

**State of Washington  
Department of Ecology  
Criteria Pollutants and  
Toxic Air Pollutants  
Phase I Notice of Construction for  
the Hanford Site Spent Nuclear  
Fuel Project--Hot Conditioning  
System Annex, Project W-484**

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**United States  
Department of Energy**

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LIST OF TERMS

CSB	Canister Storage Building
CVD	Cold vacuum drying
CVDF	Cold Vacuum Drying Facility
DOE/RL	U.S. Department of Energy, Richland Operations
Ecology	State of Washington Department of Ecology
EIS	Environmental Impact Statement
HCS	Hot conditioning system
HCSA	Hot Conditioning System Annex
HCSE	Hot conditioning system equipment
HEPA	High-efficiency particulate air
HWVP	Hanford Waste Vitrification Plant
MCO	Multi-canister overpack
NOC	Notice of construction
PUREX	Plutonium-Uranium Extraction
SEPA	(Washington) State Environmental Policy Act of 1971
SNF	Spent nuclear fuel
WAC	Washington Administrative Code

**CRITERIA POLLUTANTS AND TOXIC AIR POLLUTANTS  
WASHINGTON STATE DEPARTMENT OF ECOLOGY  
PHASE I NOTICE OF CONSTRUCTION FOR  
THE HANFORD SITE SPENT NUCLEAR FUEL PROJECT--  
HOT CONDITIONING SYSTEM ANNEX, PROJECT W-484**

**1.0 INTRODUCTION**

This notice of construction (NOC) provides information regarding the source and the air toxic and criteria pollutants resulting from operation of the Hot Conditioning System Annex (HCSA). Additional details on emissions generated by the operation of the HCSA will be discussed again in the Phase II NOC. This Phase I NOC is defined as, constructing the substructure, including but not limited to pouring the concrete for the floor; construction of the process pits and exterior walls; making necessary interface connections to the Canister Storage Building (CSB) ventilation and utility systems for personnel comfort; and extending the multi-canister overpack (MCO) handling machine rails into the HCSA. A Phase II NOC, will be submitted for approval prior to installing and is defined as the completion of the HCSA, which will consist of installation of the Hot Conditioning System Equipment (HCSE), air emissions control equipment, and emissions monitoring equipment.

About 80 percent of the U.S. Department of Energy's spent nuclear fuel (SNF) inventory is stored under water in the Hanford Site K Basins. Spent nuclear fuel in the K West Basin is contained in closed canisters, while the SNF in the K East Basin is contained in open canisters, which allow free release of corrosion products to the K East Basin water. Storage in the K Basins was originally intended to be on an as-needed basis to sustain operation of the N Reactor while the Plutonium-Uranium Extraction (PUREX) Plant was refurbished and restarted. The decision in December 1992 to deactivate the PUREX Plant left approximately 2,300 MT (2,530 tons) of N Reactor SNF in the K Basins with no means for near-term removal and processing.

The HCSA will be constructed as an addition to the CSB and will contain the HCSE. The hot conditioning system (HCS) will remove chemically-bound water and will passivate the exposed uranium surfaces associated with the SNF. The HCSA will house seven hot conditioning process stations, six operational and one auxiliary pit which could be used as a welding area for final sealing of the vessel containing the SNF, or for neutron interrogation of the vessel containing the SNF to determine residual water content. Figures 1 and 2 contain map locations of the Hanford Site and the HCSA.

Figure 1. Hanford Site Map.

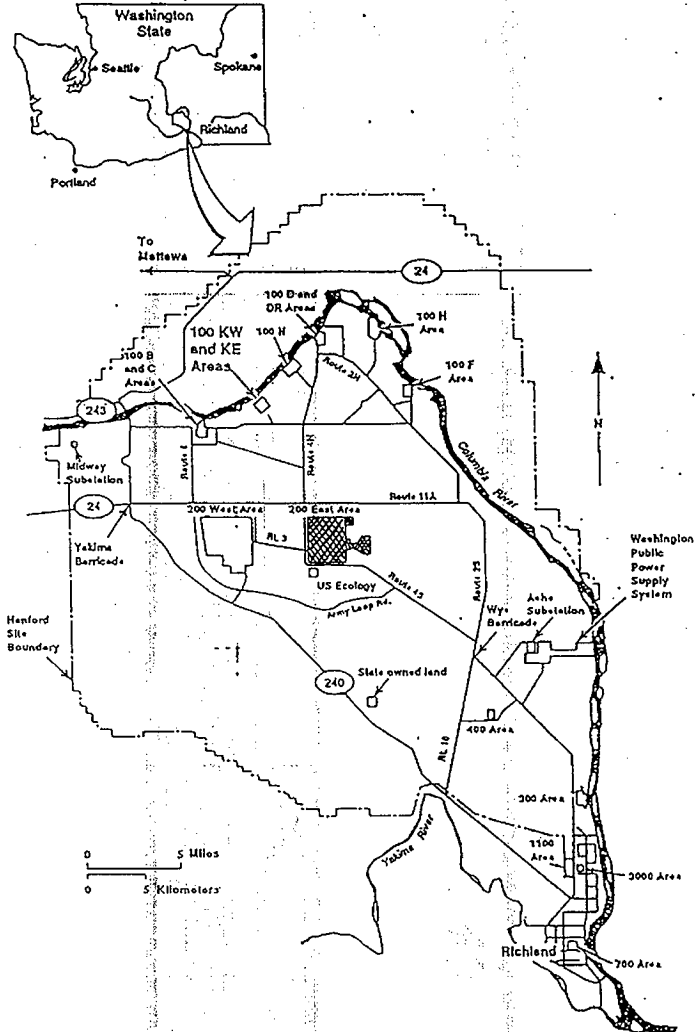
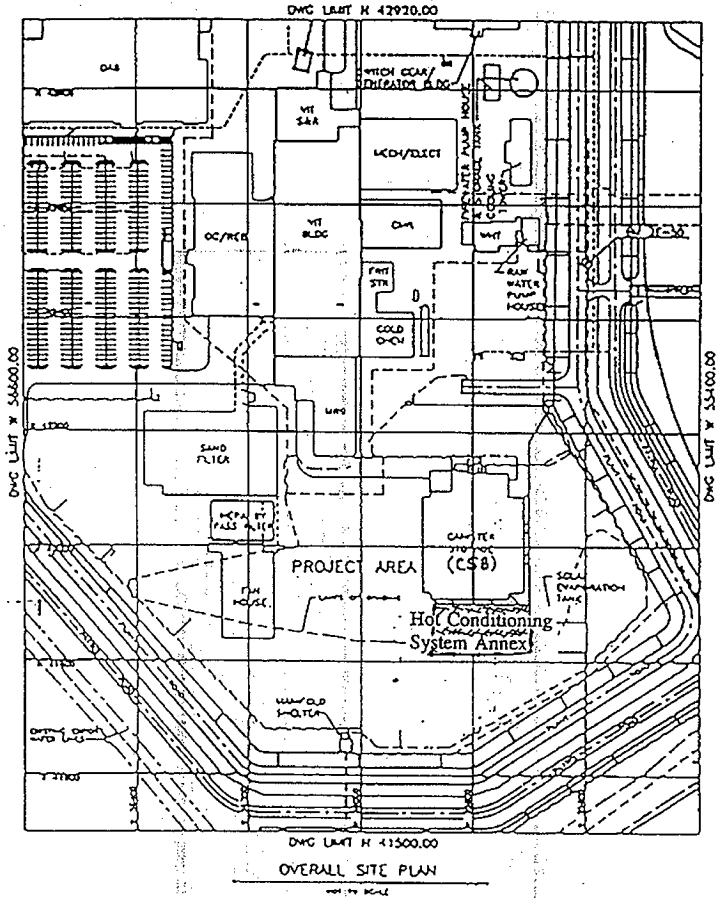


Figure 2. Overall Site Plan.



## 1.1 PROJECT DESCRIPTION

The SNF presently stored in the K Basins will be retrieved and placed in containers, processed to remove water, and stored dry in accordance with the *Hanford Federal Facility Agreement and Consent Order* (referred to as the Tri-Party Agreement) (Ecology et al. 1994). Processing of the SNF will take place at the Cold Vacuum Drying Facility (CVDF) and HCSA, while storage of the SNF will take place at the CSB.

The SNF will be removed from the K Basins as part of the SNF retrieval process. The first step in processing will begin at the CVDF, where free water (bulk water [water that surrounds the SNF in each vessel containing the SNF] and absorbed water [water that adheres to the SNF after removal of bulk water]) will be removed from the vessel containing the SNF. After the SNF is dried at the CVDF, it will be moved to the CSB for staging. Once the SNF reaches the CSB, SNF that requires additional drying will be sent to the HCSA for conditioning. Process descriptions and other related topics associated with the CVDF and the CSB will be presented in this application for information purposes. The CSB construction began in April 1996.

The SNF will be moved from the staging area of the CSB to the HCSA and conditioned for interim storage. Potential toxic air and criteria pollutants air emissions generated at the HCSA will be presented in a separate NOC (Phase II) which will be submitted to State of Washington Department of Ecology (Ecology) in accordance with Washington Administrative Code (WAC) 173-400 and 460. Construction of the HCSA is scheduled to begin in October 1996. After the SNF is conditioned at the HCSA, the fuel will be returned to the CSB and placed into interim storage for up to 40 years. During the interim storage period, the SNF will be stored in sealed vessels and no emissions will be generated.

## 1.2 FACILITY IDENTIFICATION AND LOCATION

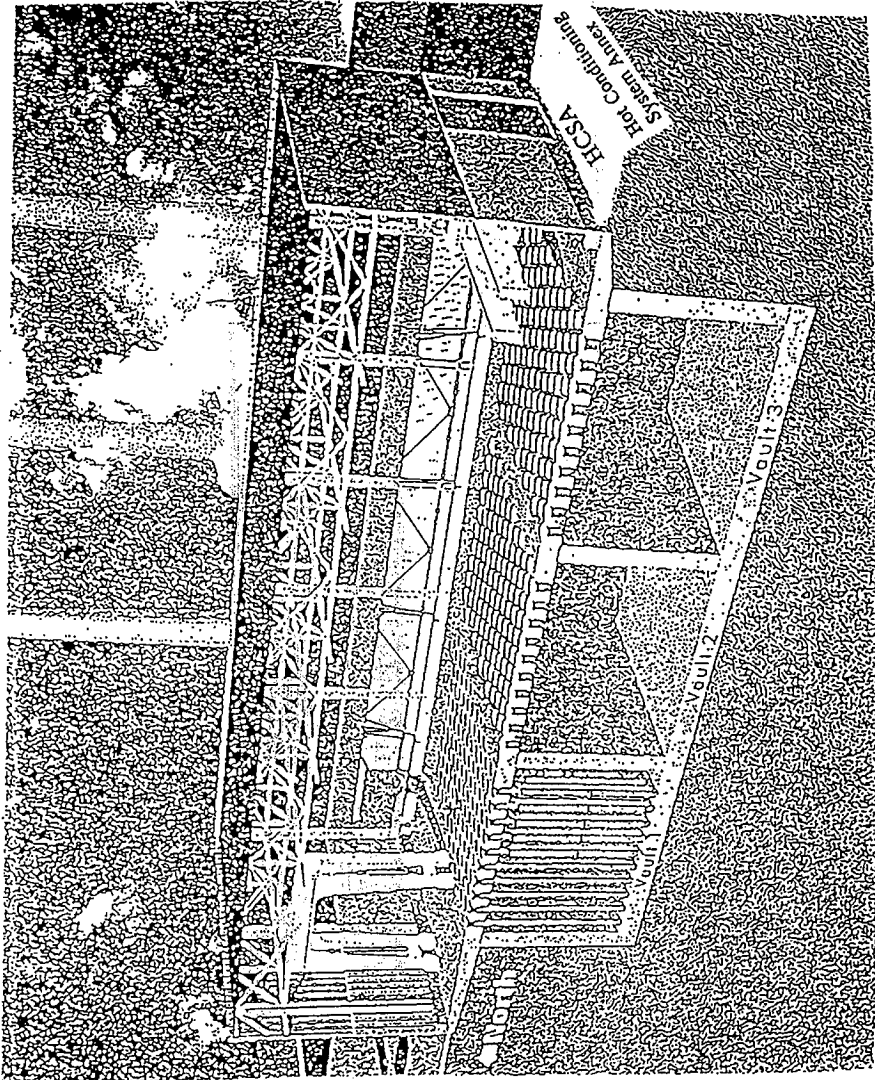
Owner:

U.S. Department of Energy, Richland Operations Office  
P.O. Box 550  
Richland, Washington 99352

Responsible Manager:

Ms. E. D. Sellers, Director Spent Nuclear Fuels Project Division  
U.S. Department of Energy, Richland Operations Office  
P.O. Box 550  
Richland, Washington 99352

Figure 3. Canister Storage Building and Hot Conditioning System Annex Layout.



### 1.2.1 Facility Description

The CSB will be a completed version of the 55.78 m by 4,267 m (183 ft by 140 ft) Hanford Waste Vitrification Plant (HWVP) CSB that was started in January 1993, for storing vitrified glass logs containing radioactive waste. The HCSA will be located on the south end of the CSB (see Figure 3). The HCSA will be approximately 9.14 m (30 ft) long by 41.45 m (136 ft) wide by 16.76 m (55 ft) high. Figures 4 and 5 show the basic features of the HCSA. The HCSA will be an extension of the CSB and will house the HCSE.

As originally discussed in the *Hot Conditioning Trade Study* (Fluor Daniel, Inc. 1995) and modified during conceptual design, the HCSA will be the last SNF chemical processing step before final interim storage. The main processes and potential emission points of the HCSA are presented in this NOC. The following description of the HCSA is submitted for approval under this NOC. The information is based on the latest conceptual design at the time of submittal of this NOC.

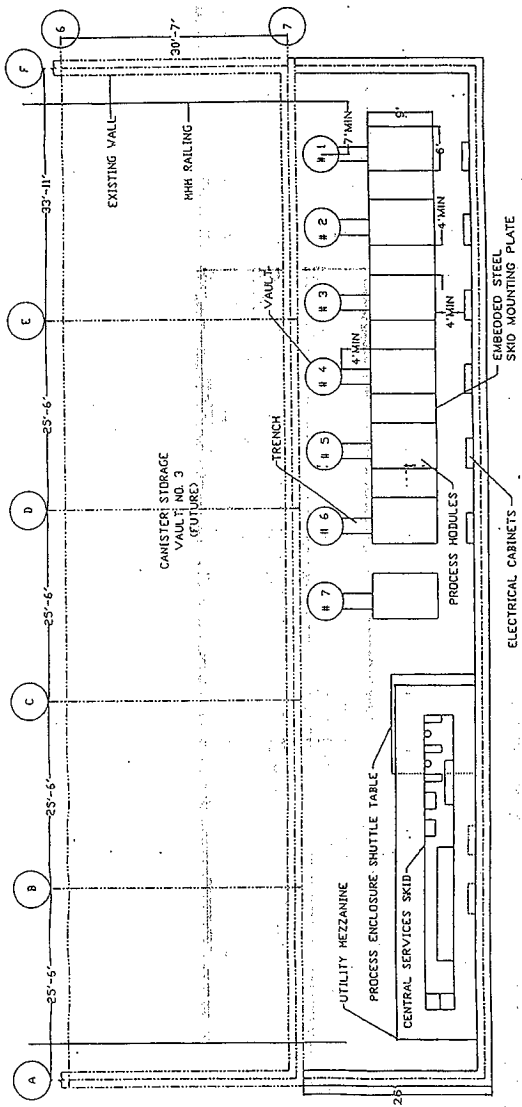
The HCSA will house seven hot conditioning process stations, six operational and one auxiliary pit which could be used as a welding area for final sealing of the vessel containing the SNF, or for neutron interrogation of the vessel containing the SNF to determine residual water content. Each hot conditioning process station will be comprised of a process pit and a process module. Each process pit will be a hole in the HCSA floor approximately 1.22 m (4 ft) diameter and 6.10 m (20 ft) deep. The process pit will hold the oven where the vessel containing the SNF will be heated and the SNF conditioned.

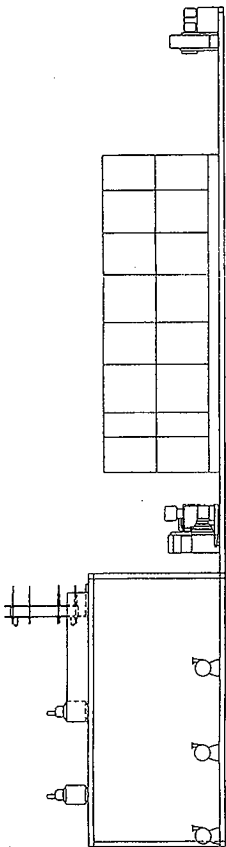
The process module will be a skid which contains the hot conditioning process equipment. The process module will measure approximately 1.82 m (6 ft) by 2.74 m (9 ft) and is 2.44 m (8 ft) high. There will be one process module per process pit. The process modules will be arranged to allow a 1.22 (4 ft) wide aisle all around to provide access for maintenance. The process module will contain the vacuum pump, heat exchanger, valving, instrumentation, and other hot conditioning process equipment that does not have to be located in the process pit or trench. The trench will be a rectangular cross-section space, 60.96 cm (24 in) wide by 114.30 cm (45 in) deep, located below the HCSA floor level that will connect the process pit with the process module. The piping that connects the vessel containing the SNF and oven with equipment that will be located in the process module.

The HCSE will contain its own exhaust fans, ducts, and nuclear grade filtration systems. Intake air will be drawn from the HCSA volume, through high-efficiency particulate air (HEPA) filters into potentially contaminated pit space, through the potentially contaminated trench, through the HCSE HEPA filter and supply fan, and out the HCSE stack. The HCSE stack will be approximately 21.95 m (72 ft) tall with a 20.32 cm (8 in) diameter. See Figure 6 for an illustration of the six operational hot conditioning process stations exhaust system.

All of the HCSE components that will be located outside of the HCSA are classified as auxiliary facilities. These include the ventilation stack, the refrigerant condenser for the

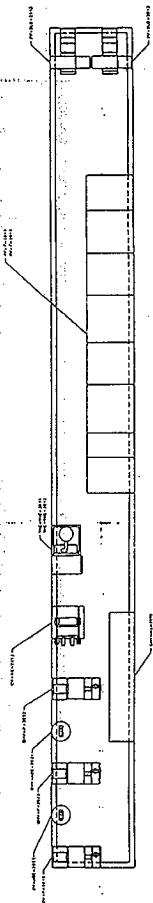
Figure 4. Hot Conditioning System Annex Layout.





CENTRAL SERVICES PROCESS EQUIPMENT — SKID ELEVATION

1/4" = 1'-0"



CENTRAL SERVICES PROCESS EQUIPMENT — SKID PLAN

1/4" = 1'-0"



chilled water system, the gas bottles, and the tube trailers. The auxiliary facilities will be located to the immediate west of the HCSA.

### 1.2.2 Location of Facility

The CSB and HCSA will be located at the site of the unfinished HWVP CSB that was planned for the vitrification program. The HCSA will be located at Hanford Site coordinates N42000, W55800. The HCSA location in the 200 East Area is shown on Figure 2.

## 1.3 TYPE OF PROPOSED ACTION

This NOC is being submitted for the CVDF in accordance with WAC 173-400-040, "New Source Review" and WAC 173-460-080, "New Source Review". The HCSA is one of three facilities that will be designed and constructed to complete the retrieval, processing, and storage of SNF from the K East and K West Basins. This NOC is being submitted to ensure the HCSA is in full compliance with WAC 173-460-040(8), "Commencement of Construction". This Phase I NOC is defined as constructing the substructure, including but not limited to, pouring the concrete for the floor; construction of the process pits and exterior walls; making necessary interface connections to the CSB ventilation and utility systems for personnel comfort; and extending the multi-canister overpack (MCO) handling machine rails into the HCSA. A Phase II NOC will be submitted for approval prior to installation, and is defined as the completion of the HCSA which consist of installation of HCSE, air emissions control equipment, and emission monitoring equipment. The project is under the management of the U.S. Department of Energy, Richland Operations (DOE/RL) Office and its contractors, working at the Hanford Site SNF Project.

## 1.4 STATE ENVIRONMENTAL POLICY ACT ENVIRONMENTAL CHECKLIST

The SNF CVDF is required by WAC 197-11-960 to prepare and submit a (Washington) *State Environmental Policy Act of 1971* (SEPA) checklist to Ecology. In our opinion, the K Basin Environmental Impact Statement (EIS) that was prepared for the SNF Project fulfills the SEPA requirement. Because Ecology has accepted National Environmental Policy Act documentation on the Hanford Site Projects as fulfilling the SEPA requirements, DOE/RL is not submitting a SEPA checklists. Copies of the K Basin EIS are available through the DOE/RL office upon request.

## 2.0 SOURCE INFORMATION

The following sections provide information regarding the source and the estimated air toxic and criteria pollutants that represent the potential air emissions, resulting from operation of the HCSA. Details on potential emissions generated by the HCSA process and emission controls will be presented in the Phase II NOC.

Section 2.5, HCSA, covers the functional and process operations requiring approval under this NOC. Section 3.0 lists the air toxic and criteria air pollutants of the HCSA requiring approval under this NOC. Information presented in the other sections of this NOC is for background and will be further developed in the other facilities NOCs.

### 2.1 PROCESS DESCRIPTION

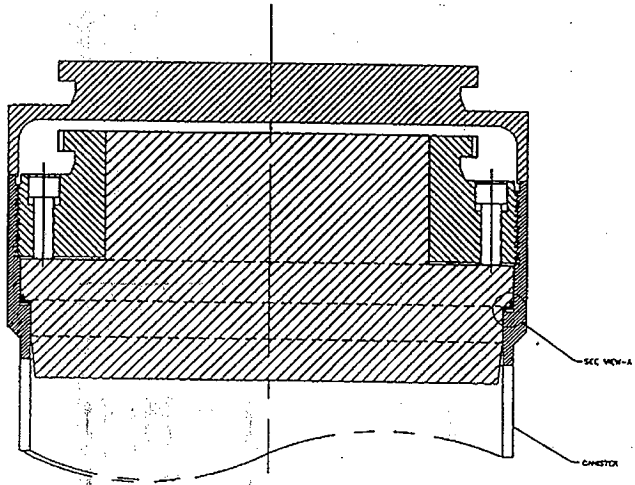
The Westinghouse Hanford Company SNF Project has been assigned the task to remove approximately 2,300 MT (2,530 tons) of SNF from the K East and K West Basins, condition it, and place it into dry storage. The process requires the design and construction of several new facilities, to allow the conditioning and storage of the SNF. The retrieval of the SNF will be accomplished in existing facilities at the K Basins. The objective of the project is to safely remove and condition the SNF for interim storage that can last up to 40 years and may be extended to a total of 75 years. Part of the retrieval process will be to load the SNF into new MCOs for conditioning and interim storage. The new MCOs will be a single use SNF vessel that will be capable of maintaining SNF containment and subcriticality after being closed and sealed. Each MCO will consist of a shell, a shield plug, several rerack baskets, and incidental equipment. Figure 7 illustrates a welded-type MCO assembly. Figure 8 shows a mechanical closure being considered for sealing the MCOs. Either design will secure the MCO for processing and transport.

As discussed in the *Performance Specification for the Spent Nuclear Fuel Multi-Canister Overpack* (WHC 1996a), the MCO shell will be a cylindrical stainless-steel vessel that provides access to its cavity through its top end and receives a shield plug for its closing. The MCOs will be approximately 406.4 cm (160 in.) long with a 60.46 cm (24 in.) diameter. Each MCO will weigh approximately 1,812 kg (4,000 lbs) empty, and can hold approximately 7,248 kg (16,000 lbs) of SNF and water (for a full weight of approximately 9,060 kg [20,000 lbs] including rerack baskets, shell, shield plug, incidental equipment, and water and SNF from the basins).

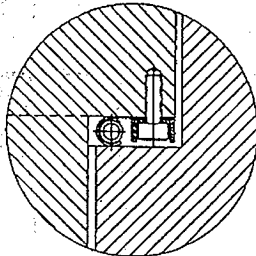
The MCOs will hold rerack baskets that will be loaded at the basins with SNF elements or SNF fragments. The rerack baskets will be cylindrical annular open-top containers that receive and hold the SNF elements or SNF fragments. Five types of rerack baskets are planned: two types to handle N Reactor SNF, which holds an average of 48 to 54 SNF elements; one type for Single Pass Reactor SNF, which holds 120 single pass SNF elements; and two types for SNF fragments, which holds 50 percent by weight of the rerack basket. All of the rerack baskets will be designed to maximize payload and minimize



Figure 8. Multi-Canister Overpack Mechanical Closure.



ASSEMBLY  
NOT TO SCALE



VIEW-A

movement during shipping, while considering ease of loading into the MCOs and gas circulation for conditioning.

The shield plug provides penetrations, ports and connections, a rupture disk, and an internal and external HEPA filter. The rupture disk and a HEPA filter will be connected to the outside of the shield plug. Incidental equipment includes criticality control structures, a dip tube connecting to ports on the MCO shield plug, features and devices to seal the MCO, and interface features for component handling. To reach the final interim storage of stabilized SNF in the CSB the following steps will be required:

- Retrieval of SNF from the K Basins
- Cold vacuum drying (CVD) of SNF in the MCOs at the CVDF
- Staging the MCOs in the CSB
- Hot conditioning of SNF in the MCOs at the HCSA
- Interim storage of the MCOs at the CSB.

The following descriptions of the SNF retrieval, CVD, staging, and interim storage of MCOs are provided only as background information because they are incidental to the HCSA. The descriptions are general in nature because many of the details have not yet been defined and the processes are not part of this NOC. Approval will be obtained, before commencement of the described activities, as required by federal and state regulations. Separate NOCs will be submitted to all regulatory agencies for the K Basin activities, the CVDF, CSB, and HCSA, as applicable.

Transport of all K Basin SNF to the CSB will require approximately two years and the hot conditioning process will require approximately two and one-half years for all of the SNF to be processed after the start of SNF retrieval (DOE 1994). Staging of the MCOs will occur simultaneously with the CVDF and HCSA processing.

## 2.2 SPENT NUCLEAR FUEL RETRIEVAL FROM THE K BASINS

The SNF in K East Basin is currently stored in open canisters, while SNF in K West Basin is stored in closed canisters. The process for retrieval and cleaning of the SNF is discussed in *Spent Nuclear Fuels, Fuel Retrieval Sub-Project Conceptual Design Report* (LATA/BNFL/Foster Wheeler, 1996). The cleaning process will minimize the amount of basin floor sludge and SNF canister sludge that leaves the K Basins. The K Basin project is working on methods to treat and dispose of any waste products, such as old SNF canisters, floor, sludge, etc., while minimizing waste and ensuring a safe cleanup which protects the environment. A brief description of the SNF cleaning process which takes place at both K East and K West Basins is presented below. This description supports sound engineering judgement for the amount of SNF canister sludge that could be transport in each MCO.

All SNF canisters will be retrieved from the basin and sent to the primary clean station. The primary clean station will consist of a containment box with an internal perforated wash basket. The cleaning process will begin by loading a single SNF canister

containing SNF assemblies into the wash basket and closing and locking the containment box lid. The wash basket will be rotated for one cycle, as basin water is flushed through the wash basket and containment box to remove SNF canister sludge and basin floor sludge (accumulated basin dirt and debris) from the SNF.

Upon completion of the initial cycle, rotation of the wash basket will be stopped with the SNF canister in an inverted position. The SNF canister will be removed from the containment box, allowing the SNF assemblies (Figure 9) to discharge to the wash basket. The containment box lid will be closed and locked, and a second cleaning cycle will begin. During the second cleaning cycle, the SNF assemblies will be tumbled as basin water is flushed through the wash basket and containment box to remove SNF canister sludge and basin floor sludge from the individual SNF assemblies.

Some of the SNF assemblies will be moved for disassembling. The SNF assemblies, requiring disassembling will be disassembled by removing the inner SNF element from the outer SNF element. A portion of the SNF elements will be visually inspected. If a SNF element fails the inspection, it will be subject to a secondary cleaning process. The secondary cleaning station will use a high pressure water jetting system on individual SNF elements. The SNF element will be placed into a SNF element cradle within a containment enclosure to remove adhering sludge. The SNF element cradle will align the SNF element axis with the jetting nozzle enabling the high pressure water jetting action to pass through the bore of the element. After cleaning, the SNF elements will be moved to the MCO loading area for placement into the MCO rerack baskets.

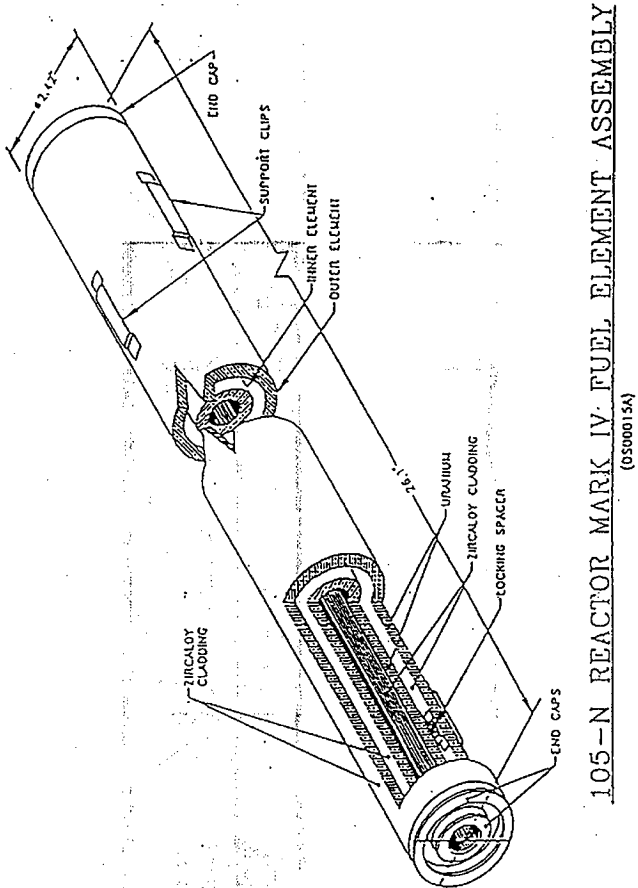
At the basin MCO loading area the SNF will be placed into the MCO rerack baskets and loaded under water into the MCOs. Each MCO will be filled and the payload maximized. Once a MCO is filled with SNF rerack baskets, it will be readied for transportation. At this time the MCO shield plug will be replaced and the MCO sealed by mechanical closure or welding before being removed from the load out pits. Each transport cask will be sealed, and checked for contamination on the external surfaces, after being removed from the basin load out pit. If necessary, the transport cask will be cleaned to remove any contamination. The level of cleanliness is governed by safe handling levels and worker protection.

Each MCO and cask will then be removed from the basin and placed on a SNF transport trailer and readied for transfer by truck to the CVDF. The transport cask will provide secondary confinement to the SNF inside the MCO. Once the transport cask is loaded on the SNF transport trailer, it will remain there until it is removed at the CSB.

### 2.3 COLD VACUUM DRYING

As discussed in the *Conceptual Design Report for the Cold Vacuum Drying System* (WHC 1996b), the CVD will be the first chemical processing step in ensuring proper storage of the SNF. The following is a description of the process and the equipment used to remove the water from the MCO.

Figure 9. 105-N Reactor Mark IV Spent Nuclear Fuel Element Assembly.



The CVD process will be used to remove as much free water as possible from the MCOs before they are transported to the CSB. Bulk water will be removed by pumping. Remaining absorbed water will be removed by heating to 50°C (122°F) in a vacuum for a period of approximately 24 hours.

The CVD process will arrest further SNF corrosion, reduce the potential for temperature driven excursions, and prevent excessive hydrogen build-up. Cold vacuum drying will not be expected to remove chemically-bound water (water chemically adhered to the SNF). It is estimated that approximately 2 kg (4.41 lbs) of chemically-bound water may not be removed by CVD; thereby, remaining in each MCO.

Following CVD, each MCO will be heated to 75°C (167°F) and held for six hours to verify that the MCO will not overpressurize during transportation to the CSB. Following the post CVDF monitoring, the temperature of each MCO will be lowered to 25°C (77°F) and the MCO inerted with helium at approximately 155.10 mmHG (3 lbf/in<sup>2</sup>[g]) pressure. The MCOs will then be released from the CVDF and transported on the SNF transport trailer by truck to the CSB.

#### 2.4 MULTI-CANISTER OVERPACK STAGING

Once the CVDF processing is complete, the MCOs will be transported to the CSB for staging. During transportation to the CSB, the temperature of the MCOs may rise slightly and some hydrogen may be generated from the reaction of residual water with the SNF. The hydrogen generation reaction rate doubles for each 8.33 to 11.11°C (15 to 20°F) temperature rise. The MCOs are expected to arrive at the CSB at a total internal pressure of approximately 1,034 to 1,551 mmHg (20 to 30 lbf/in<sup>2</sup>[g]).

Each MCO will be unloaded at the CSB from its SNF transport trailer using a crane to move the cask and MCO into the MCO receiving station. The MCO and cask will then be monitored and, if required, connected to a purge system at the receiving station. Monitoring will identify any gas buildup due to oxidation.

Connected by a single pipe, the purge system consists of an inert gas cylinder and a vacuum pump, which exhausts to the CSB exhaust stack. By opening and closing a series of valves, the purge system can draw a vacuum on the MCO to remove gases and then change its operation to flow inert gas into the MCO to purge the MCO. When the purge system is coupled to each MCO quick-connect fitting, gas contained in each MCO will flow through a canister-type HEPA filter and the attached flexible connection to a pressure gage. After the pressure is recorded, a sample of the gas will be taken and the temperature of the gas will be recorded. After the sample is secured, the remaining gas in each MCO will be vented through a vent line equipped with testable HEPA filters, leading to the CSB exhaust stack.

Once each MCO is depressurized, a vacuum pump will be used to remove as much of the remaining gas as possible. Purging will then reduce any pressure buildup in each MCO, ensuring an inert internal environment, and will allow staging to begin with the lowest

possible concentration of hydrogen. It is expected that the MCO internal pressure will depend on the initial pressure, the time elapsed since each MCO was closed, and the internal temperature during that period. The purge system vacuum pump will exhaust into the CSB exhaust, which is connected to the CSB exhaust stack. To complete the purge, each MCO will be refilled with inert gas to reach a slight positive pressure. With purging complete, the quick-connect canister-type HEPA filter will be removed, the cover on the quick-disconnect will be replaced, and the covers on each MCO HEPA filter and rupture disc will be removed to activate them.

Following purging, each MCO will be transferred and loaded into storage tubes within the CSB by means of the MCO handling machine. The MCO handling machine will have a self-contained dual HEPA filtered ventilation system as shown in Figure 10. The MCO handling machine ventilation system will exhaust filtered air into the operating space of the CSB.

In the CSB the MCOs will be stored vertically in storage tubes with one or two MCOs in each storage tube. The storage tubes will be closed with a shield plug that incorporates a redundant seal, a HEPA filtered vent, and a quick disconnect fitting for depressurizing or purging the storage tube. The storage tube HEPA filter on the vent is not testable in service; however, it is pre-tested and has the same effectiveness as the main ventilation filters. All MCOs will be vented while being staged at the CSB before hot conditioning.

After the transfer cask is unloaded, a new, empty MCO will be loaded into the cask and sent to the K Basins. This cycle is expected to be repeated over a two year period to remove and stage all of the SNF from the basins. The MCOs will be staged until they are hot vacuum conditioned and placed into interim storage.

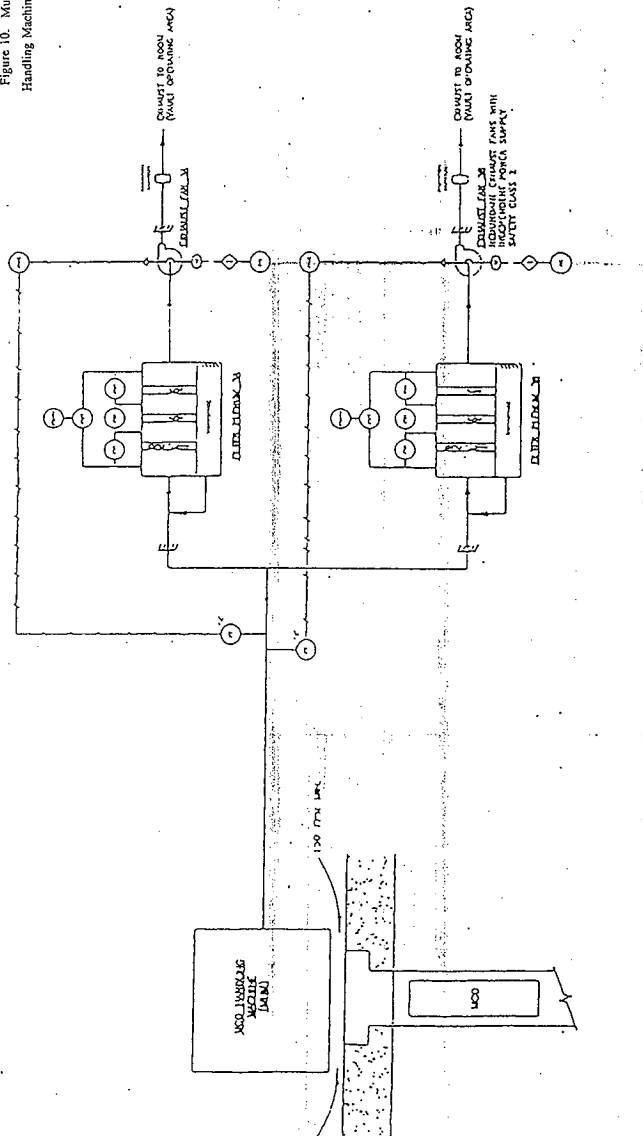
## 2.5 HOT CONDITIONING SYSTEM ANNEX

The following information was first presented in the *Hot Conditioning Trade Study* (Fluor Daniel, Inc. 1995). Since then Westinghouse Hanford Company has contracted with a design firm to complete the final design of the HCSA and a different design firm for the HCSE to be used to perform the final chemical processing step prior to interim storage of the SNF. As discussed in Section 2.0, this section of the NOC is submitted for approval.

### 2.5.1 Process Description and Equipment

Hot conditioning of SNF contained in the MCO will be performed in the HCSA subsequent to the initial CVD done at the CVDF. It will ensure that gas generation from the radiolyses of water and other potentially volatized material does not exceed the sealed MCO design pressure limit. Hot conditioning will consist of heating the SNF to approximately 300 to 350°C (572 to 662°F) under a vacuum. This will remove the chemically bound water and cause a significant portion of the uranium hydride that may be present to decompose and

Figure 10. Multi-Canister Overpack  
Handling Machine Ventilation Diagram.



release hydrogen from the SNF. A passivation step will be completed to reduce the overall reactivity of the SNF. In the passivation step, the MCO would be cooled to 150°C (302°F) and a controlled amount of oxygen in an inert gas diluent will be added to the MCO to oxidize highly reactive surfaces.

The process equipment required for hot conditioning will consist of seven hot conditioning process stations, six operational and one auxiliary pit which could be used as a welding area for final sealing of the MCOs, or for neutron interrogation of the MCO to determine residual water content.

Each hot conditioning process station will be comprised of a process pit and a process module. Each process pit will be a hole in the HCSA floor approximately 1.22 m (4 ft) in diameter and 6.10 m (20 ft) deep. The process pit will hold the oven where the MCO will be heated and the SNF conditioned. The oven will essentially be a thermos bottle placed within the process pit. The MCO will be placed inside the oven. Heating will be accomplished by blowing hot air through the oven (Figure 11). A cover ring will be placed so that the hot air blown through the annular space between the MCO and oven interior wall is not lost into the process pit.

The process module will be a skid which contains the hot conditioning process equipment. The process module will measure approximately 1.83 m (6 ft) by 2.74 m (9 ft) and 2.44 m (8 ft) high. There will be one process module per process pit. The process modules will be arranged to allow a 1.22 m (4 ft) wide aisle all around to provide access for maintenance. The process module will contain the vacuum pumping system and inert gas purge system to handle gas within the MCO, gas recirculation blower with a heater/cooler, valving, instrumentation, and other hot conditioning process equipment that does not have to be located in the process pit or trench. The trench will be a rectangular cross section space, approximately 60.96 cm (24 in) wide by 114.30 cm (45 in) deep, located below the HCSA floor level that will connect the process pit with the process module. The process piping that connects the MCO and oven with the process module will be located in the trench.

To protect workers and the working space environment of the HCSA, a portable process enclosure will be used to make connections to the MCO while it is in the oven. The portable process enclosure will be placed over the oven after the MCO is placed in the oven. The portable process enclosure will contain shielding, a hoist, and tele-operated manipulators, used to make and break connections to the MCO. In addition, the portable enclosure will be used to replace the cold trap contained in the process piping located in the trench. If required, welding may be accomplished with the portable enclosure at the process pit the MCO is currently in or at the auxiliary pit. The portable enclosure will be fitted with a HEPA filter which will allow HCSA air volume to flow through the oven and trench ventilation line to the HCSE stack (Figure 12).

The HCSE exhaust gas system will consist of a HEPA filter intake, ducted manifold for up to six process stations, isolation nuclear grade dampers, two stage testable HEPA filter plenum with pre-filter, variable speed exhaust fan, static pressure sensors, and exhaust stack.



### 2.5.2 Process Steps

A MCO will be retrieved from a storage tube in the CSB by the MCO handling machine. The HCSE ventilation system is turned on and allowed to flow from the HCSA, through the process station and trench. The MCO will then be placed into a process pit oven in the HCSA (see Figure 11). The portable enclosure will be placed over an oven and the MCO connections made to the process module and HCSE exhaust and the oven cover closed. After all connections are made the oven cover will be closed and the portable enclosure is removed.

The vacuum system of the hot conditioning process module will be started to initiate flow through the MCO. Inert gas will be heated and bled into the MCO as the vacuum pump maintains the purge flow. The process gases will be circulated through the cold trap and maintained at a temperature that ensures proper heat transfer to the SNF for conditioning. Heating will be started in the process station and the core temperature of the MCO will be raised to approximately 300 to 350°C (572 to 662°F). The internal pressure of the MCO will be reduced to approximately 6.5E+02 Pa (5 TORR), the MCO will be maintained at this temperature and pressure for approximately 48 hours. During this time the process gas and water and hydrogen will be bled off and sent to the HCSE ventilation system. The process gases will pass through the cold trap where cesium gases, and iodine gases will be collected, and the remaining air pollutants pass through the process lines to the HEPA filters where particulate matter will be collected.

Heating will be stopped at approximately 48 hours and cooling will begin by reducing the temperature of the air flowing through the oven annular space. The MCO temperature will be lowered to approximately 150°C (302°F). A controlled partial pressure of oxygen will be introduced into the MCO, along with an inert carrier gas, to passivate remaining reactive surfaces. The MCO will remain at approximately 150°C (302°F) with oxygen present for passivation for approximately 12 hours.

The MCO will be slowly cooled to storage temperature. The MCO will be flushed with inert gas to remove oxygen from the MCO. The portable enclosure will be moved back over the oven and the oven will be opened. The MCO will be isolated from the process and offgas systems and then disconnected from those systems.

The MCO valves will be seal welded either at the process station if it is contained in or moved to the auxiliary pit. The welding fumes will be collected by the hot conditioning module ventilation exhaust system and discharged to the HCS exhaust system and then to the HCS stack. Welding will take place once the MCO has been verified that the SNF has been conditioned properly for interim storage. The top of the MCO will be surveyed and decontaminated as necessary, to ensure safe handling. The cold trap will be replaced periodically, depending on the amount of pollutants collected per MCO. This determination will be based on radiation readings, to ensure that the cold trap can be safely handled and disposed of.



After all disconnections and welding, as applicable, is completed, the portable enclosure will be moved away from the oven and the MCO handling machine will be brought back to lift the MCO out of the oven and place it back into a CSB storage tube. As a result of hot conditioning, the SNF will be expected to be stabilized for interim storage and the MCO vents will be sealed. Some of the MCOs may not be sealed immediately following hot conditioning, some may be placed back into the CSB for continued staging until it is confirmed that the SNF has been properly conditioned for interim storage. After a MCO is placed into interim storage there is expected to be little or no further potential for emissions from the MCO and storage tubes. Periodic gas sampling and pressure checks of the storage tubes and MCO may be conducted during storage. However, the specific requirements and procedures for testing during storage have not been determined at this time.

### 2.5.3 Solid Waste/Process Exhaust Gases

The sources of solid waste generated by the HCSE will fall into two categories. The first is waste as a direct result of operating and conditioning equipment (i.e., HEPA filters, cold traps, and filters used by the monitoring equipment). The second is general cleaning and inspection (i.e., welding rods, wipes, swipe test, etc.). The solid waste will be collected in drums and transported by hand carts to the HCSA solid waste staging area. From there the waste will be sent to the appropriate waste disposal or treatment facility.

## 2.6 INTERIM STORAGE

Upon completion of hot conditioning or upon confirmation the MCO is ready, each MCO will be sealed and placed in interim storage. The SNF in each MCO is expected to generate minimal gas and oxide particulates during interim storage. Interim storage will end when the sealed MCOs are either shipped to a repository for permanent disposal, or shipped to a yet undefined processing plant. Because the exact outcome of the SNF is not yet defined, the MCOs may remain in interim storage for up to 40 years. In addition to the expected 40-year interim storage period, provisions will be made for extending storage to 75 years, if necessary. Sealed MCOs are not expected to be vented before removal and shipping; thus, no environmental releases are expected during interim storage.

### 3.0 EMISSION SOURCE

There are no expected emissions from the construction of the substructure, including but not limited to, pouring the concrete for the floor; construction of the process pits and exterior walls; making necessary interface connections to the CSB ventilation and utility system for personnel comfort; and extending the MCO handling machine rails into the HCSA. The emissions generated at the HCSA will be caused by the process equipment and actual processing of the SNF in each MCO. The installation of the process equipment and associated air pollution control and ventilation system will not occur until a Phase II NOC is approved. An evaluation of the material that could be contained in each MCO has been established based on sound engineering judgement and is presented in the following sections.

#### 3.1 CRITERIA POLLUTANTS

The potential criteria pollutants inventory is listed in Table 1. This table contains the source of the pollutant from HCS operations based on process knowledge and conceptual design. The majority of the pollutants listed will be generated from the SNF contained in the MCO or the welding of the MCO closed for interim storage. This will mostly consist of metals, however, non-significant volatile organic compounds may also be present. Based on the process description in Section 2.0, there is a very small chance that chemically bound waste contained in the SNF and contained from the MCOs will contain the listed materials. Any additional process, such as back up power generators, will be discussed in separate NOCs as final safety analyses are completed and final decisions are made on the necessary support facilities for the HCSA.

Table 1. Criteria Pollutants for the Hot Conditioning System Annex.

Compound	Source
Lead, cladding impurity	Engineering Judgement
PM10, welding	EPA AP-42 Emission Factors

PM10 = particulate matter

EPA = U.S. Environmental Protection Agency

#### 3.2 TOXIC AIR POLLUTANTS

The potential toxic air pollutants inventory is listed in Table 2. This table contains the source of the pollutant from HCS operations based on process knowledge and conceptual design. The majority of the pollutants listed will be generated from the SNF contained in the MCO or the welding of the MCO closed for interim storage. This will mostly consist of

Table 2. Air Toxic Pollutants from the Hot Conditioning System Annex.

Laboratory Name	Toxic Air Pollutant	Class	Source
Beryllium-Braze Ring	beryllium compounds	A	Engineering Judgement
Beryllium-Fuel Meat	beryllium compounds	A	Engineering Judgement
Chromium, welding	Chromium (II, III, or metal)	B	EPA Emission Factors
Cobalt	Cobalt as Co metals, dust and fumes	B	EPA Emission Factors
Lead-cladding impurity	lead compounds	A/special	Engineering Judgement
Manganese welding	manganese fume	B	EPA Emission Factor

EPA = U.S. Environmental Protection Agency

metals, however, non-significant volatile organic compounds may also be present. Based on the process description in Section 2.0, there is a very small chance that chemically bound water contained in the SNF and conditioned from the MCOs will contain the listed material. Any additional process, such as back up power generators, will be discussed in separate NOCs as final safety analysis are completed and final decisions are made on the necessary support facilities for the HCSA.

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