 percent waste and 70 percent additives. The facility will annually produce an average of 480 canisters.



July 2008

Low-Activity Waste (LAW) Vitrification Facility

Waste Treatment Plant Project www.bechtelvitplant.com

Overview

A few miles west of the Columbia River, 53 million gallons of radioactive and chemical waste is stored in 177 underground tanks, a deadly legacy of the Cold War era. An estimated one million gallons of this waste has leaked from at least 67 of the tanks, threatening the Columbia River and millions of residents downstream.

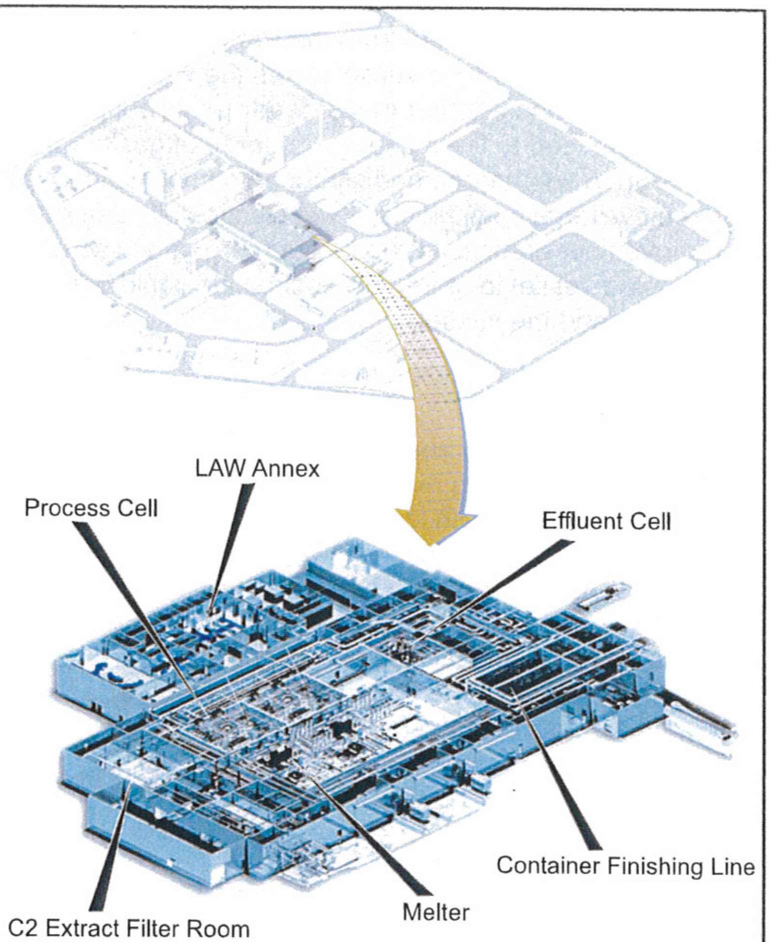
Bechtel National, Inc. is designing and building a Waste Treatment Plant to vitrify Hanford's tank waste. Vitrification is a process of blending the tank waste with molten glass and placing the product in stainless steel canisters. The waste will become stable and impervious to the environment while its radioactivity dissipates over hundreds to thousands of years.

Low-Activity Waste Vitrification Facility

The Low-Activity Waste Vitrification Facility will turn low-activity radioactive and chemical waste into a glass product that will be permanently stored at Hanford.

Concentrated low-activity waste will be transferred from the Pretreatment Facility to the LAW Facility where it will be mixed with silica and other glass-forming materials. The mixture will be fed into the LAW's two melters and heated to 2,100 degrees Fahrenheit. The 200-ton melters are approximately 20 x 30 feet and 16 feet high. The molten waste/glass mixture will be poured into stainless steel containers, each four feet in diameter, seven feet tall and weighing more than seven tons. The containers will be stored at Hanford in permitted trenches and covered with soil.

The LAW Facility is one football field long, one-and-a-half football fields wide and seven stories tall.



Low-Activity Waste Vitrification Building
(Plan at Elevation 3'-0")

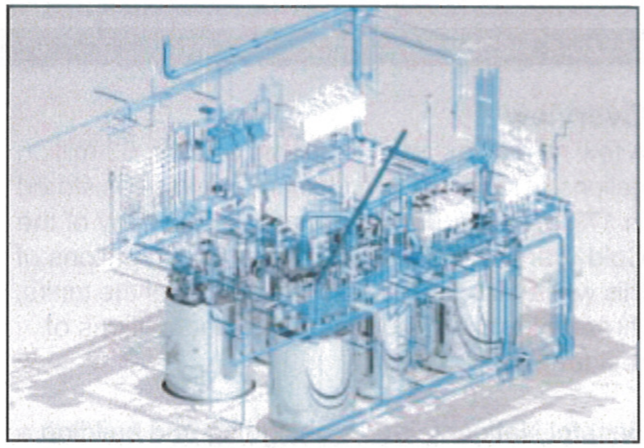
Low-Activity Waste Construction

- **Building Volume:** 6,500,000 cubic feet
- **Concrete:** 28,589 cubic yards
- **Structural Steel:** 6,239 tons
- **Heating and Ventilation Ductwork:** 945,595 pounds (473 tons)
- **Piping:** 107,309 feet (20 miles)
- **Electrical Raceway:** 109,243 feet (21 miles)
- **Electrical Cable:** 799,380 feet (151 miles)
- **Craft Hours to Build:** 2,454,000 hours
- **Building Size:** 240 feet by 330 feet by 90 feet tall (building 21 feet below ground level)
- **Plant Output:** Two melters producing 30 tons of glass daily

A closer look inside the Low-Activity Waste Facility

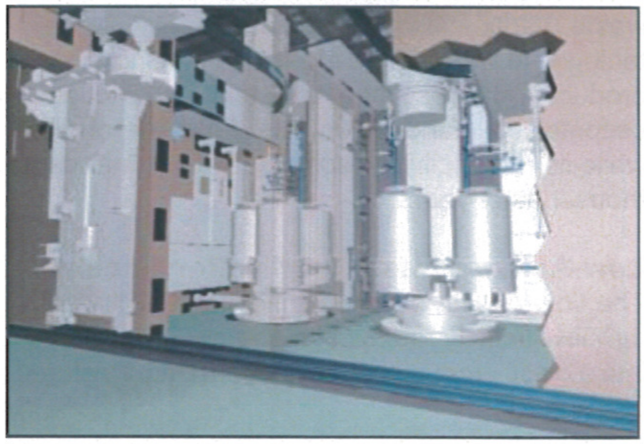
Process cell

The process cell consists of six large stainless steel vessels: three for feeding waste to two low-activity waste melters and three for treating the melters' offgas. The concentrate receipt vessel receives waste feed from the Pretreatment Facility; a melter feed preparation vessel mixes the waste feed with glass formers; and another melter feed vessel supplies the mixed waste feed to the melters. The three offgas treatment vessels are a submerged bed scrubber to cool melter offgas and remove large particulates, a wet electrostatic precipitator to remove finer particulate, and a submerged bed scrubber condensate vessel to store and re-circulate liquid between a scrubber and the vessel.



Pour cave turntables and elevators

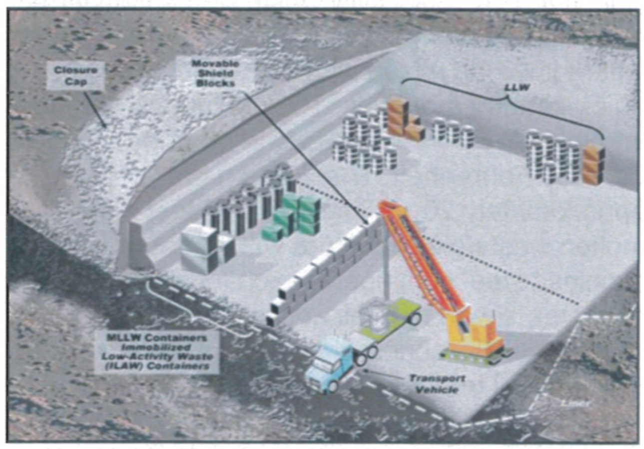
Each low-activity waste melter has two pour spouts leading down to a pour cave with two turntables and elevators. Each turntable has positions for three low-activity waste containers. An elevator raises a container under the melter pour spout. Once filled with glass, the container is lowered to the turntable and rotated to the second position to cool. The third position is for removal of the filled, cooled container and replacement with a new empty container.

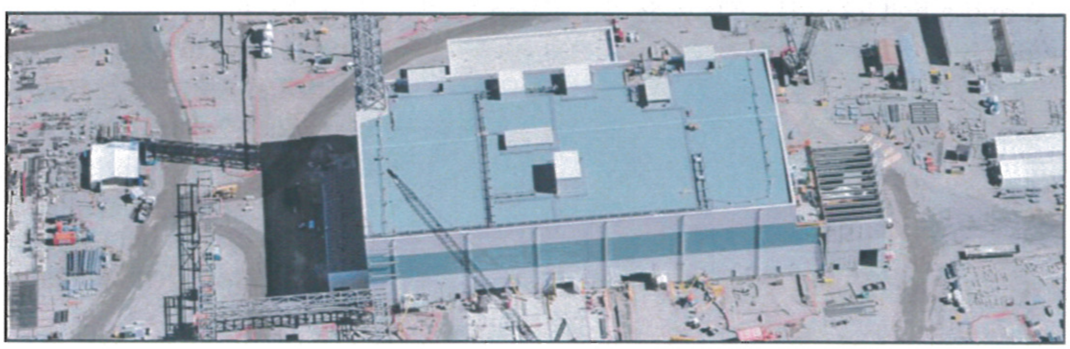


Production and operations

The Low-Activity Waste Facility will contain two identical melters that will produce a sturdy glass product consisting of about 20 percent waste and 80 percent additives.

The facility will annually produce approximately 1,100 containers.





Pretreatment (PT) Facility

Overview

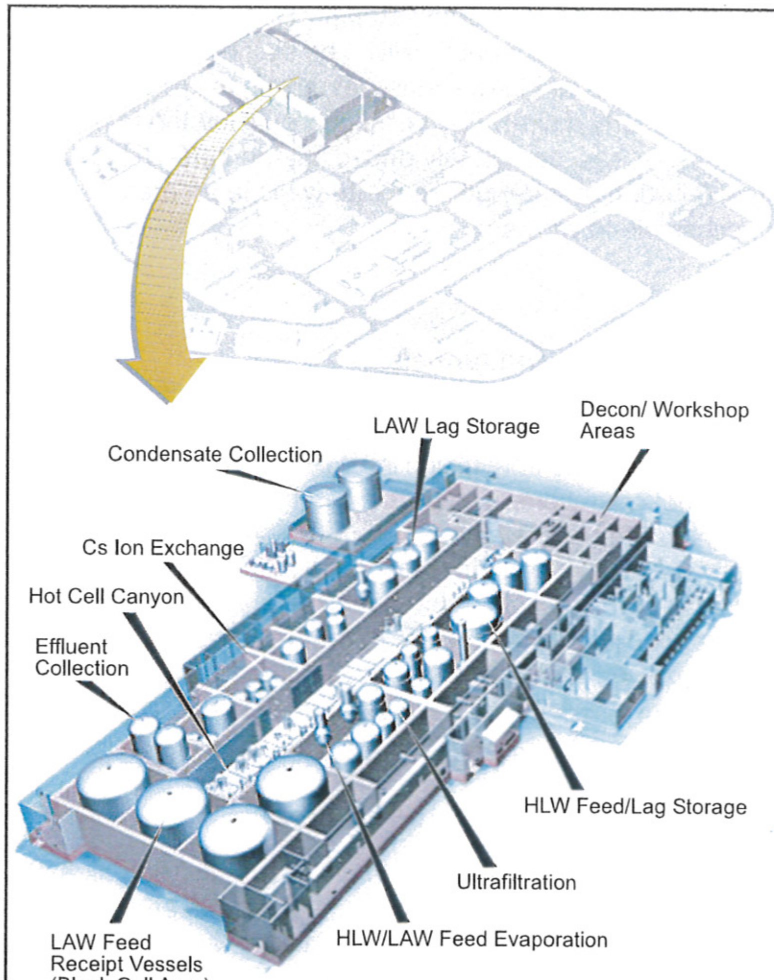
A few miles west of the Columbia River, 53 million gallons of radioactive and chemical waste is stored in 177 underground tanks, a deadly legacy of the Cold War era. An estimated one million gallons of this waste has leaked from at least 67 of the tanks, threatening the Columbia River and millions of residents downstream.

Bechtel National, Inc. is designing and building a Waste Treatment Plant to vitrify Hanford's tank waste. Vitrification is a process of blending the tank waste with molten glass and placing the product in stainless steel canisters. The waste will become stable and impervious to the environment while its radioactivity dissipates over hundreds to thousands of years.

Pretreatment Facility

The Pretreatment Facility is the first step in the process of vitrifying Hanford's tank waste. The Pretreatment Facility is the largest of the four nuclear facilities and is approximately one and one-half football fields in length, and more than one field in width. It is 12 stories tall and has 490,000 square feet of total area.

The radioactive waste is pumped from the tanks to the Pretreatment Facility's interior waste feed receipt vessels. During the first stage of pretreatment, the waste is concentrated by removing water in an evaporation process. Solids are filtered out and the remaining soluble, highly radioactive isotopes are removed by an ion exchange process. The facility's main elevation houses a 406-foot-long hot cell. The hot cell contains cesium ion exchange columns, ultra filtration equipment, evaporator reboilers, evaporator recirculation pumps and various mechanical process pumps for transferring process fluids to other tanks for processing. Hot cell process equipment connects to tanks and other equipment by a series of "jumpers"–remotely removable items for fluids, gases and electricity. The solids are sent to the High-Level Waste Vitrification Facility, while the remaining liquids are sent to the Low-Activity Waste Vitrification Facility.

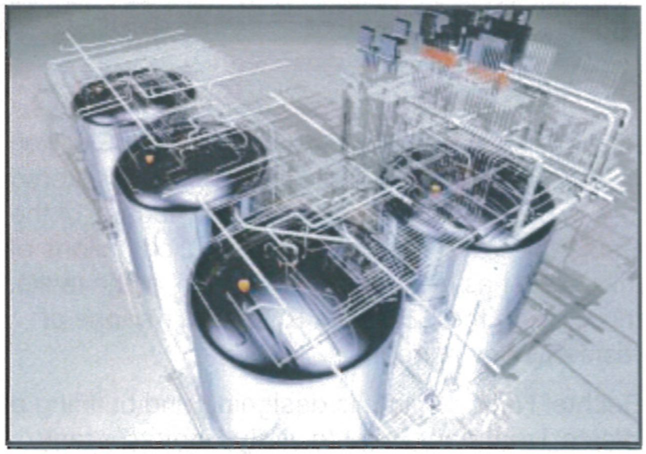


Pretreatment Building
(Plan at Elevation 0'-0")

Pretreatment Construction

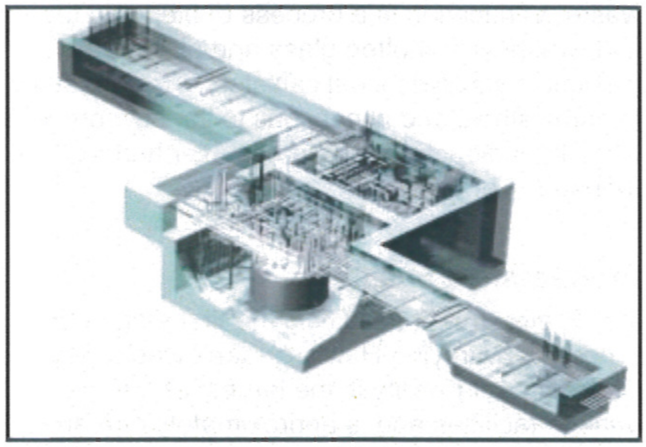
- **Building Volume:** 13,900,000 cubic feet
- **Concrete:** 113,475 cubic yards
- **Structural Steel:** 16,835 tons
- **Heating and Ventilation Ductwork:** 1,782,214 pounds (891 tons)
- **Piping:** 538,467 linear feet (102 miles)
- **Electrical Raceway:** 322,765 feet (61 miles)
- **Electrical Cable:** 1,477,726 feet (280 miles)
- **Tanks:** 51 major vessels, approx. 4 million gallons capacity
- **Craft Hours to Build:** 8,300,000 hours
- **Building Size:** 215 feet by 540 feet by 120 feet tall (building primarily at ground level)
- **Plant Output:** 12,000-gallon waste receiving and treating capacity

A closer look inside the Pretreatment Facility



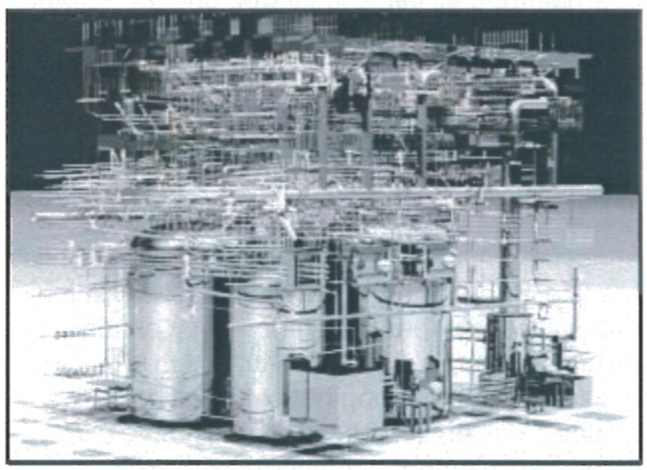
Waste feed receipt vessels

Four waste feed receipt vessels, each with a 375,000-gallon holding capacity, are the first stop for Hanford's tank waste entering the Pretreatment Facility. The stainless steel vessels contain a series of internal pulse jet mixers to keep incoming waste properly mixed. The vessels are inside the facility's black cell areas, completely encapsulated behind thick steel-laced, high-strength concrete walls in an area inaccessible to workers.



45-foot-deep pit and tunnels

A 45-foot-deep pit and adjoining tunnels lie at the center of the Pretreatment Facility. The pit is a collection point for any potential overflows from piping inside the underground tunnels during hot operations. The pit is a combination of steel-laced, high-strength concrete lined with 1/8-inch stainless steel. The pit is also a secondary overflow unit for two 60-ton stainless steel vessels at the bottom of the pit. One vessel collects overflow from the Pretreatment Facility's primary storage tanks; the other vessel collects liquids from the High-Level Waste Facility and Analytical Laboratory drains.



Piping module assembly

The Pretreatment Facility includes more than 100 miles of piping. Several on-the-ground piping modules are being fabricated while civil construction activities and vessel installations continue inside the building. The piping modules are an intricate assembly of piping spools and hangers attached to structural steel beams that will be placed inside the facility. The modules are being constructed on the ground to ensure worker safety and high quality standards.

July 2008

Analytical Laboratory (LAB)

Waste Treatment Plant Project www.bechtelvitplant.com

Overview

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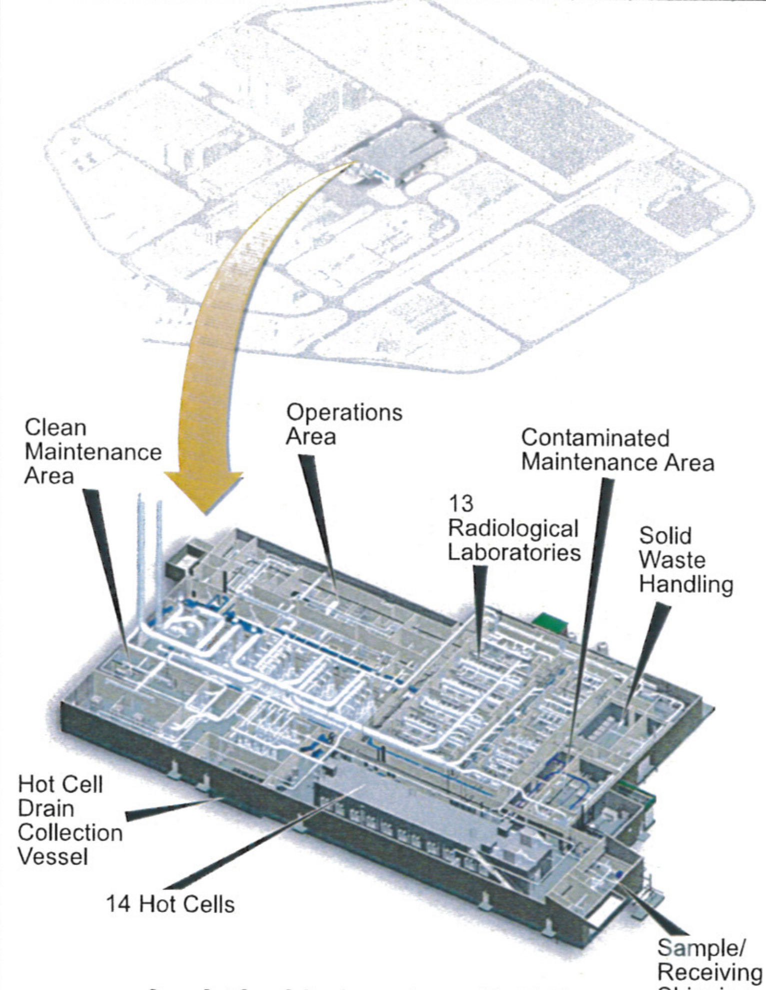
Bechtel National, Inc. is designing and building a Waste Treatment Plant to vitrify Hanford's tank waste. Vitrification is a process of blending the tank waste with molten glass and placing the product in stainless steel canisters. The waste will become stable and impervious to the environment while its radioactivity dissipates over hundreds to thousands of years.

Analytical Laboratory

The Analytical Laboratory is the vital link that brings the waste vitrification process together. The Laboratory is a process link between the Pretreatment, High-Level Waste Vitrification and Low-Activity Waste Vitrification facilities. Its key function is to ensure that the final glass product meets all regulatory requirements and standards.

The Laboratory will annually analyze 10,000 waste samples. Initial samples identify the correct glass former "recipe" to produce a consistent glass form. Once the recipe is identified, the glass formers and the waste are delivered to the high-level waste and low-activity waste feed preparation vessels where they are mixed together and then fed into melters. Additional waste samples ensure good process controls and a high quality product.



Analytical Laboratory Building
(Plan at Elevation 0'-0")

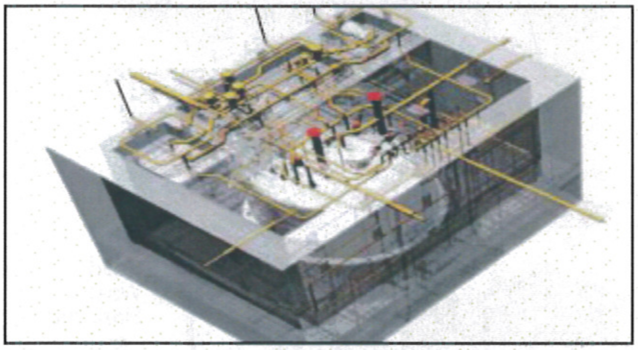
Laboratory Construction

- **Building Volume:** 2,592,000 cubic feet
- **Concrete:** 12,184 cubic yards
- **Structural Steel:** 1,777 tons
- **Heating and Ventilation Ductwork:** 314,499 pounds (157 tons)
- **Piping:** 35,749 feet (7 miles)
- **Electrical Raceway:** 54,121 feet (10 miles)
- **Electrical Cable:** 172,434 feet (33 miles)
- **Craft Hours to Build:** 670,000 hours
- **Building Size:** 320 feet by 180 feet by 45 feet tall

A closer look inside the Analytical Laboratory

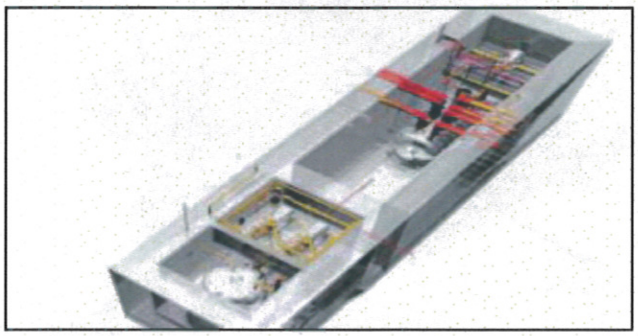
Environmental emissions stack assembly

The 68-foot stack assembly will exhaust emissions from the Laboratory's ventilation systems, filtering radioactive and chemical contaminants from the air to ensure it meets strict regulations. Made of structural steel, the assembly contains three environmental emission stacks and weighs approximately 140,000 pounds with a base that measures 16 feet by 20 feet. The assembly sits atop the Laboratory, making the Laboratory more than 119 feet tall.



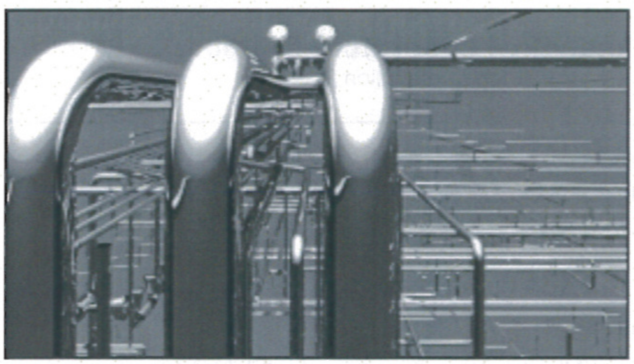
Hot cell drain collection vessel

The underground hot cell collection vessel is a collection, containment, staging, transfer and secondary containment area for waste streams from the analytical services. The vessel contents are recycled to the Pretreatment Facility.



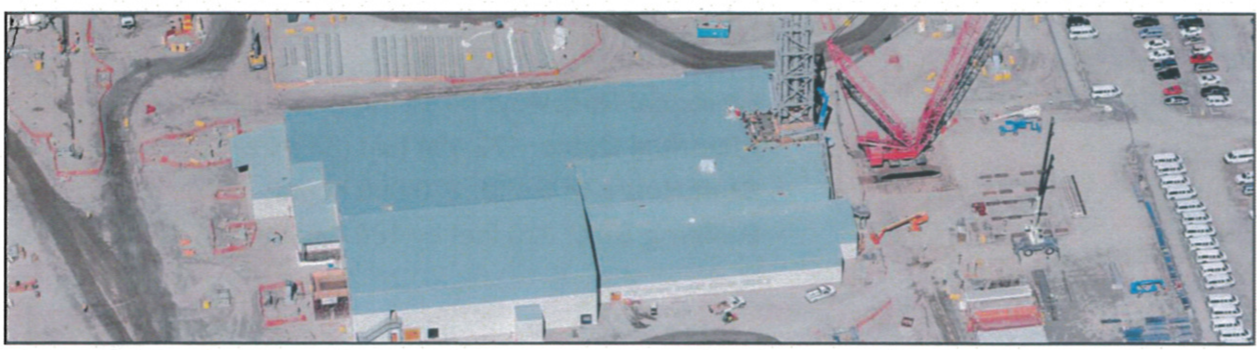
Drain collection vessels cell and fire water vault

The floor and sink drain collection vessel also collects water overflow in the event of a fire. The area includes radioactive liquid discharge pumps, ventilation systems and specialized exhaust systems to prevent potential cross-contamination among areas.



Above ground and embedded foundation piping

The Laboratory contains piping for drainage and waste transfer. Piping may be above ground; within underground cells and vaults; or embedded in the thick concrete foundation. All process piping is nuclear-grade stainless steel or Hastelloy and is installed to exacting specifications using the most advanced welding and installation techniques.



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