CHAPTER 4.0
PROCESS INFORMATION

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4.0 PROCESS INFORMATION

This chapter discusses the processes involved in the operation of the Plutonium Uranium Extraction Facility (PUREX) Storage Tunnels. The PUREX Storage Tunnels are used for the storage of mixed waste from the PUREX Plant and other onsite sources.

The PUREX Storage Tunnels were designed and constructed to provide a means of protecting personnel and the environment from exposure to mixed waste associated with stored material. This design also serves to protect personnel and the environment from the dangerous waste component of the mixed waste stored inside the tunnels.

The PUREX Storage Tunnels are being permitted as a miscellaneous unit under Washington Administrative Code (WAC) 173-303-680. The WAC regulations require that miscellaneous unit permit terms and provisions address appropriate requirements provided for other treatment, storage, and disposal (TSD) units. Because the operation and construction of the PUREX Storage Tunnels most closely resemble that of a container storage unit, the appropriate requirements prescribed for a container storage unit are addressed in this chapter.

4.1 Operation of the PUREX Storage Tunnels

This section describes the selection, characterization, preparation, placement, and removal activities associated with storage of mixed waste in the PUREX Storage Tunnels.

4.1.1 Preparation for Tunnel Activities

Management, with the concurrence of an appropriate cognizant engineer, determines when material is to be removed and transported to the PUREX Storage Tunnels. A job specific work plan describing the overall transfer activities is prepared.

4.1.1.1 Storage/Removal Equipment Preparation

A remotely controlled, battery-powered locomotive normally was used to move railcars into and out of the PUREX Storage Tunnels. Other mechanical means such as a standard locomotive or a winch also can be used independently or in combination with the remote locomotive should the need arise. Methods for use of the remote locomotive are described in this chapter as this represents the normal placement and removal of railcars at the PUREX Storage Tunnels. Should storage activities require the use of a mechanical means other than the remote locomotive to place or withdraw a railcar, methods for that application will be developed.

Preparatory activities associated with the remote-controlled locomotive included the following:

- Charging the batteries for both the locomotive and the radio transmitter.
- Performing operational checks.
- Installing a plastic shroud over the locomotive to facilitate decontamination.
- Installing an anticoupling device on the south coupler of the locomotive (storage only).
- Performing physical inspections of the railroad track within the railroad tunnel to ensure that the track switches are positioned properly and the track is clear of obstructions.

4.1.1.2 Water-Fillable Door Preparation

Each PUREX Storage Tunnel has a water-fillable door that isolates the storage area from the PUREX railroad tunnel.

Currently, the water-fillable door to Tunnel Number 2 is empty and is not expected to be filled. Operational checks are performed on the door hoists. Before performing operational checks on the water-fillable door, the operator confirms with a dispatcher that the railroad tunnel area is clear of personnel.

4.1.1.3 Other Preparation Tasks

Before material storage, the following preparatory tasks are completed.

- The storage tunnel exhaust fan is verified to be operating.
- Labels will be attached to the railcar in accordance with WAC 173-303-395(6) and 173-303-630(3) if the material contains dangerous waste components.

4.1.2 Tunnel Storage Activities

This section describes the placement of material within the PUREX Storage Tunnels.

4.1.2.1 Physical Characterization of Material to be Stored

Physical characterization includes an evaluation of the following physical properties:

- Length, width, and height.
- Gross weight and volume.
- Preferred orientation for transport and storage.
- Presence of mixed waste.

Information sources used in physical characterization include equipment fabrication and installation drawings, operational records, and process knowledge. Physical characterization provides information necessary to appropriately describe the mixed waste materials. Such information also is used to design and fabricate, if required, supports on the railcar.

Specific material known to contain constituents that would cause the equipment to be designated as mixed waste is discussed in the waste analysis plan (Chapter 3.0). The material includes but is not limited to dissolvers that contain elemental mercury; silver reactors that contain silver salts; jumpers and other equipment that have elemental lead counterweights; a concentrator that contains chromium; neutron absorbing equipment containing cadmium. Characteristics of these materials when stored as mixed waste are described in Chapter 3.0. Waste transferred to the PUREX Storage Tunnels from other than PUREX Plant also would be physically characterized.

4.1.2.2 Material Flushing

Before removal from service, the material from the PUREX Plant was flushed to minimize loss of products, to reduce contamination, and to reduce to nonregulatory levels the concentration of any dangerous chemicals present in a residual heel. In the future the analysis of the rinsate will be used to determine when these goals have been achieved. The analysis of the final flush will be retained as part of the PUREX Storage Tunnel records. Material removed from other onsite units will be prepared for transfer to the tunnels in accordance with this dangerous waste permit.

4.1.2.3 Railcar Preparation

Railcars are modified to serve as dedicated storage platforms and transporters for material placed in the PUREX Storage Tunnels. The wooden decking on the railcars is removed to minimize the amount of combustible material placed in the PUREX Storage Tunnels. The south coupler is disabled or removed to prevent the railcar from coupling to the railcar stored ahead. Brakes are disabled to ensure freewheeling of the railcar. Steel decking, catch pans filled with absorbent, and equipment cradles are provided as needed to modify the railcar for its specific task.

4.1.2.4 Placement of Material into Storage Position

With all preparations complete and with the approval of cognizant management, transferring material to the PUREX Storage Tunnels proceeds as follows.

- The water-fillable door to the storage tunnel is opened.
- The railcar is loaded as specified in the storage tunnel checklist.
- An inventory of items loaded on the railcar and a record of their location on the railcar are recorded in the storage tunnel checklist.
- A survey is obtained of the loaded railcar at a distance commensurate with ALARA practices.
- The railcar is pushed into the storage tunnel to its storage position.
- Once the railcar is in position, the water-fillable door is closed.

4.1.3 Removal of Stored Material

Removal of material stored within the PUREX Storage Tunnels is not conducted routinely. It is planned that the material will remain in storage until a means to accommodate processing and repackaging of the material for disposal or further storage or until another final disposition option becomes available. Removal of material from storage within the PUREX Storage Tunnels would proceed after the preparation activities identified in Section 4.1.1.

With all preparations complete and approval of management, removal of material from the storage area of the PUREX Storage Tunnels would proceed as follows.

- The equipment that will be used to remove material is positioned in the PUREX railroad tunnel.
- Verification is made that the PUREX railroad tunnel is configured properly to proceed with entrance into the PUREX Storage Tunnels (i.e., tunnel ventilation system is operating, the overhead door is closed and a survey of the area is performed for as low as reasonably achievable [ALARA] concerns).
- The water-fillable door is opened.
- The equipment that will be used to remove material is moved into the storage tunnel and connected to the railcar.
- Verification is made that the railcar is connected to the removal equipment and the railcar is extracted from the storage tunnel and positioned within the PUREX railroad tunnel.
- The water-fillable door is closed.

The loaded railcar retrieved from the tunnel would be remotely viewed and measurements may be obtained to determine the possibility of mixed waste containment failure during storage in the PUREX Storage Tunnels. If evidence of containment failure is detected, the specific details (i.e., material, location on railcar, storage position) would be documented and attached to the waste tracking form. This information would be maintained in the files and would be used to establish sampling locations within the tunnels at closure. After remote viewing and surveying, the railcar and associated material may be prepared as required for transfer to an appropriate onsite TSD unit for treatment or further storage.

4.1.4 Filling the Water-Fillable Door (Tunnel Number 2)

If shielding beyond that provided by the empty water-fillable door becomes necessary, the door can be filled with water. In the past, this was accomplished by connecting a fire hose from the water hydrant to the wall stub on the exterior of the door housing (Figure 4.1). Once the fire hose was in place, the hydrant valve was opened and the door was filled with water.

The hydrant was closed by personnel when a high-level indicator light illuminated. Although attendance by an operator is required at all times during filling operations, should the door overfill, excess water is channeled through a vent/spill pipe to the door sump. A 15.2-centimeter drain is provided in each door sump. Water accumulated in the door sump was pumped out to the Double-Shell Tank System, and the sump and drain were made inoperable during PUREX Facility deactivation activities.

The drain was sealed during PUREX Facility deactivation. In the future, a temporary source of water could be provided for filling the water-fillable door.

4.1.5 Post Storage Activities

The following post storage activities would conclude the tunnel storage task.

- Decontamination activities, if required, are performed.
- Management is notified of any unusual conditions observed during the storage/retrieval activities.

4.1.6 Operation of the Tunnel Ventilation System

The ventilation systems for Tunnel Number 1 and Tunnel Number 2 were designed to ventilate air from within the tunnels so the airborne contamination is vented through a High Efficiency Particulate Air (HEPA) filtered exhaust system.

4.1.6.1 Tunnel Number 1 Ventilation

Active ventilation of Tunnel Number 1 presently is not provided. After placement of the last railcar into Tunnel Number 1, the tunnel was sealed (Chapter 2.0). As part of the sealing activities, the ventilation fan was deactivated electrically and the exhaust stack and filter were isolated from the system by installing blanks upstream and downstream of both the exhaust fan and filter and the stack was removed. In the event railcar removal activities are initiated, it is planned that the ventilation system would be reactivated. Operation of the ventilation system would be similar to that for Tunnel Number 2.

4.1.6.2 Tunnel Number 2 Ventilation

The Tunnel Number 2 ventilation system presently is inactive. As part of PUREX Facility deactivation, the water-fillable door and outer PUREX railroad tunnel door were sealed. The seal may be temporary or permanent depending on the future need for storing waste in the tunnel. The ventilation system may be operated continuously, or de-energized and reactivated during waste placement activities. During deactivation, a blank was installed on the downstream side of the filter and the stack was capped. When the determination has been made that Tunnel Number 2 will no longer receive waste, the ventilation system will be blanked and deactivated electrically similar to the Tunnel Number 1 ventilation system. While the Tunnel Number 2 ventilation system is operating and the water-fillable door is closed, the exhaust system, which discharges approximately 100 cubic meters per minute, maintains a slightly negative pressure in the tunnel. The exhaust air is replaced by infiltration around the water-fillable door and through the porosity of the tunnel structure (e.g., the rail-bed ballast). When the water-fillable door is open (during transfer activities), inward airflow is maintained through the open doorway. This inward airflow channels airborne radioactive contamination away from both the railroad tunnel and personnel following railcars (if allowed) into the storage tunnel. A HEPA filter provides filtration of all exhaust air before release to the atmosphere. When the ventilation system is operating, the HEPA filter is tested in place at least annually to ensure radioactive particulate removal efficiency. Exhausted air is sampled periodically and analyzed for airborne radionuclides.

4.2 Containers

This section describes the various types of containment used to isolate mixed waste stored in the PUREX Storage Tunnels. The PUREX Storage Tunnels are considered to be a miscellaneous unit most closely resembling that of a container storage unit. The mixed waste stored in the PUREX Storage Tunnels is contained and is not considered a risk to human health or to the environment.

4.2.1 Containers with Free Liquids

The only mixed waste stored as a free liquid is elemental mercury. A small quantity, less than 1.7 liters, of mercury is contained in each of the two thermowells attached to and contained within each dissolver (Chapter 3.0).

Primary containment of the mercury is provided by the all-welded construction of the thermowell itself, which is fabricated from 7.6-centimeter, Schedule 80, 304L stainless steel pipe. The open upper end of the thermowell was plugged with a 304L stainless steel nozzle plug in preparation for storage. The dissolver rests on a cradle on its railcar in an inclined position. This ensures that the mercury remains in the lower portion of the thermowell and is not in contact with the mechanical closure on the nozzle end of the thermowell.

A secondary containment barrier for mercury, should it leak from the thermowell, is provided by the dissolver itself. The dissolver is a 304L stainless steel process vessel constructed from 1-centimeter-thick plate and is approximately 2.7 meters in diameter. The dissolver is of all-welded construction and contains no drains or nozzle outlets in the bottom several feet of its lower section, which contains both thermowells.

The 304L stainless steel used to contain the elemental mercury is both compatible with the waste itself and the storage environment. The potential for significant deterioration of either the primary or secondary containment barrier material before closure is considered to be negligible.

The dissolvers stored within the PUREX Storage Tunnels are not labeled as containing characteristic toxic mercury (D009) [WAC 173-303-090(8)(c)]. Procedures for labeling were not in place at the time of storage. Personnel access into the storage area for purposes such as labeling is not feasible and cannot be justified under ALARA guidelines. Based on ALARA, mixed waste presently within the PUREX Storage Tunnels will remain unlabeled. However, during future transfers of mixed waste into the PUREX Storage Tunnels the railcars will be labeled as specified by WAC 173-303-395(6) and WAC 173-303-630(3).

4.2.2 Containers without Free Liquids that do not Exhibit Ignitability or Reactivity

Most lead is fully contained in all-welded encasements of either carbon steel or 304L stainless steel (refer to Chapter 3.0, Table 1). The encasement serves as support, protection against mechanical damage, and protection of the lead from exposure to the environment. Also, lead has been placed in burial boxes of appropriate size. The boxes provide secondary containment for the lead in the unlikely event the primary encasement should fail. Although boxes may be open on the top, the PUREX Storage Tunnels are enclosed; therefore, the containers are protected from the elements.

Both carbon steel and 304L stainless steel used to encase the lead are compatible with the waste and the storage environment. Significant deterioration of either the primary or secondary containment barrier materials before closure is not considered to be credible.

In the past, material that contains lead or that has encased lead attached was not labeled as containing characteristic toxic lead (D008) [WAC 173-303-090(8)], because the requirements were not yet on line. As stated in Section 4.2.1, personnel entry into the tunnel storage area for purposes of labeling would be inconsistent with ALARA guidelines. However, during future storage of material containing lead the railcars will be labeled in accordance with WAC 173-303-395(6) and WAC 173-303-630(3).

4.2.3 Protection of Extremely Hazardous Waste in Containers

The present amount of mixed waste stored in the PUREX Storage Tunnels is sufficient to characterize this material as extremely hazardous waste. Because the PUREX Storage Tunnels are enclosed totally, protective covering from the elements and from run-on is provided for the storage of extremely hazardous waste. Periodic inspection of the equipment stored in the PUREX Storage Tunnels is not feasible and cannot be justified under ALARA guidelines. Safe management of this waste is based on the following considerations.

- The operation of the PUREX Storage Tunnels is passive, i.e., once a storage position is filled, the storage position remains undisturbed until closure.

- The extremely hazardous waste is compatible with its storage container and the storage environment.

4.2.4 Prevention of Reaction of Ignitable, Reactive, and Incompatible Waste in Containers

There is no reactive or incompatible waste known to be stored in the PUREX Storage Tunnels. The only mixed waste stored in the PUREX Storage Tunnels considered an ignitable waste is the silver nitrate in Tunnel Number 2. The silver nitrate fraction of the silver salts, within the silver reactors, exhibits the characteristic of ignitability as defined in 49 CFR 173.127(a). Therefore, the silver salts are managed as an ignitable dangerous waste in accordance with WAC 173-303-395.

- The risk of fire associated with the storage of silver nitrate in the PUREX Storage Tunnels is considered to be extremely low. This conclusion is based on the following considerations.
- The operation of the PUREX Storage Tunnels is passive; i.e., once a storage position is filled, the storage position remains undisturbed until closure.
- The silver nitrate is contained within large, heavy-walled stainless steel vessels that isolate the silver nitrate from contact with any combustibles that might be in the tunnels.
- The silver nitrate is dispersed over a large surface area on a ceramic packing substraight and is not conducive to build-up of heat that could lead to spontaneous combustion.
- Personnel access to the occupied areas of the tunnels is not permitted, thereby precluding activities that could present a fire hazard (e.g., smoking, flame cutting, welding, grinding, and other electrical activities).

Although ignitable waste storage units are required by WAC 173-303-395(1)(d) to have inspections conducted at least yearly by a fire marshall or professional fire inspector familiar with the requirements of the uniform fire code, the ALARA concerns within the PUREX Storage Tunnels make such inspections impractical. These inspections are not considered appropriate or necessary for the safe operation of the unit because of the nature of the ignitable waste, the means of storage, and ALARA concerns (Chapter 6.0, §6.2).

4.3 Engineering Drawings

As-built drawings for the PUREX Storage Tunnels:

H-2-55587	218-E-14 Structural Floor Plan and Section
H-2-55588	Structural Sections and Details: Disposal Facility for Failed Equipment
H-2-55589	Structural Sections and Details: Disposal Facility for Failed Equipment
H-2-55590	Door and Hoist Details
H-2-55591	Door and Hoist Details
H-2-55592	Door and Hoist Details
H-2-55593	Electrical Details
H-2-55594	Shielding Door Fill and Drain Lines Arrangement: Disposal Facility for Failed Equipment
H-2-55599	Electrical Door Control Plan, Elementary Diagram and Miscellaneous Details: Disposal Facility for Failed PUREX Equipment
H-2-58134	Ventilation Details; Sheet 1, Sheet 2, Sheet 3, Sheet 4
H-2-58175	PUREX Tunnel

H-2-58193	Sump Details
H-2-58194	Sump Details
H-2-58195	Structural Sections and Details: Equipment Disposal - PUREX
H-2-58206	Sump Details
H-2-58208	Fan Details; Sheet 1, Sheet 2, Sheet 3
H-2-94756	Filter Details; Sheet 1, Sheet 2

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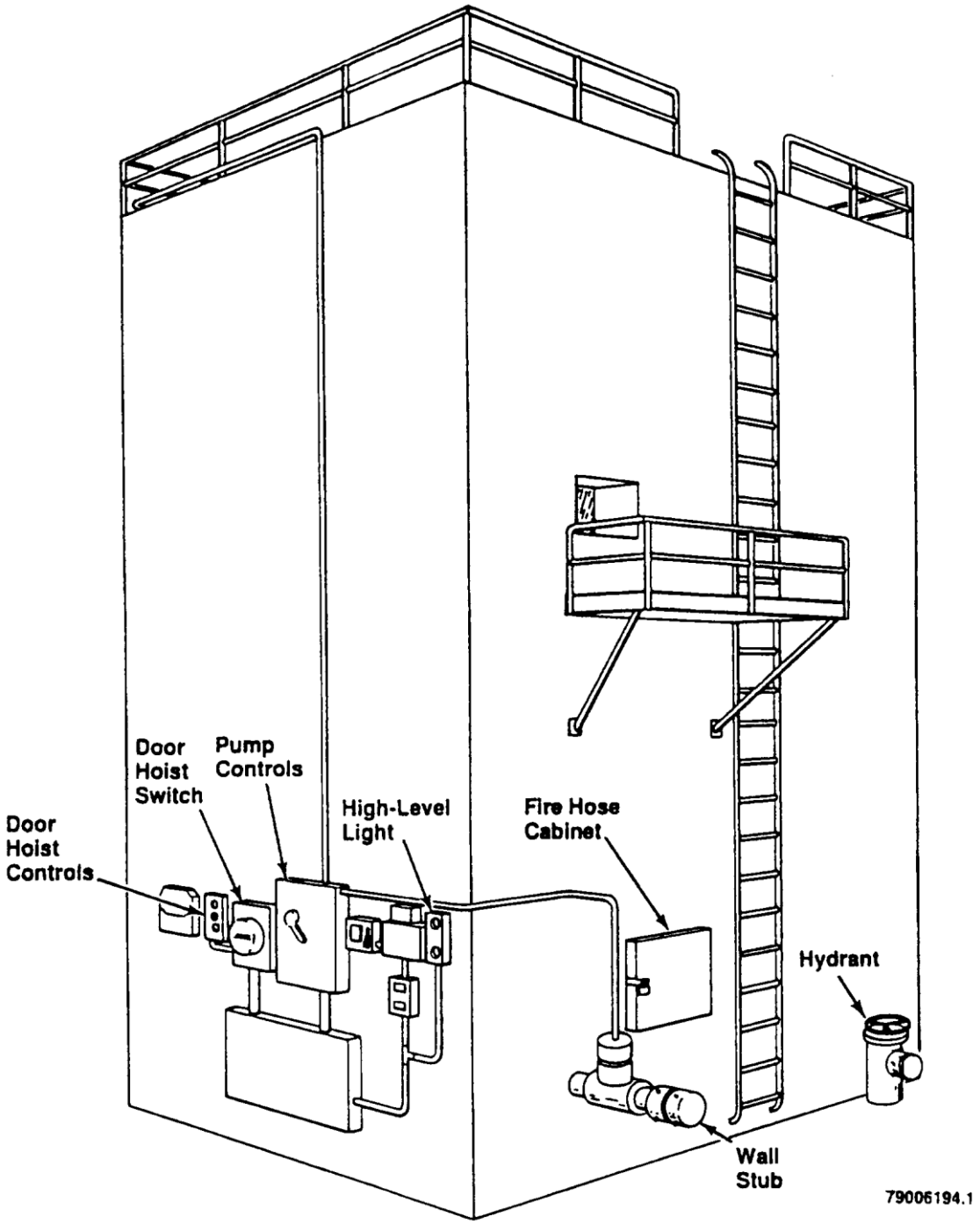

Figure 4.1. Water Fillable Door Exterior (Tunnel Number 2)