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State of Washington Department of Ecology Toxic Air Pollutants Phase II Notice of Construction for the Hanford Site Spent Nuclear Fuel Project--Cold Vacuum Drying Facility, Project W-441

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United States
Department of Energy
P.O. Box 550
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GLOSSARY

BARCT	best available radionuclide control technology
CSB	canister storage building
CVD	cold vacuum drying
CVDF	cold vacuum drying facility
DOE/RL	U.S. Department of Energy, Richland Operations Office
Ecology	Washington State Department of Ecology
EIS	environmental impact statement
HCS	hot conditioning system
HCSA	hot conditioning system annex
HEPA	high-efficiency particulate air
MCO	multi-canister overpack
NOC	notice of construction
NPH	normal paraffin hydrocarbon
PUREX	plutonium-uranium extraction (process)
SEPA	(Washington) *State Environmental Policy Act of 1971*
SNF	spent nuclear fuel
T-BACT	best available control technology for toxics
TBP	tributyl phosphate
VPS	vacuum pumping system
WAC	Washington Administrative Code
cm	centimeter
ft	foot
ft^2	square foot
gal/min	gallons per minute
g	gauge

GLOSSARY (cont)

in	inch
in^2	square inch
Kg	kilogram
lbs	pounds
lbf	foot pounds
L/min	liters per minute
m	meter
m^2	square meter
ml	milliliter
mm HG	millimeters of mercury
Pa	pascal
std	standard
°C	degrees Celsius
°F	degrees Fahrenheit

TOXIC AIR POLLUTANTS
STATE OF WASHINGTON DEPARTMENT OF ECOLOGY
PHASE II NOTICE OF CONSTRUCTION FOR
THE HANFORD SITE SPENT NUCLEAR FUEL PROJECT--
COLD VACUUM DRYING FACILITY, PROJECT W-441

SUMMARY

This Phase II notice of construction (NOC) provides the additional information committed to in the Phase I NOC submittal (DOE/RL-96-55) regarding the air toxic and criteria pollutants that could potentially be emitted during operation of the Cold Vacuum Drying Facility (CVDF). This Phase II NOC is being submitted to ensure the CVDF is in full compliance with Washington Administrative Code (WAC) 173-460-040(8), "Commencement of Construction". The Phase I NOC (approved September 30, 1996) was defined as constructing the substructure, including but not limited to, pouring the concrete for the floor, and construction of the exterior. This Phase II NOC is being submitted for approval before installation and operation of the process equipment that will generate any potential air emissions at the CVDF, and installation and operation of the emissions control equipment.

New or revised information, since submittal of the Phase I NOC, is provided in the text of the Phase II NOC, using footnotes.

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1.0 INTRODUCTION

This notice of construction (NOC) provides information regarding the air toxic and criteria pollutants that could potentially be emitted during operation of the Cold Vacuum Drying Facility (CVDF). This NOC is being submitted to ensure the CVDF is in full compliance with Washington Administrative Code (WAC) 173-460-040(8), "Commencement of Construction". This Phase II NOC is submitted for approval prior to installation and is defined as the installation of the process equipment that will generate any potential air emissions at the CVDF.

About 80 percent of the U.S. Department of Energy's 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 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 2,100 MT (2,300 tons) of uranium as part of the N Reactor SNF in the K Basins with no means for near-term removal and processing.

The CVDF will be constructed in the 100 Area northwest of the 190 K West building, which is in close proximity to the K East and K West Basins (Figures 1 and 2). The CVDF will consist of up to six process bays[1] in which SNF transport trailers can be housed while water is drained and a vacuum/gas purge process dries the SNF. The CVDF will have a support area consisting of a control room, change rooms, and other functions required to support operations.

1.1 PROJECT DESCRIPTION

The SNF presently stored in the K Basins will be retrieved and placed in vessels, processed to remove water, and stored dry consistent with the Record of Decision from the *Final Environmental Impact Statement: Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington* (DOE 1996a)[2]. Processing of the SNF will take

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[1] Although Phase I documentation indicated that six process bays would be constructed, current design information indicates that the CVDF will consist of <u>up to</u> six process bays. The present plan is to have four operating bays, with a fifth as a contingency.

[2] The Phase I NOC indicated that the action was in accordance with the *Hanford Federal Facility Agreement and Consent Order* [referred to as the Tri-Party Agreement (Ecology et al. 1996)]. Although milestones associated with the Tri-Party Agreement will be established with ongoing negotiations among DOE, Ecology and EPA, the action is

place at the CVDF and Hot Conditioning System Annex (HCSA), while storage of the SNF will take place at the Canister Storage Building (CSB). Construction of the three facilities has begun or will begin in 1996.

The SNF will be removed from the K Basins as part of the SNF retrieval process. The first step will begin at the CVDF, where free water (bulk water [water that surrounds the SNF in each vessel containing the SNF], absorbed water (water that has penetrated the SNF) and absorbed water (water that adheres to the surface of the SNF after draining the free water)[3] will be removed from the vessel containing the SNF. Potential air toxic and criteria air pollutants generated at the CVDF will be presented in a separate NOC (Phase II) which will be submitted to the State of Washington Department of Ecology (Ecology) in accordance with WAC 173-400 and 460. Construction of the CVDF is scheduled to begin in November 1996.

After the SNF is dried at the CVDF, it will be moved to the CSB for staging. Once the SNF reaches the CSB, SNF will be sent to the HCSA for conditioning[4]. Potential emissions that could be generated in the CSB are non-significant; therefore, no NOC will be filed with Ecology. A brief process description the HCSA and the CSB will be presented in this NOC 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. After the SNF is conditioned at the HCSA, the SNF will be returned to the CSB and placed into interim storage that can last up to 40 years and may be extended to a total of 75 years. The project design goal is to store the SNF in sealed vessels with no emission being generated during interim storage[5].

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proceeding based upon DOE's evaluations and determinations under the *National Environmental Policy Act* (NEPA) *of 1969.*

[3] The Phase I NOC addressed only free and absorbed water. Absorbed water is water that has penetrated the inner structure of the fuel. Additionally, "adsorbed" water (i.e., water that adheres to the surface of the fuel after free water is removed, will be present. After the free water is removed, the bulk of both the absorbed and adsorbed water will be removed in the CVDF.

[4] The Phase I NOC implied that only some SNF would be sent to the HCSA for conditioning. It is anticipated that <u>all</u> SNF will be sent to the HCSA.

[5] It is noted that the Phase I reference to "...sealed vessels..." was a project goal. This is not intended to mean a guaranteed condition. It is reiterated that it is a goal, and not meant to infer that a potential demonstrated or quantified value is available.

1.2 FACILITY IDENTIFICATION AND LOCATION

Owner:
U.S. Department of Energy, Richland Operations Office
Hanford Site
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

1.2.1 Facility Description

As discussed in the *Conceptual Design Report of the Cold Vacuum Drying System* (WHC 1996a), the CVDF will be the first step in ensuring proper storage of the SNF. The main processes and potential emission points of the CVDF are presented in this NOC. The following is a description of the CVDF.

The CVDF will consist of up to six process bays within a steel-framed pre-engineered metal building containing a second level mezzanine. Attached to the process bays will be a single-story pre-engineered metal building that will enclose administrative and change room functions. The exterior will be constructed of pre-cast concrete panels and insulated metal panels. The CVDF will have a building footprint of approximately 1,300 m^2 (14,400 ft^2) for the process bay areas and 280 m^2 (3,000 ft^2) for administrative and change room functions.

The process bay building will have a process bay width of approximately 9 m (30 ft) and a nominal building width of approximately 18 m (60 ft). The height of the process bays will be nominally 10 m (32 ft), which will be dictated by the personal access working level of the SNF shipping cask, the crane access to remove the cask lid, and the physical/functional requirements for all of the operations necessary in the CVDF.

Figures 3, 4, and 5 show the layout of the CVDF, which shows up to six independent process bays where SNF transport trailers will be parked and processed. These process bays will be connected by a corridor that will run along the west side of the building. Access to the process building will be accomplished with a corridor that will be adjacent to the main change room for radiological control of access/egress from the process bays. Individual process bay access/egress control will be through a change room. Truck access to each process bay will be through rollup doors[6] along the east side of the building. The corridor will allow personnel access through step off pads, as well as acting as a chase for service header piping and conduits.

The SNF from the K Basins will be retrieved and placed into vessels called multi-canister overpacks (MCO). The MCOs will be transported in a SNF shipping cask on a SNF transport trailer to the CVDF. Each process bay of the CVDF will be designed to enclose a SNF shipping cask and SNF transport trailer, without the truck attached, and will provide the operational space necessary to meet the function of the CVDF. Process bay construction is designed to provide radiological separation and containment within each process bay.

Personnel will enter the building through the support area at the south end, where there will be areas for changing, bathrooms, lunch, and control of the building activities. Each process bay will be an independent nuclear material secondary confinement structure that will block release to the outside environment should an accident or natural phenomena event cause a release from the drying process.

Each process bay will be served by a dedicated ventilation system. Each ventilation system, equipped with a high-efficiency particulate air (HEPA) filter, will circulate room air, as well as control process exhaust, vent streams, and emissions collected from a hood at the top of the MCO where process connections will be made and broken. These exhausts will be collected in the CVDF exhaust stack that will be monitored to detect radioactive emissions. The ventilation system diagrams are shown on Figures 6, 7, 8, and 9.

Other mechanical systems that will be connected to each process bay will include provisions for tempered water, compressed inert gas, fire suppression water, radioactive water collection, gases, and potable water. Radioactive water will be collected in a tank at the CVDF located in an isolated room with controlled access, located next to a process bay, to allow a tanker truck to enter the process bay and receive the water from the storage tank. The radioactive water will be processed and disposed of or stored at an appropriate facility located on the Hanford Site.

1.2.2 Location of Facility

The CVDF will be a facility constructed at the K Basin Site in close proximity to the basins. The site selected for the CVDF is to the southwest of 165KW Building, Power

[6] The Phase I discussion of Figures 3, 4, and 5 referred to "...garage doors..". More correctly, rollup doors will be installed. Current design considerations note that, if necessary, a second door might be installed to provide additional protection during high winds or tornado conditions.

Control Building, and 105KW Reactor Building. The CVDF Hanford Site coordinates are N4000, E7500. The CVDF location in the 100 Area is shown on Figure 2.

1.3 TYPE OF PROPOSED ACTION

The Phase I NOC was submitted for the CVDF in accordance with WAC 173-400-110, "New Source Review" and WAC 173-460-040, "New Source Review". The CVDF 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. The Phase I NOC was submitted to ensure the CVDF is in full compliance with WAC 173-460-040(8), "Commencement of Construction". The Phase I NOC is defined as, constructing the substructure, including but not limited to, pouring the concrete for the floor, and construction of the exterior walls.

The Phase II NOC is being submitted for approval prior to installation of the process equipment that will generate any potential air emissions at the CVDF. The project is under the management of the U.S. Department of Energy, Richland Operations Office (DOE/RL).

1.4 STATE ENVIRONMENTAL POLICY ACT ENVIRONMENTAL CHECKLIST

The DOE/RL is required by WAC 197-11-960 to prepare and submit a (Washington) *State Environmental Policy Act* (SEPA) *of 1971* checklist to Ecology. The K Basin Environmental Impact Statement (EIS) that was prepared for the SNF Project (DOE 1966) 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 checklist. Copies of the K Basin EIS are available through the DOE/RL upon request.

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2.0 SOURCE INFORMATION

The following sections provide background information on the entire SNF project, process, and facilities. Information presented in the other sections of this NOC are for background and will be developed further in the NOCs for other facilities.

2.1 PROCESS DESCRIPTION

Fluor Daniel Hanford, Inc. (with Duke Engineering Services of Hanford having primary subcontractor responsibilities)[7] has been assigned the task to remove approximately 2,100 MT (2,300 tons) of uranium as part of the 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 that will house 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 might 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 10 illustrates a welded-type MCO assembly. This assembly will have to be sealed by welding. Figure 11 shows a mechanical closure that also is being considered for sealing the MCOs. Either design will secure the MCO for processing and transport. The two designs will undergo testing and the best design will be used in the final MCO design[8].

As discussed in the *Performance Specification for the Spent Nuclear Fuel Multi-Canister Overpack* (WHC 1996b), 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 cm (160 in.) long with a 60 cm (24 in.) diameter. Each MCO will weigh approximately 1,800 kg (4,000 lbs) empty, and will hold approximately 7,300 kgs (16,000 lbs) of SNF and water [for a full weight of approximately 9,100 kg (20,000 lbs) including rerack baskets, shell, shield plug, incidental equipment, and water and SNF from the basins].

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[7] Fluor Daniel Hanford, Inc. has replaced Westinghouse Hanford Company as the major contractor associated with operations at the Hanford Site.

[8] Presently, mechanical closure of the MCO, as depicted in Figure 11, is the leading method of choice. Welded closure (Figure 10), however, still is being maintained as an option, pending completion of ongoing evaluations to determine the final closure method.

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

The shield plug provides penetrations, ports and connections, a relief valve[9], a rupture disk, and an internal HEPA filter[10]. 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 system (HCS) of SNF in the MCOs at the HCSA
- Interim storage of the MCOs at the CSB.

The following descriptions of the SNF retrieval, staging, hot conditioning, and interim storage of MCOs are provided only as background information because these activities are incidental to the CVDF. 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 2 years and the hot conditioning process will require approximately 2 years for all of the SNF to be

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[9] Although not mentioned specifically in Phase I, the design includes a relief valve.

[10] The Phase I NOC referred to an external HEPA filter. In an earlier operational concept, a HEPA filter was to be added to the vented port of the MCO before placement into staging at the CSB. Currently, the MCOs are not planned to be vented during staging, and therefore no external HEPA filter will be placed on the MCOs. The internal HEPA quality filter is retained in the current design.

processed (WHC 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 currently is 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 canister sludge that leaves the 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 that protects the environment. A brief description of the SNF cleaning process that takes place at both K East and K West Basins follows. This description supports sound engineering judgment for the amount of SNF canister sludge that could be transported in each MCO.

All SNF canisters will be retrieved from the basins 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 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.

On completion of the initial washing of the canister and SNF, 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 12) 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. These will be disassembled by removing the inner SNF element from the outer SNF element. A portion of the SNF elements will be inspected visually. If a SNF element fails the inspection, the element will be subject to a secondary cleaning process. The secondary cleaning station will use a high pressure water jetting system, or a mechanical brush system[11], 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

[11] Design considerations for cleaning presently include hydraulic or mechanical means to remove any residual sludge.

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 loadout pits. Each transport cask will be sealed, and checked for contamination on the external surfaces, after being removed for the basin loadout 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 be removed from the basin and placed on a SNF transport trailer and readied for transport 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 1996a), CVD will be the first 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. As discussed in Section 2.0, this section of this NOC is submitted for approval.

The CVD process will be used to remove as much free water as possible from the MCOs before transportation to the CSB. Bulk water will be removed by pumping. Remaining absorbed and adsorbed water will be removed by heating[12] up to 75°C (167°F)[13] in a vacuum for a period of approximately 24 hours.

The CVD process will mitigate further SNF corrosion, reduce the potential for temperature driven excursions, and prevent excessive hydrogen buildup. The CVD process will not be expected to remove chemically-bound water (water chemically adhered to the SNF). It is estimated that approximately 2 kg (4 lbs) of chemically-bound water might not be removed by CVD; thereby, remaining in each MCO.

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[12] Heating would be accomplished by circulating heated water through the annulus between the MCO and the cask, allowing for a consistent thermal gradient throughout the MCO. The water would be heated using an electric hot water heater.

[13] The Phase I NOC referred to heating to 50°C (122°F). Although this is the current baseline, temperatures up to 75°C (167°F) are being evaluated.

Before transport, each MCO will be heated to, and held at, approximately 75°C (167°F) to verify that the MCO will not overpressurize during transportation to the CSB[14]. 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 mm Hg (3 lbf/in^2[g]) pressure. The MCOs will be released from the CVDF and transported on the SNF transport trailer by truck to the CSB.

2.3.1 Cold Vacuum Drying Facility Process Equipment

Each MCO will be emptied of bulk water and evacuated by a vacuum system to remove residual free water and to prevent atmospheric and other gases from reacting with the uranium metal of the SNF elements. The vacuum system will extend from the MCO (after the first isolation valve) to the exhaust manifold that interfaces with the CVDF ventilation exhaust system.

2.3.1.1 Vacuum Pumping System. The vacuum pumping system (VPS) for the CVDF drying module will consist of a single-stage vacuum pump, valves, traps, filters, instrumentation, and ducting that will achieve and maintain the required operating pressures in the MCO. The VPS will evacuate each MCO to remove residual free water and to prevent atmospheric and reactive gas species from reacting with the uranium metal of the SNF elements.

The VPS will remove gas species (volumetric, outgassing, residual free water, and in-leakage) from each MCO to the degree required for proper transport of each MCO within a transport cask to the staging area of the CSB. Gases to be removed include the following:

- Residual free water (as vapor) following bulk water pumping of the MCO
- Air from the initial evacuation of the MCO
- Inert gas (argon, helium, or nitrogen) used to backfill the MCO
- Tritium and fission gases generated by the SNF elements
- Atmosphere in-leakage.

The VPS will consist of one active pump per drying module. The system will contain filters to prevent the contamination of the downstream equipment. The VPS will control the internal pressure inside each MCO during the initial pumpdown to prevent the water from freezing and to achieve a pressure of 1.3 E+01 Pa (1 E-01 torr) for residual water vapor removal. The VPS will evacuate each MCO to an operating internal pressure in 24 hours with the gas loads at the average decay heat power condition.

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[14] Phase I referred to a 6-hour holding time at this temperature. Ongoing evaluations indicate that the holding time may be extended (e.g., up to 10 hours).

The VPS will control the introduction of inert gas for backfilling each MCO (normal shutdown) and in off-normal (non-emergency) shutdown conditions and will prevent contaminants from backstreaming to each MCO through the use of the inert gas purge system. All valves will have electropneumatic operators. The VPS will be designed to assist in the helium leak checking of each MCO following installation of the top shield.

2.3.1.2 Multi-Canister Overpack/Cask Temperature Control System. The MCO/cask and temperature control system for the CVDF will provide all necessary equipment and controls to allow the efficient and timely heatup and cooling of each MCO/cask to approximately 75°C (167°F) for post-CVD monitoring. The MCO/cask will be cooled to approximately 10°C (50°F) for safe cold standby condition or 25°C (77°F) for nominal transport condition. The heating system also will provide heating of the vacuum piping to prevent condensation of water occurring in the piping leading to the system condenser and the residual gas analyzer.

2.3.1.3 Solid and Water Collection System. The solid and water collection system for the CVDF will consist of collection tanks, transfer pumps, piping, and valves for disposal of water from the MCO, and a radioactive liquid waste system (Figure 13)[15]. The solid and water collection system will provide for the disposal of HEPA filters, and any contaminated equipment at end of the project.

2.3.1.4 Cold Vacuum Drying Facility Structures and Auxiliaries. The CVDF structures and auxiliary systems will consist of concrete pads, confinement, shielding walls, cranes, handling equipment, fixtures, remote connection equipment, process HVAC systems, electric load centers, inert gas bottle racks, water supplies and drains, area public address/alarms, telephones, data acquisition and control centers, fire protection systems, area radiation detectors, and security detection interfaces for the CVDF.

2.3.2 Process Steps

The sequence of actions expected to occur in the CVDF is shown on Figure 14 and described in the following.

The MCO/cask SNF transport trailer will be aligned in the CVD process bay; the truck will be disconnected from the SNF transport trailer and driven out of the station. The cask external surface dose rate will be surveyed by CVD module instrumentation and verified to be acceptable for personnel access. The SNF transport trailer could be secured to the

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[15] The water collection system will include a radioactive liquid waste system. The current concept for the radioactive liquid waste system is shown in Figure 13. The system also would include any appropriate piping and/or valving for truck transfer capability.

foundation due to seismic concerns[16]. The process bay doors will be closed, sealing the SNF transport trailer within a radiological confinement zone.

The cask top cover will be removed and the ventilation hood installed over each MCO/cask top. Each MCO HEPA filter will be isolated (blank flange installed). The MCO will be sealed by ensuring the mechanical closure is closed properly for CVD or the MCO shield plug will be weld sealed before CVD. Either method will ensure that when CVD begins, the MCO will be able to be pressurized. The process bay drying system will be connected to each MCO, and the free water pumping process will begin.

The MCO/cask annulus water heating/cooling system will be connected and a water outlet temperature of up to 75°C (167°F) will be obtained[17]. This will achieve a hot standby condition for the SNF, which will allow a quicker drying cycle. The heatup rate of 20°C (35°F) per hour will be achieved by circulating heated water at 94 L/min (25 gal/min) in the MCO/cask annulus. Each MCO could be cooled to 10°C (50°F) by the water heating/cooling system. This latter condition will be the safe cold standby condition for the SNF.

The initial removal of the free water from each MCO will be by inert gas purging and suction pump [nominal removal rate shall be 37 L/min (10 gal/min)]. The nominal amount of bulk water is 685 L (181 gal) for MK1A SNF and 571 L (151 gal) for MK1V SNF. The water will be drained and transferred to the drying station radioactive water storage tank. Following bulk water draining, each MCO could be optionally purged with an inert gas at a rate of 0.1 to 0.2 m^3/min (3 to 5 std ft^3/min) for approximately 40 to 60 minutes. This step will partially dry the SNF and sweep loose particulate into the internal MCO HEPA filter. Following the pump and purge operation, there will be absorbed and adsorbed water left on the internal surfaces of each MCO and surfaces of the SNF elements. Also, less than approximately 300 ml (10 ounces) of water will be left at the lower end of the axial dip tube. Each MCO will be evacuated to an initial pressure in the range of 1.3 E+03 Pa to 1.3 E+04 Pa (10 to 100 torr) (to the vapor pressure of water at the saturation temperature) by the VPS.

As each MCO is heated, the vapor pressure of the water in the MCO will increase to a minimum of 1.9 E+04 Pa (139 torr) at 75°C (167°F)[18]. As the absorbed and adsorbed

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[16] Ongoing design evaluation will determine the necessity for seismic restraint of the SNF transport trailer.

[17] Phase I indicated a water outlet temperature of 50°C (122°F) would be obtained. Ongoing evaluations indicate that a water outlet temperature as high as 75°C (167°F) may be used.

[18] Phase I discussed a pressure of 1.2 E+04 Pa (92.5 torr) at 50°C (122°F). It is anticipated that the temperature could be as high as 75°C (167°F).

waters are depleted by evacuation, the MCO pressure will be reduced to less than 65 Pa (0.5 torr). During the evacuation period, a combination of an inert gas purge and a throttle valve adjustment will prevent the pressure from being lower than 650 Pa (5 torr) to mitigate water freezing in the MCO. The purge will be interrupted at the end of the drying phase to achieve a base pressure of 390 Pa (3 torr) or less. The purge will be stopped for no more than 60 minutes at a time (the vacuum pump will be isolated if purge cannot be re-established within the 60 minute period). To satisfy the initial drying criteria, a water vapor pressure of less than 390 Pa (3 torr) will be required during a 1-hour hold period with the VPS isolated. The residual free water removed by the VPS will be collected in a condenser and drained to the CVD process bay radioactive water storage tank[19].

The VPS and inert gas purge systems will then be isolated, the MCO will be heated to 75°C (167°F) for two to six hours, and the MCO total and partial pressures will be monitored for up to ten hours[20]. The partial pressure increase rates for argon, hydrogen, krypton, nitrogen, oxygen, and water will be measured. Upon verification that the monitored conditions are acceptable, the MCO will be lowered to a temperature of 25°C (77°F) and readied for transfer to the CSB.

The MCO will then be backfilled with an inert gas and slightly pressurized. The process connections will be removed and blank flanges will be installed. The MCO process, vent, and pressure relief ports will be helium-leak checked to ensure that the MCO is sealed during transport to the CSB. The MCO/cask annulus will be drained of water, purged with an inert gas[21], and back filled with an inert gas to approximately 155 mm Hg (3 lbf/in^2[g]) pressure.

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 might rise slightly

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[19] Before transfer to the radioactive water storage tank (that vents from the CVDF), process water will be subjected to ion exchange to reduce the level of contamination. This process water, containing radioactive and toxic materials, will be transferred intermittently (e.g., trucked) to the K Basins for additional treatment before transport to the Effluent Treatment Facility (ETF) in the 200 East Area, or trucked directly to the ETF, depending upon levels of contamination.

[20] Phase I discussed heating for 6 hours, and monitoring for 6 hours. Ongoing evaluations indicate that a 2-hour minimum heating period might be sufficient, and that monitoring might be conducted for up to 10 hours.

[21] Rather than "vacuum drying" as referred to in the Phase I submittal, the MCO/cask annulus will be purged with an inert gas after draining.

and some hydrogen might be generated from the reaction of residual water with the SNF. The hydrogen generation reaction rate doubles for each 8 to 11°C (15 to 20°F) temperature rise. The MCOs are expected to arrive at the CSB with a total internal pressure of approximately 1,000 to 1,600 mm Hg (20 to 30 lbf/in^2[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 be monitored and, if required, connected to a purge system at the receiving station. Monitoring will identify gas build up due to oxidation.

Connected by a single pipe, the purge system consists of an inert gas cylinder and a vacuum pump that 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 change its operation to flow inert gas into the MCO for purging. When the purge system is coupled to each MCO fitting, gas contained in each MCO will flow through a canister-type testable 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 purge line equipped with canister-type testable HEPA filter, 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 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 canister-type HEPA filter[22] will be removed, the cover will be replaced, and the covers on each MCO HEPA filter and rupture disc will be removed to activate.

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. 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 fitting for depressurizing or purging the storage tube. The storage tube HEPA filter on the vent is not testable in service; however, it is

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[22] Phase I referred to the fitting as a "quick-connect" type. Ongoing evaluations will determine the necessity of the quick-connect feature.

pre-tested and has the same effectiveness as the main ventilation filters. It is intended that the MCOs will be sealed with pressure relief protection during staging[23].

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 2-year period to remove and stage all of the SNF from the basins. The MCOs will be staged until hot vacuum conditioned and placed into interim storage.

2.5 HOT CONDITIONING SYSTEM

The following information was first presented in the *Hot Conditioning Trade Study* (Fluor Daniel, Inc. 1995). Since then, a design firm to complete the final design of the HCSA and conditioning equipment to be used to perform the final step prior to interim storage of the SNF has been contracted. The following is a brief summary to provide an overview of the interaction between the CVDF and HCSA.

Hot conditioning of SNF contained in the MCOs will be performed in the HCSA. Hot conditioning will ensure that gas generated from the radiolysis of water and other potential volatilized material does not exceed the sealed MCO design pressure limits. Hot conditioning will consist of heating the SNF to approximately 300 to 350°C (572 to 662°F) under vacuum. This will remove the chemically bound water and cause a significant portion of the uranium hydride that might be present to decompose and release hydrogen from the SNF. A passivation step will be completed to reduce the overall reactivity of the SNF. In the passivation step, each MCO would be cooled to 150°C (302°F) and a controlled amount of oxygen (in an inert gas diluent) will be added to each MCO to oxidize any highly reactive surfaces.

The process equipment required for HCS will consist of seven similar hot conditioning process stations, six operational and one auxiliary pit that 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 consist of a process pit and a process module. The process pit will hold the oven where the MCO will be heated and the SNF conditioned. The process module will be a skid that contains the hot conditioning process equipment. The process piping connecting the MCO and oven to the process module will be located in a trench below the HCSA floor.

[23] Phase I discussed "...provisions have been made for venting the MCOs during staging, if necessary...". It has been determined that it is not necessary to vent the MCOs during staging.

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 MCOs 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 to a yet undefined processing plant. Because the exact outcome of the SNF is not yet defined, the MCOs may stay in interim storage for up to 40 years. In addition to the expected 40-year interim storage period, provisions can be made for extending storage to 75 years, if necessary. The project goal is to store the SNF in sealed vessels with no emissions being generated during interim storage.

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3.0 EMISSION SOURCE

No significant emissions are expected during construction of the CVDF substructure, which includes, but is not limited to, pouring the concrete for the floor, and construction of the exterior walls. The emissions generated at the CVDF will be caused by the process equipment and actual processing of the SNF in the MCOs. Installation of the process equipment and associated air pollution control and ventilation system will not occur until this Phase II NOC is approved.

An estimate of the pollutants that could be contained in the MCOs has been established based on sound engineering judgment and process knowledge. Because of the engineered fuel cleaning processes (Section 2.2), potential toxic pollutants are limited to materials related to the fuel. Based on the process description in Section 2.0, there is a very small chance that free water contained and pumped 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 CVDF.

The following sections provide descriptive text and a quantitative discussion of toxic air pollutants that might be released to the environment as a result of CVDF operations.

3.1 TOXIC AIR POLLUTANTS

Table 1 lists those pollutants that have a potential to be released from the CVDF as a result of operations.

As shown in Table 1, all Class A and Class B Toxic Air Pollutants are well below even the most restrictive small quantity emission rate standards per WAC 173-460-080.

The potential quantitative releases associated with toxic air pollutants from the CVDF process water truck tanker transport are considered in this Phase II NOC. For purposes of this Phase II NOC, a conservative estimate of potential air toxic releases is provided, based on a methodology previously submitted to Ecology for approximately 79,500 liters of 25 volume percent tributyl phosphate (TBP) in normal paraffin hydrocarbon (NPH) diluent associated with the Hanford Site's Plutonium-Uranium Extraction (PUREX) Facility [Telephone Conference Memorandum, DOE-RL (S. D. Stites)/WHC (J. J. Luke) and Ecology (R. C. King and S. E. Brush), August 13, 1993]. The calculations (Attachment) estimate that under worst-case conditions, a total of approximately 228 milliliters of TBP would be released to the atmosphere from evaporation. This number was based on approximately eight loads at approximately 28 milliliters each. Although the CVDF will not contain TBP or other volatile organics, it would be expected that, on a 'per process water truck transport' basis, the volume of material would be the same for TBP or for CVDF

Table 1. Potential Quantitative Releases from the Cold Vacuum Drying Facility Toxic Air Pollutants*.

Constituent	Class A/B	Concentration in canister sludge (ug/g)	Fraction which becomes airborne	Fraction released from HEPA filters	Total Annual release (kg/yr)	Total Annual Release (lb/yr)
Beryllium	A	3.20 E +01	1.00 E -03	3.33 E -04	1.68 E -08	3.70 E -08
Cadmium	A	6.30 E +01	1.00 E -03	3.33 E -04	3.31 E -08	7.28 E -08
Chromium	A	1.19 E +03	1.00 E -03	3.33 E -04	6.25 E -06	1.38 E -05
Nickel	A	2.26 E +01	1.00 E -03	3.33 E -04	1.19 E -08	2.62 E -08
Lead	A	7.14 E +02	1.00 E -03	3.33 E -04	3.75 E -07	8.25 E -07
Antimony	B	3.24 E +01	1.00 E -03	3.33 E -04	1.70 E -08	3.74 E -08
Barium	B	4.07 E +02	1.00 E -03	3.33 E -04	2.14 E -07	4.71 E -07
Manganese	B	6.16 E +02	1.00 E -03	3.33 E -04	3.24 E -07	7.13 E -07
Uranium	B	9.67 E +03	1.00 E -03	3.33 E -04	5.10 E -05	1.12 E -04
Zirconium	B	6.63 E +02	1.00 E -03	3.33 E -04	3.48 E -07	7.66 E -07

* Based on an estimated 1.58 E+06 grams per year of canister sludge (i.e., fuel corrosion product). Although dealing with nonradioactive emissions, for conservatism the fraction that becomes airborne was based on 40 CFR 61, Appendix D, "Methods for Estimating Radionuclide Emissions."

process water. Assuming one transfer per week (52 weeks per year), the total annual airborne release would be no greater than approximately 1,500 milliliters (1.5 liters). Note that the TBP, being an organic, would tend to evaporate much more readily than the process water associated with the CVDF.

3.2 BEST AVAILABLE CONTROL TECHNOLOGY FOR TOXICS (T-BACT)

As described in Section 3.2, potential emissions from the CVDF are comprised of Class A and Class B particulates (no volatile organics are associated with the fuel or corrosion products), all of which are below small quantity emission rate standards. Further, the CVDF design includes HEPA filtration, which has been recognized by the State of Washington Department of Health as "best available radionuclide control technology" (BARCT) for particulates. Therefore, the minimal potential releases from the CVDF, coupled with the emission control system, comprise necessary T-BACT requirements associated with this Phase II NOC.

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4.0 REFERENCES

DOE, 1996, *Final Environmental Impact Statement: Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington*, DOE/EIS-0245-F, U.S. Department of Energy, Richland, Washington.

DOE/RL, 1993, Telephone Conference Memorandum, DOE-RL (S. D. Stites)/WHC (J. J. Luke) and Ecology (R. C. King and S. E. Brush), August 13, 1993.

DOE/RL-96-55, *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--Cold Vacuum Drying Facility, Project W-441*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, EPA, and DOE-RL, 1996, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department of Ecology, U.S. Environmental Protection Agency, U.S. Department of Energy, Richland Operations Office, Olympia, Washington, amended periodically.

Fluor Daniel, Inc., 1995, *Hot Conditioning Trade Study*, Fluor Daniel, Inc. for Westinghouse Hanford Company, Richland, Washington.

LATA/BNFL/Foster Wheeler, 1996, *Spent Nuclear Fuels, Fuel Retrieval Sub-Project Conceptual Design Report*, Volume I and II, L/B-SD-SNF-RPT-09, Revision 0, LATA/BNFL/Foster Wheeler for Westinghouse Hanford Company, Richland, Washington.

WHC, 1994, *Integrated Process Strategy for K Basins Spent Nuclear Fuel*, WHC-SD-SNF-SP-005, Volume 1, Rev, 0, July 1995.

WHC, 1996a, *Conceptual Design Report for the Cold Vacuum Drying System*, WHC-SD-SNF-CDR-003, Revision 0, Merrick & Company for Westinghouse Hanford Company, Richland, Washington.

WHC, 1996b, *Performance Specification for the spent Nuclear Fuel Multi-Canister Overpack*, WHC-S-0426, Revision 1, Westinghouse Hanford Company, Richland, Washington.

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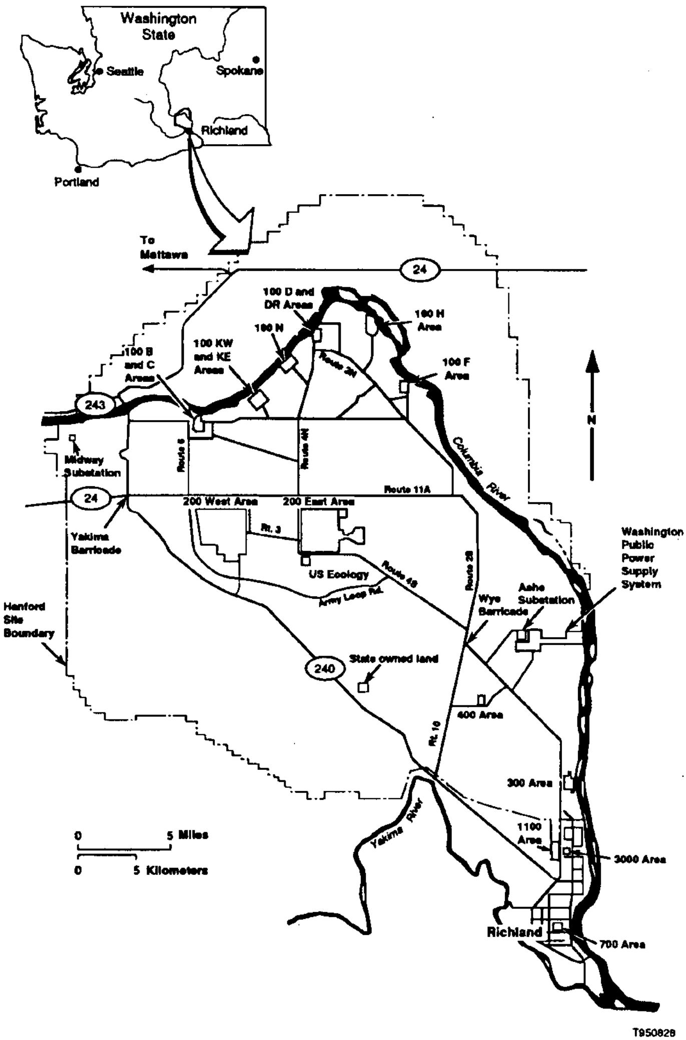

Figure 1. Hanford Site and Vicinity Map.

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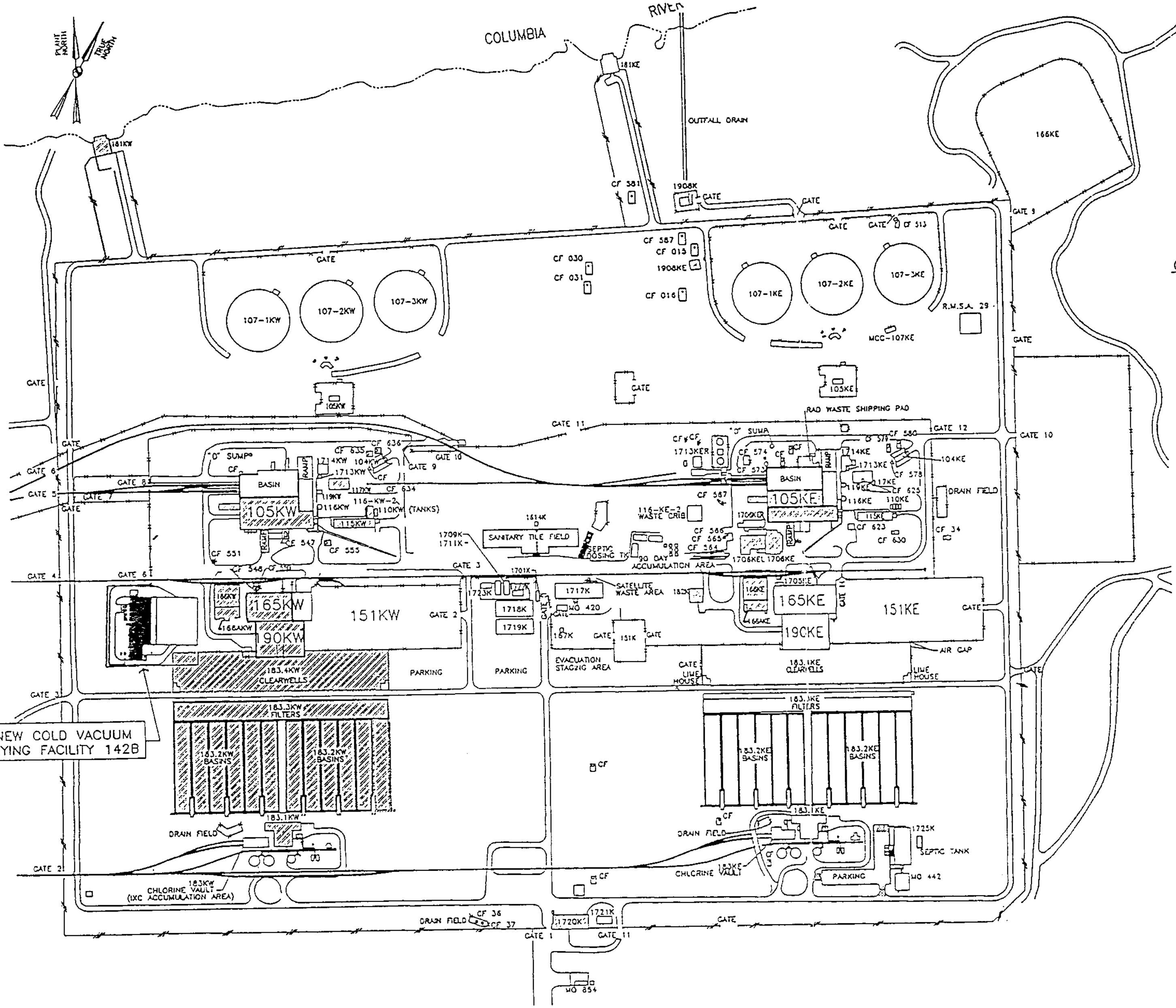

GENERAL NOTES:

1. DRAWING IS FOR LAYOUT AND ARRANGEMENT REFERENCE ONLY.
2. DO NOT SCALE DRAWING FOR CONSTRUCTION OR ENGINEERING PURPOSES.
3. DRAWING H-1-5595 SHTS 1 THRU 4 (ELECT DISTRIBUTION MAP).

K BASIN O & M FACILITIES DESCRIPTION			
K EAST		K WEST	
105 KE	WATER TUNNELS, BASIN, OFFICE & FUEL TRANSFER AREA	105 KW	WATER TUNNELS, BASIN, OFFICE & FUEL TRANSFER AREA
119 KE	EXHAUST AIR SAMPLE BUILDING	119 KW	EXHAUST AIR SAMPLE BUILDING
1614 KE	ENVIRONMENTAL MONITORING STATION	165 KW	SWITCH GEAR, CONTROL ROOM
165 KE	POWER CONTROL BUILDING ELECT SWITCH GEAR, CONTROL ROOM	183 KW	CHLORINE VAULT
166 AKE	MATERIAL STORAGE BUILDING	1713 KW	WAREHOUSE/SHOP
181 KE	RIVER PUMP HOUSE	1714 KW	OIL/PAINT STORAGE
183 KE	CLEARWELLS, FILTERS, SEDIMENTATION BASINS, HEADHOUSE, CHLORINE VAULT		
190 KE	MAIN PUMP HOUSE		
1705 KE	EFFLUENT WATER TREATMENT		
1713 KE	SHOP BUILDING		
1714 KE	OIL & PAINT SHOP		
1717 KE	MAINTENANCE SHOP		
1717 AKE (167K)	FAN HOUSE		
1908 KE	OUTFALL INSTRUMENTATION BUILDING		
1908 K	OUTFALL STRUCTURE		

BUILDING	MO
1701K	MO 214
1709K	MO 102
1711K	MO 101
1718K	MO 401
1719K	MO 402
1721K	MO 382
1722K	MO 907
1723K	MO 928
1725K	MO 923

LEGEND

- CF - CONFINED SPACE
- PERIMETER FENCES
- SECURITY, WARNING FENCES
- RAILROADS
- ROADS
- UNIMPROVED ROADS
- GATE
- BUILDINGS
- D & D AREA OR HANFORD ANALYTICAL SERVICES
- CONCRETE PADS

Figure 2. Cold Vacuum Drying Facility Site Location.

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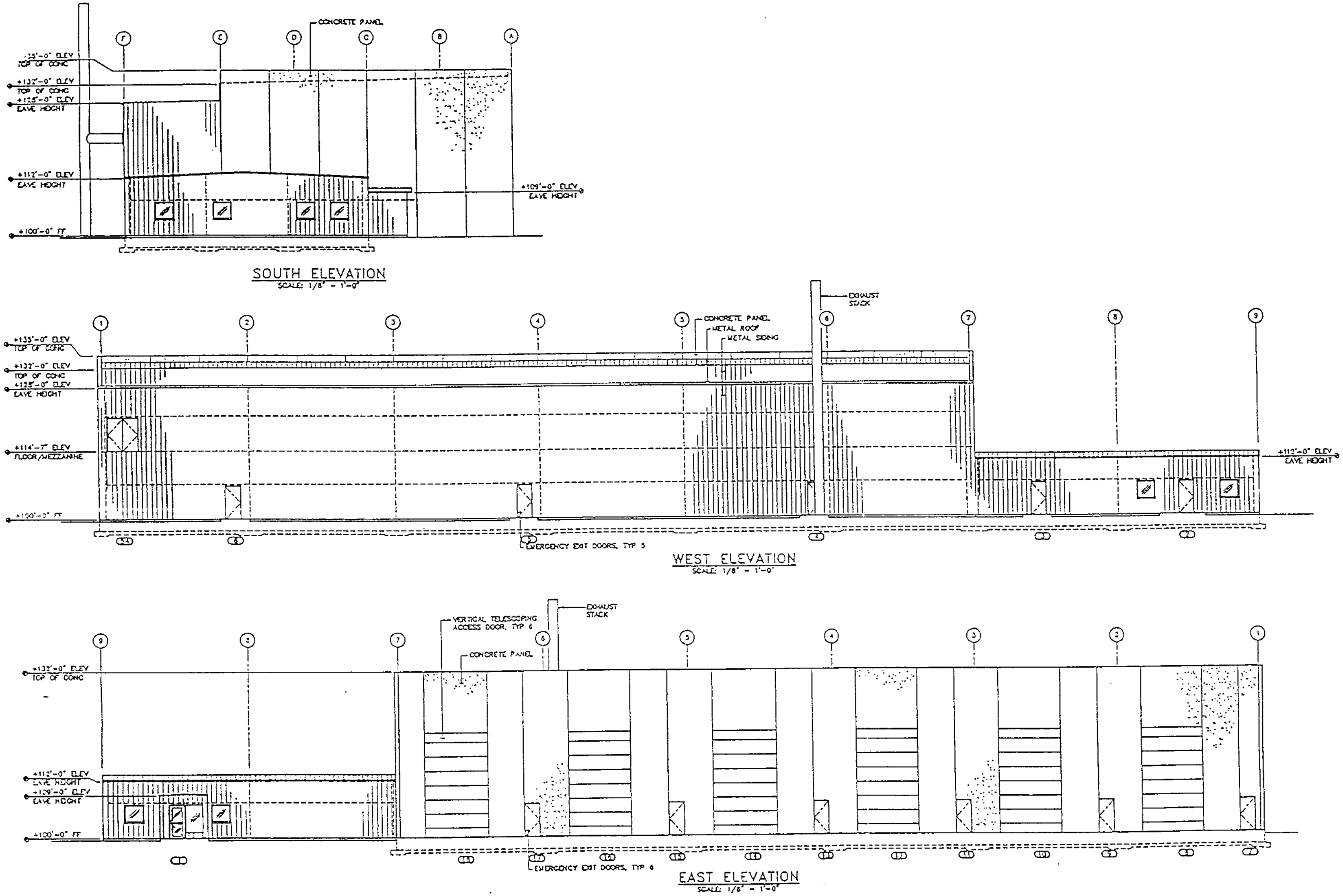

Figure 3. Architectural Building Sections
Cold Vacuum Drying Facility.

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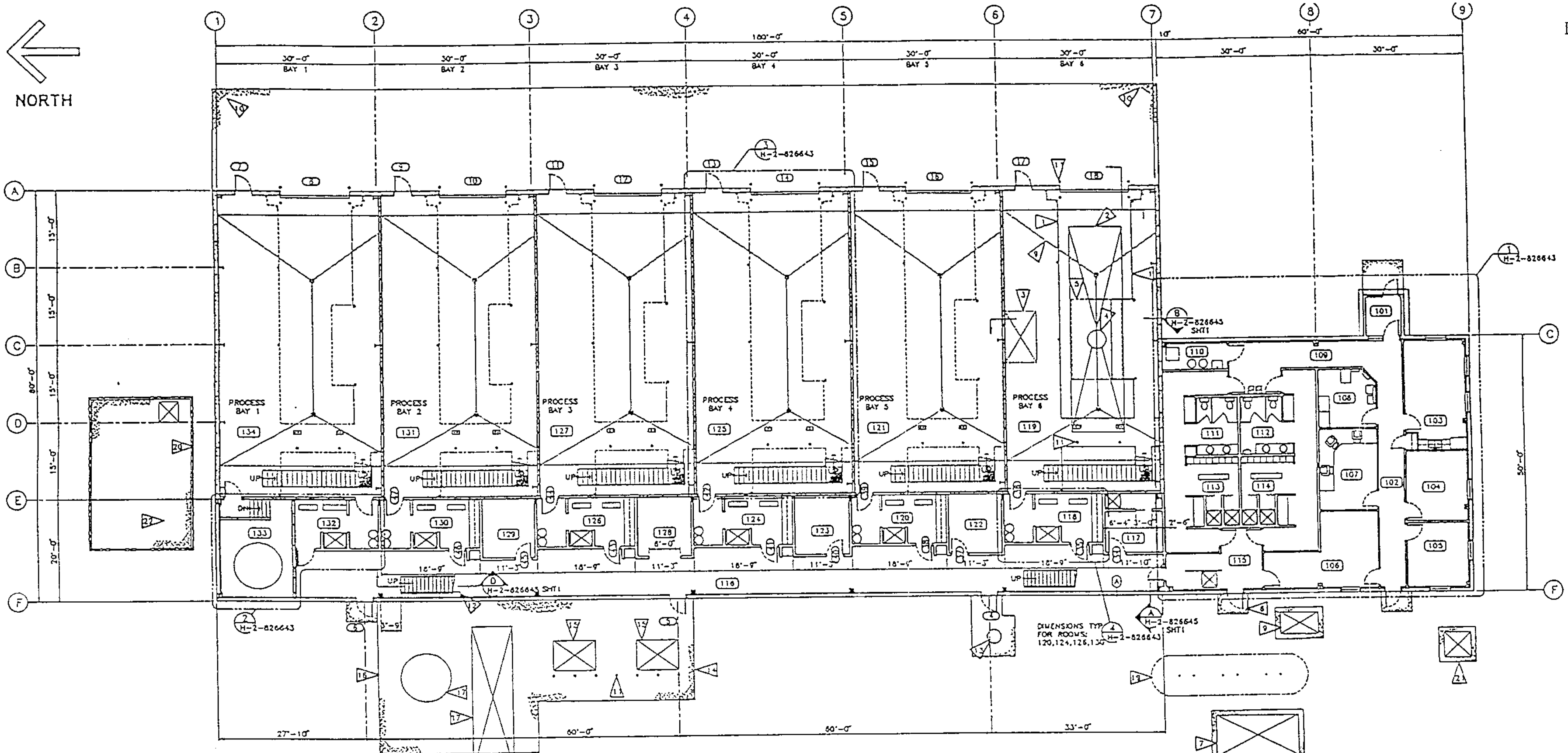

FIRST FLOOR PLAN
SCALE: 1/8" = 1'-0"

FLAG NOTES

1. OUTLINE OF MEZZANINE ABOVE
2. TRANSPORTER
3. PUMP ASSEMBLY EQUIPMENT (SKID)
4. CASK
5. OUTLINE OF TRANSPORTER MOUNTED MEZZANINE.
6. 4'-0"x8'-0" CONCRETE PAD. TYP 4 LOCATIONS.
7. BACKUP ELECTRICAL POWER GENERATOR ON CONCRETE PAD
8. PERSONNEL CONTAMINATION MONITOR
9. FLOOR SLOPE, SEE STRUCTURAL
10. CONCRETE APPROACH APRON
11. STEEL PIPE BOLLARD
12. GAS MANIFOLD
13. EXHAUST STACK
14. 20'x30' CONCRETE PAD
15. HVAC CONDENSER/ COMPRESSOR UNITS
16. 30'x30' CONCRETE PAD
17. GAS STORAGE TANKS (1 EACH OF NITROGEN AND HELIUM)
18. NOT USED
19. SANITARY SEWER HOLDING TANK (UNDERGROUND)
20. PROCESS BAY FLOOR DRAIN RETENTION BASIN WITH GUARD RAIL PROTECTION
21. ELECTRICAL TRANSFORMER ON CONCRETE PAD
22. SPILL COLLECTION/ MONITORING TANK

LEGEND

PCM	PERSONNEL CONTAMINATION MONITOR
EWC	ELECTRIC WATER COOLER
MCO	MULTIPLE CANISTER OVERPACKS
FF	FINISHED FLOOR
ELEV	ELEVATION
TYP	TYPICAL
ANTI-C	ANTI-CONTAMINATION CLOTHING
TBD	TO BE DETERMINED
FD	FLOOR DRAIN
(000)	ROOM NUMBER
(00)	DOOR NUMBER

ROOM DESCRIPTION

ROOM NO.	ROOM DESCRIPTION	ROOM NO.	ROOM DESCRIPTION	ROOM NO.	ROOM DESCRIPTION
101	ENTRY VESTIBULE	113	WOMENS CHANGE ROOM	125	PROCESS BAY 4
102	CORRIDOR	114	MENS CHANGE ROOM	126	CHANGE ROOM 3
103	MEETING ROOM	115	CORRIDOR	127	PROCESS BAY 3
104	QUALITY ASSURANCE	116	TRANSFER CORRIDOR	128	MATERIAL STORAGE
105	SHIFT MANAGER	117	DECONTAMINATION ROOM	129	EQUIPMENT ROOM
106	HPT/RADIATION MONITOR	118	CHANGE ROOM 6	130	CHANGE ROOM 2
107	CONTROL ROOM	119	PROCESS BAY 6	131	PROCESS BAY 2
108	ELECTRICAL/TELECOMMUNICATION	120	CHANGE ROOM 5	132	CHANGE ROOM 1
109	CORRIDOR	121	PROCESS BAY 5	133	PROCESS WATER TANK ROOM
110	FIRE RISER/MECHANICAL ROOM	122	DI WATER EQUIPMENT RM	134	PROCESS BAY 1
111	WOMENS RESTROOM	123	SWIPE COUNT ROOM		
112	MENS RESTROOM	124	CHANGE ROOM 4		

NOTES

1. ALL WALLS ON THIS SHEET SHALL BE (G) UNLESS NOTED OTHERWISE.
2. FOR WALL TYPES SEE H-2-826643.

Figure 4. Cold Vacuum Drying Facility Architectural First Floor Plan.

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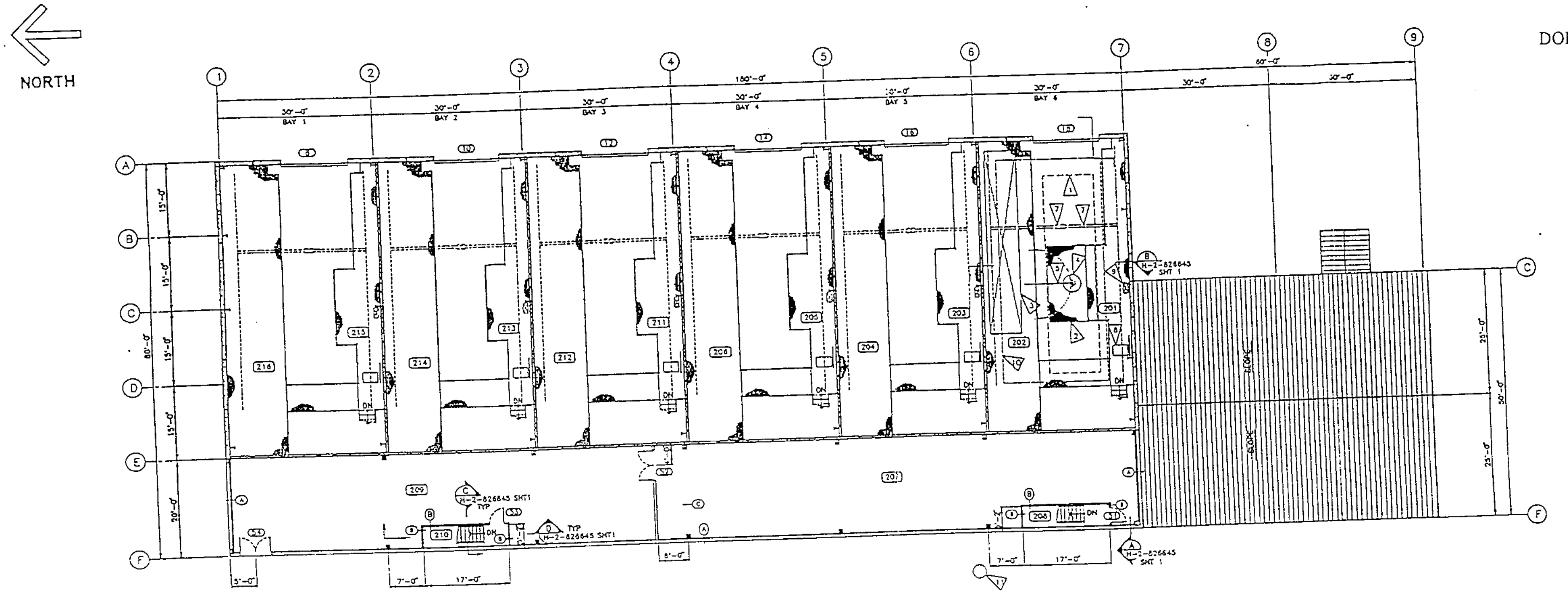

SECOND FLOOR PLAN
SCALE: 1/8" = 1'-0"

FLAG NOTES

1. OUTLINE OF TRANSPORTER BELOW
2. OUTLINE OF TRANSPORTER MOUNTED MEZZANINE
3. HVAC SYSTEM EXHAUST FANS & FILTERS
4. CASK
5. ARTICULATED JIB CRANE AND PUMP ASSEMBLY EQUIPMENT HOOD
6. NOT USED
7. OUTLINE OF 2 TON BRIDGE CRANE AND BEAMS ABOVE
8. STEP-OFF PAD AND HANDRAIL
9. EMERGENCY EYE WASH FOUNTAIN
10. OUTLINE OF CRANE HOOK TRAVEL LIMITS
11. EXHAUST STACK
12. HVAC SYSTEM WATER STORAGE TANKS
13. HVAC CHILLERS AND EQUIPMENT

ROOM DESCRIPTION

ROOM NO.	ROOM DESCRIPTION
201	HVAC MEZZANINE BAY 6
202	PROCESS MEZZANINE BAY 6
203	HVAC MEZZANINE BAY 5
204	PROCESS MEZZANINE BAY 5
205	HVAC MEZZANINE BAY 4
206	PROCESS MEZZANINE BAY 4
207	MECHANICAL ROOM
208	STAIR
209	MECHANICAL ROOM
210	STAIR
211	HVAC MEZZANINE BAY 3
212	PROCESS MEZZANINE BAY 3
213	HVAC MEZZANINE BAY 2
214	PROCESS MEZZANINE BAY 2
215	HVAC MEZZANINE BAY 1
216	PROCESS MEZZANINE BAY 1

NOTES

1. FOR NOTES AND LEGEND SEE H-2-826641.
2. FOR WALL TYPES SEE H-2-826643.

Figure 5. Cold Vacuum Drying Facility Architectural Second Floor Plan.

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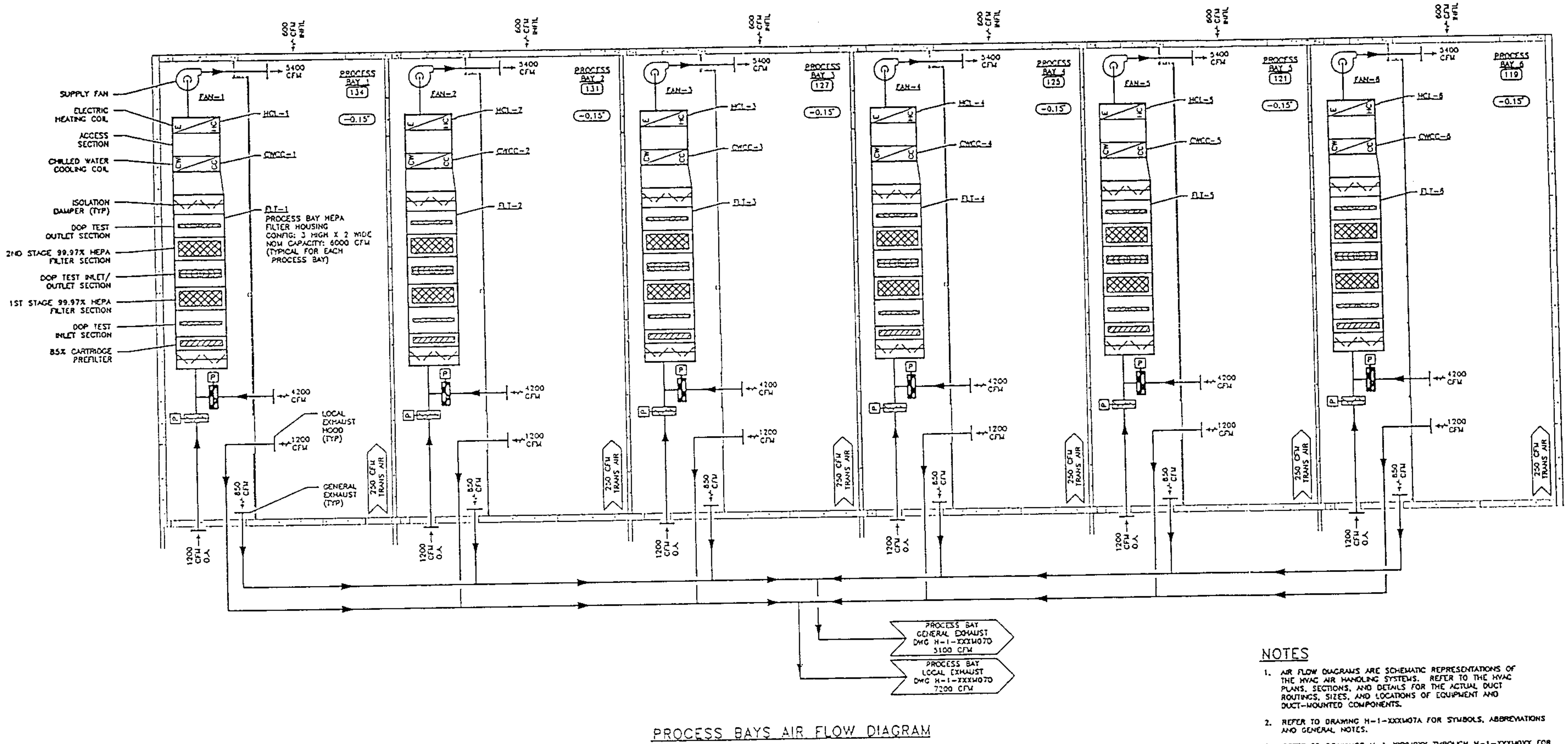

PROCESS BAYS AIR FLOW DIAGRAM

NOTES

1. AIR FLOW DIAGRAMS ARE SCHEMATIC REPRESENTATIONS OF THE HVAC AIR HANDLING SYSTEMS. REFER TO THE HVAC PLANS, SECTIONS, AND DETAILS FOR THE ACTUAL DUCT ROUTINGS, SIZES, AND LOCATIONS OF EQUIPMENT AND DUCT-MOUNTED COMPONENTS.
2. REFER TO DRAWING H-1-XXXH07A FOR SYMBOLS, ABBREVIATIONS AND GENERAL NOTES.
3. REFER TO DRAWINGS H-1-XXXH0XX THROUGH H-1-XXXH0XX FOR THE ASSOCIATED HVAC CONTROL DRAWINGS.
4. XXX

LEGEND

XXX — ROOM NUMBER
-X.XX" — ROOM DESIGN SPACE PRESSURE RELATIVE TO ATMOSPHERE
XXX-XXX — EQUIPMENT TAG NUMBER

Figure 6. Cold Vacuum Drying Facility Process Bays Air Flow Diagram.

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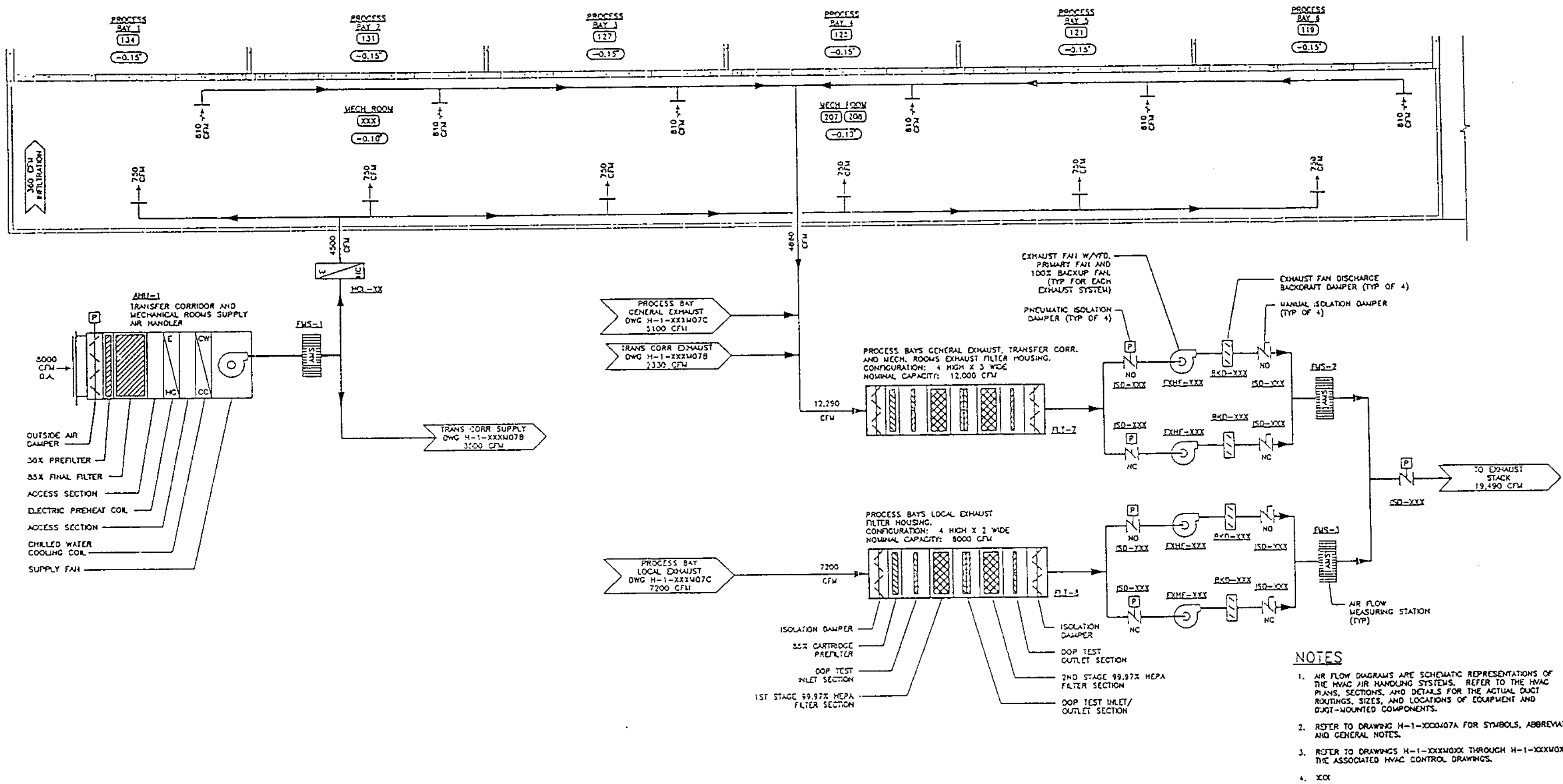

MECHANICAL ROOMS AIR FLOW DIAGRAM

NOTES

1. AIR FLOW DIAGRAMS ARE SCHEMATIC REPRESENTATIONS OF THE HVAC AIR HANDLING SYSTEMS. REFER TO THE HVAC PLANS, SECTIONS, AND DETAILS FOR THE ACTUAL DUCT ROUTINGS, SIZES, AND LOCATIONS OF EQUIPMENT AND DUCT-MOUNTED COMPONENTS.
2. REFER TO DRAWING H-1-XXXM07A FOR SYMBOLS, ABBREVIATIONS AND GENERAL NOTES.
3. REFER TO DRAWINGS H-1-XXXM0XX THROUGH H-1-XXXM0XX FOR THE ASSOCIATED HVAC CONTROL DRAWINGS.
4. XXX

LEGEND

XXX ROOM NUMBER
-X.XX" ROOM DESIGN SPACE PRESSURE RELATIVE TO ATMOSPHERE
XXX-XXX EQUIPMENT TAG NUMBER

Figure 7. Cold Vacuum Drying Facility Mechanical Rooms Air Flow Diagrams.

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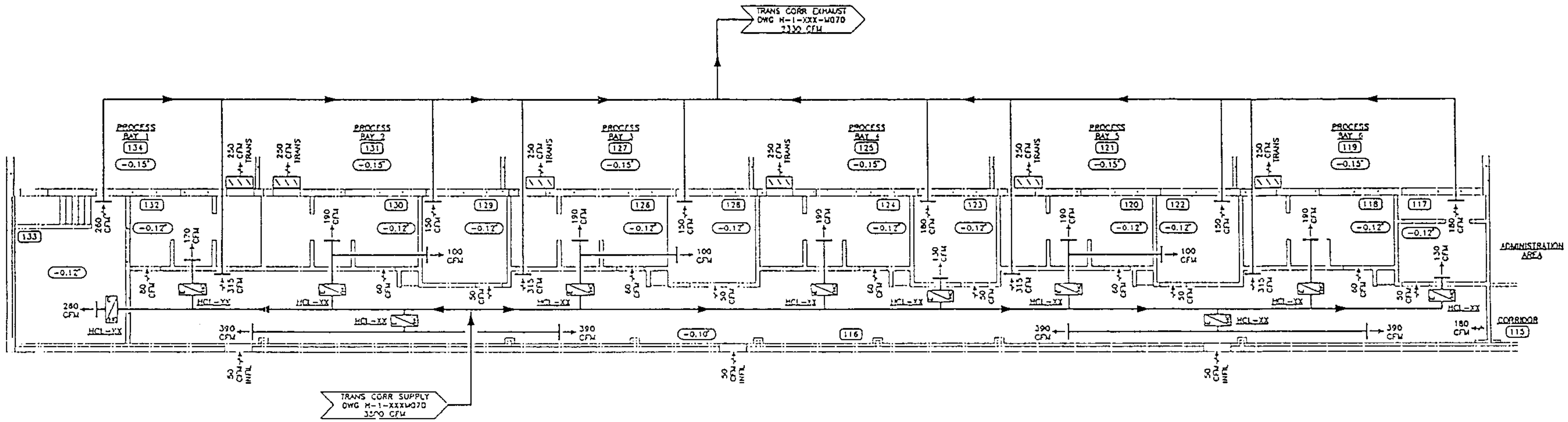

TRANSFER CORRIDOR AIR FLOW DIAGRAM

NOTES

1. AIR FLOW DIAGRAMS ARE SCHEMATIC REPRESENTATIONS OF THE HVAC AIR HANDLING SYSTEMS. REFER TO THE HVAC PLANS, SECTIONS, AND DETAILS FOR THE ACTUAL DUCT ROUTINGS, SIZES, AND LOCATIONS OF EQUIPMENT AND DUCT-MOUNTED COMPONENTS.
2. REFER TO DRAWING H-1-XXXM07A FOR SYMBOLS, ABBREVIATIONS AND GENERAL NOTES.
3. REFER TO DRAWINGS H-1-XXXM0XX THROUGH H-1-XXXM0XX FOR THE ASSOCIATED HVAC CONTROL DRAWINGS.
4. XXX

LEGEND

XXX	ROOM NUMBER
-X.XX"	ROOM DESIGN SPACE PRESSURE RELATIVE TO ATMOSPHERE
XXX-XXX	EQUIPMENT TAG NUMBER

Figure 8. Cold Vacuum Drying Facility Transfer Corridor Air Flow Diagram.

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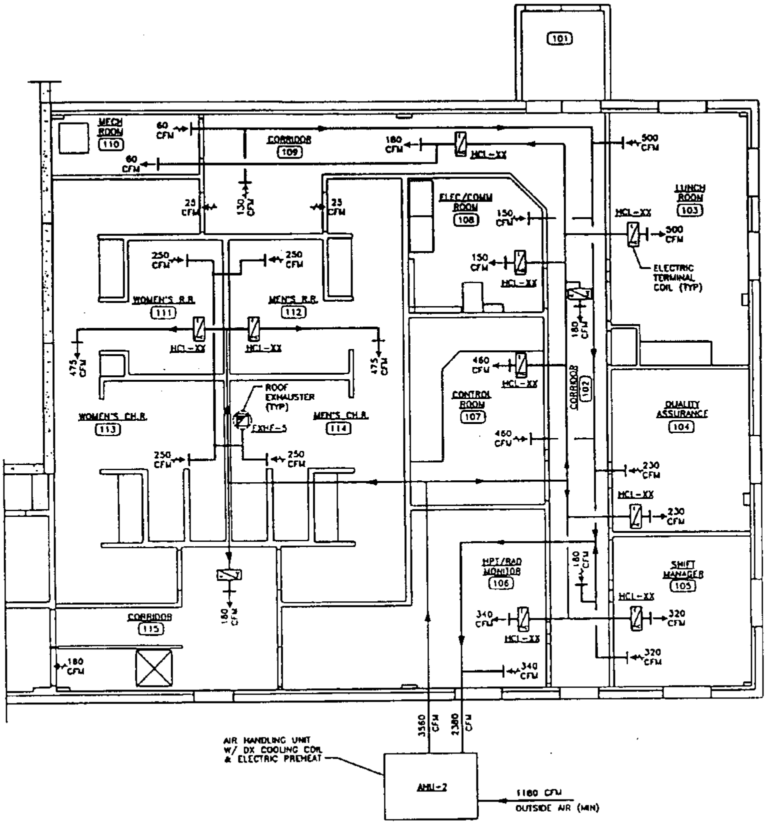

ADMINISTRATION AREA AIR FLOW DIAGRAM

NOTES

1. AIR FLOW DIAGRAMS ARE SCHEMATIC REPRESENTATIONS OF THE HVAC AIR HANDLING SYSTEMS. REFER TO THE HVAC PLANS, SECTIONS, AND DETAILS FOR THE ACTUAL DUCT ROUTINGS, SIZES, AND LOCATIONS OF EQUIPMENT AND DUCT-MOUNTED COMPONENTS.
2. REFER TO DRAWING H-1-XXXM07A FOR SYMBOLS, ABBREVIATIONS AND GENERAL NOTES.
3. REFER TO DRAWINGS H-1-XXXMOXX THROUGH H-1-XXXMOXX FOR THE ASSOCIATED HVAC CONTROL DRAWINGS.
4. XXX

LEGEND

XXX ROOM NUMBER
-X.XX ROOM DESIGN SPACE PRESSURE RELATIVE TO ATMOSPHERE
XXX-XXX EQUIPMENT TAG NUMBER

Figure 9. Cold Vacuum Drying Facility Administration Area Air Flow Diagram.

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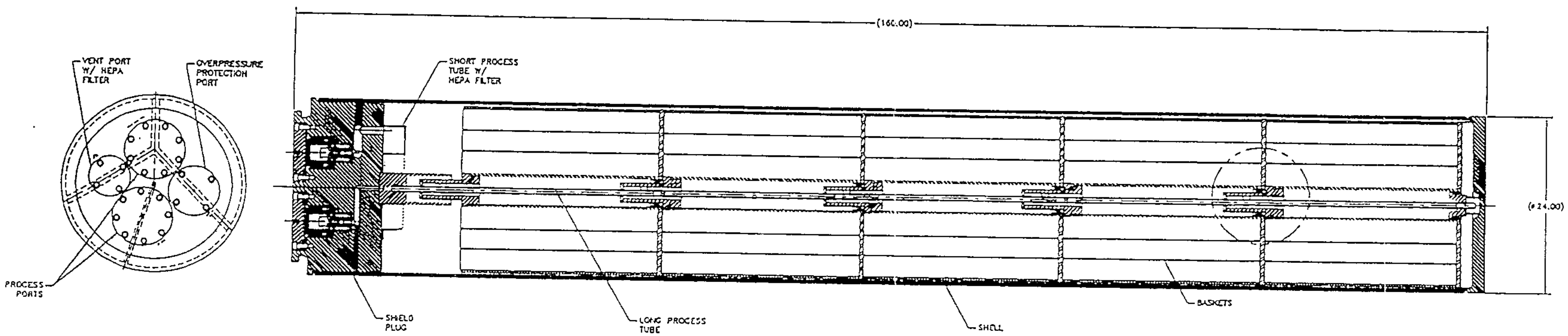

Figure 10. Multi-Canister Overpack Assembly Welded Closure.

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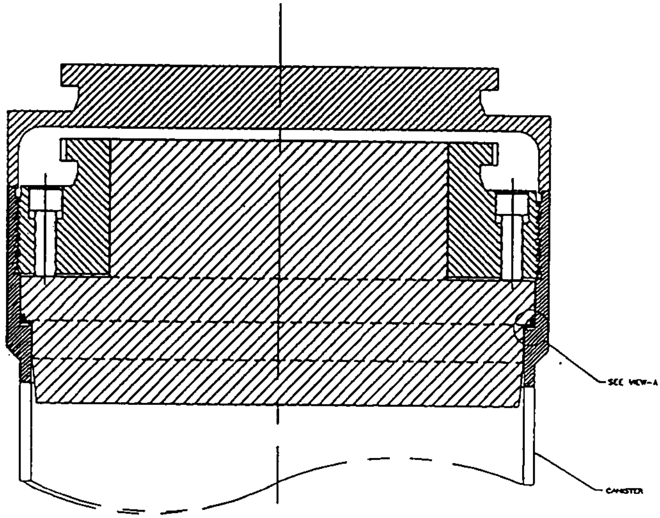

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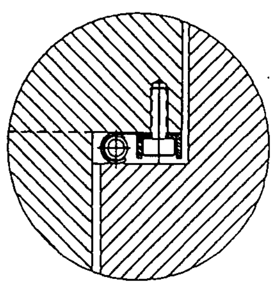

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Figure 11. Multi-Canister Overpack Mechanical Closure.

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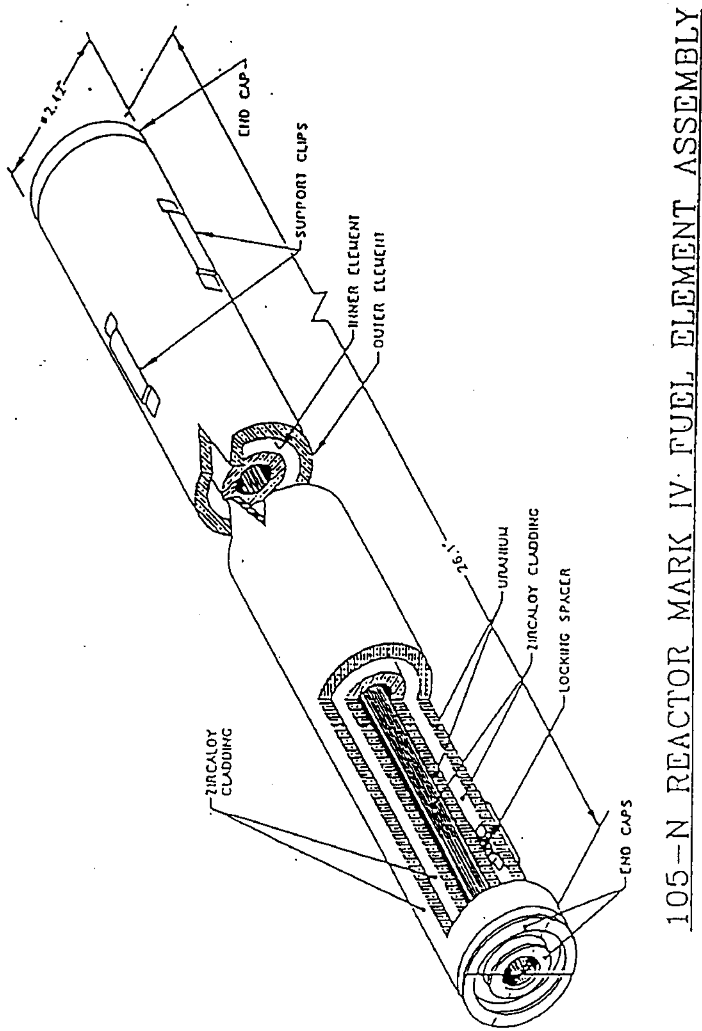

Figure 12. 105-N Reactor Mark IV Spent Nuclear Fuel Element Assembly.

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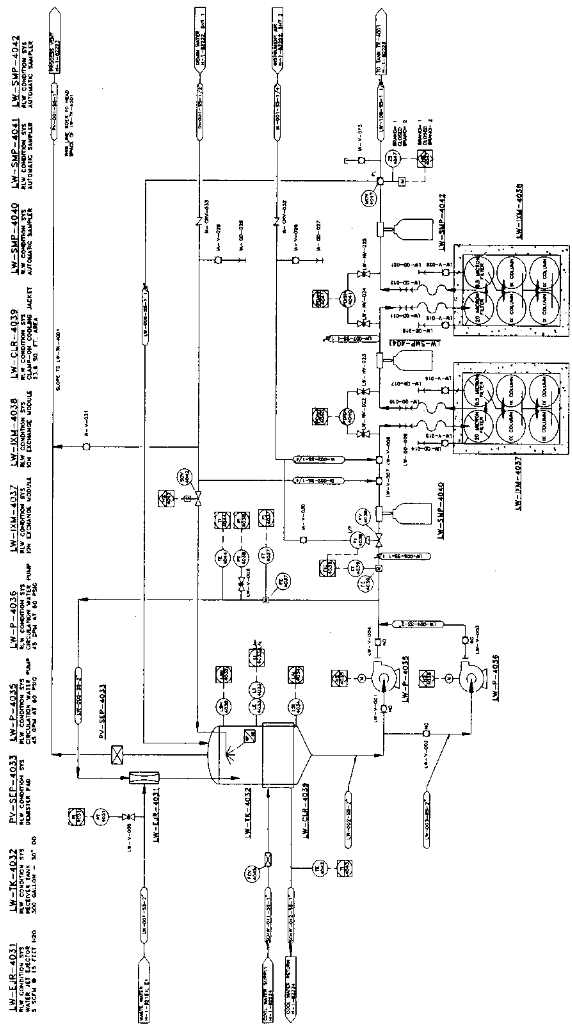

Figure 13. Radioactive Liquid Waste System.

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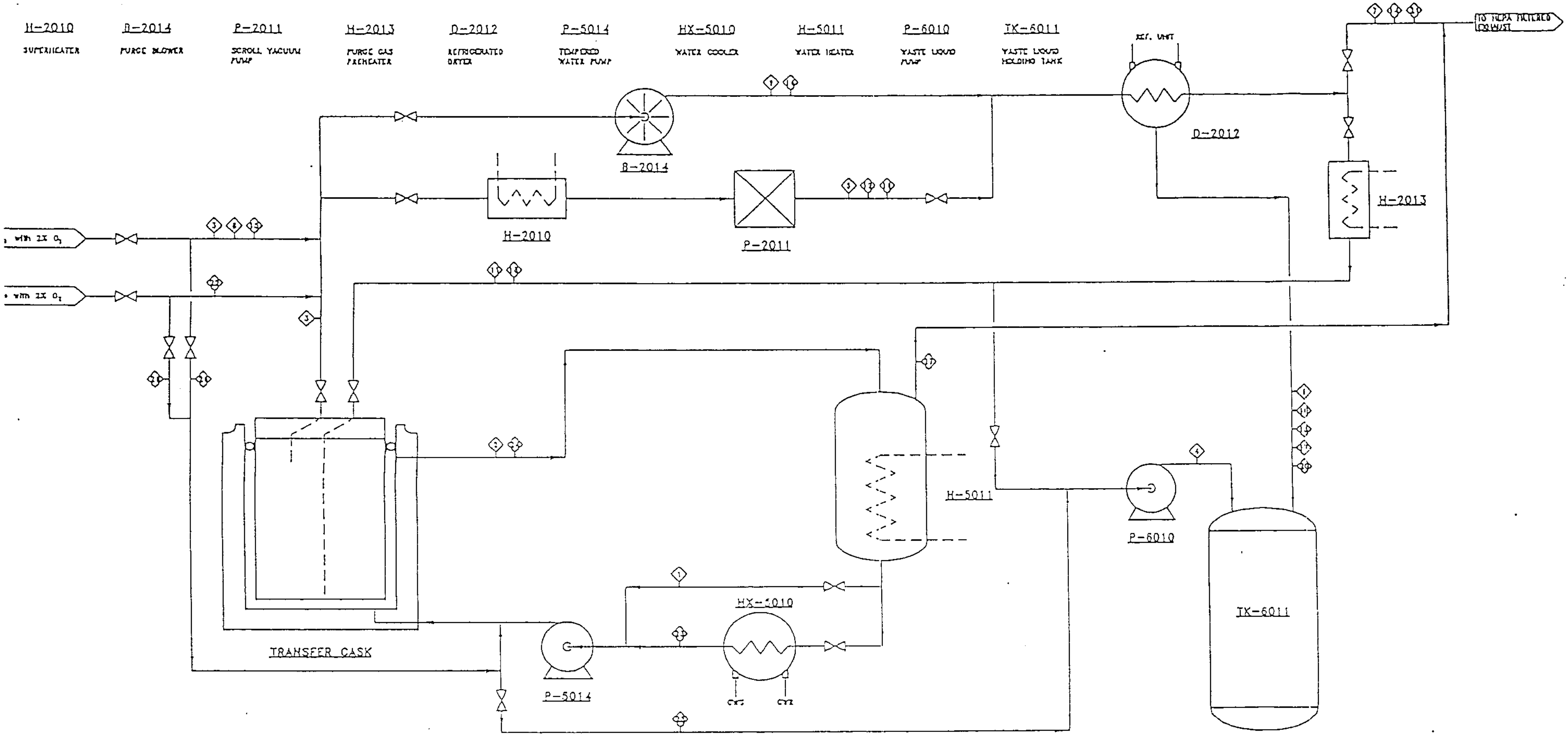

Figure 14. Cold Vacuum Drying Facility Process Flow Diagram.

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ATTACHMENT

ESTIMATED FUGITIVE EMISSIONS FROM PUREX ORGANIC SOLVENT TRANSFER

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ESTIMATED FUGITIVE EMISSIONS FROM PUREX ORGANIC SOLVENT TRANSFER

The projected fugitive emissions from transferring the PUREX solvent [75 volume % normal paraffin hydrocarbon (NPH), 25 volume % tributyl phosphate (TBP)] from tank G5 and tank R7 to a vendor tank truck was modeled as a liquid spill. The spill height was determined to be 6 feet: 5 feet from the inlet pipe to the bottom of the tank, and 1 foot of equivalent spill height. The 1 foot of equivalent spill height was calculated by determining the height required for gravitational forces to accelerate the liquid to 80 gallons per minute through a vertical two inch pipe. (80 gallons per minute is assumed to be the maximum discharge rate into the tank.)

The model considered dropping a 1 gallon batch from a height of 6 feet. The 1 gallon volume was determined by calculating the volume of a cylinder of liquid, 2 inches in diameter and 6 feet high. This models the liquid falling from the 2-inch pipe into the tank more accurately than dropping a 2,500 gallon volume all at once. The mass airborne from dropping 1 gallon was then multiplied by 2,500 to represent a continuous spill into the tank per 2,500 gallon batch. The amount of airborne TBP would be 28.59 milliliters per 2,500 gallon shipment, or 228.71 milliliters total.

The results from this model are very conservative for the following reasons.

1. The airborne material would be contained inside the air space of the tank and only could reach the environment through the 2-inch vent line of the tank. The time required to fill the tank and displace the air through the vent line (approximately 1/2 hour) would allow time for a fraction of the airborne material to condense or settle back into solution.

2. The spill height determines the amount of gravitational energy available to break up and rebound particles on impact. The spill height also influences the amount of time source material is exposed to shear forces during the fall; therefore, taller spill heights produce elevated airborne quantities. The model held the spill height constant at 6 feet; when in reality, the spill height would decrease as the tank truck filled.

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