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PUREX STORAGE TUNNELS WASTE ANALYSIS PLAN

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7. Abstract

Washington Administrative Code 173-303-300 requires that a facility develop and follow a written waste analysis plan which describes the procedures that will be followed to ensure that its dangerous waste is managed properly. This document covers the activities at the PUREX Storage Tunnels used to characterize and designate waste that is generated within the PUREX Plant, as well as waste received from other on-site sources.

8. RELEASE STAMP

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GLOSSARY

ALARA	as low as reasonably achievable
ECOLOGY	Washington State Department of Ecology
EHW	extremely hazardous waste
EPA	U.S. Environmental Protection Agency
pH	negative concentration logarithm of the hydrogen-ion concentration
PUREX	plutonium-uranium extraction
QA/QC	quality assurance and quality control
TSD	treatment, storage, and/or disposal
WAC	Washington Administrative Code
WAP	waste analysis plan

METRIC CONVERSION CHART

The following conversion chart is provided to the reader as a tool to aid in conversion.

Into metric units			Out of metric units		
If you know	Multiply by	To get	If you know	Multiply by	To get
Length			**Length**		
inches	25.40	millimeters	millimeters	0.0393	inches
inches	2.54	centimeters	centimeters	0.393	inches
feet	0.3048	meters	meters	3.2808	feet
yards	0.914	meters	meters	1.09	yards
miles	1.609	kilometers	kilometers	0.62	miles
Area			**Area**		
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.092	square meters	square meters	10.7639	square feet
square yards	0.836	square meters	square meters	1.20	square yards
square miles	2.59	square kilometers	square kilometers	0.39	square miles
acres	0.404	hectares	hectares	2.471	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.0352	ounces
pounds	0.453	kilograms	kilograms	2.2046	pounds
short ton	0.907	metric ton	metric ton	1.10	short ton
Volume			**Volume**		
fluid ounces	29.57	milliliters	milliliters	0.03	fluid ounces
quarts	0.95	liters	liters	1.057	quarts
gallons	3.79	liters	liters	0.26	gallons
cubic feet	0.03	cubic meters	cubic meters	35.3147	cubic feet
cubic yards	0.76	cubic meters	cubic meters	1.308	cubic yards
Temperature			**Temperature**		
Fahrenheit	subtract 32 then multiply by 5/9ths	Celsius	Celsius	multiply by 9/5ths, then add 32	Fahrenheit

Source: *Engineering Unit Conversions*, M. R. Lindeburg, PE., Second Ed., 1990, Professional Publications, Inc., Belmont, California.

1.0 FACILITY DESCRIPTION

This waste analysis plan (WAP) has been prepared for the Hanford Facility, PUREX Storage Tunnels, Richland, Washington, for the management of mixed waste. This WAP applies to all mixed waste (containing both radioactive and dangerous components) regulated by Washington Administrative Code (WAC) 173-303 that is transferred to and/or contained in the PUREX Storage Tunnels.

The PUREX Storage Tunnels are permitted as a miscellaneous unit under WAC 173-303-680. The bulk of the waste stored in the PUREX Storage Tunnels is not placed in a typical container; rather, this waste is placed on a portable device (railcar) that is used as a storage platform. In general, the dangerous waste stored in the PUREX Storage Tunnels is encased or contained within carbon or stainless steel plate, pipe, or vessels. Therefore, the mixed waste normally is not exposed to the tunnel environment.

The PUREX Facility, located in the 200 East Area, consists of two separate treatment, storage, and/or disposal (TSD) units, the PUREX Plant (202-A Building) and the PUREX Storage Tunnels. Access to the PUREX Storage Tunnels from the PUREX Plant is by means of the railroad tunnel.

The PUREX Storage Tunnels branch off from the railroad tunnel and extend southward from the east end of the PUREX Plant. The tunnels are used for storage of mixed waste from the PUREX Plant and from other onsite sources. Each storage tunnel is isolated from the railroad tunnel by a water-fillable shielding door. There are no electrical utilities, water lines, drains, fire detection and suppression systems, radiation monitoring, or communication systems provided inside the PUREX Storage Tunnels.

Material selected for storage is loaded on railcars modified to serve as both transport and storage platforms. Normally, a remote-controlled, battery-powered locomotive is used to position the railcar in the storage tunnel. In the past and possibly in the future, other remote movers, e.g., standard locomotive with a string of railcar spacers, power winch, etc., have or could be used to position a railcar into the tunnel or to withdraw a car from the tunnel. The railcar storage positions are numbered sequentially, commencing with Position 1 that abuts the railstop bumper at the south end of each tunnel. Position 2 is the location of the railcar that abuts the railcar in Position 1 and so forth. The railcars and material remain in the storage tunnel until retrieval is required. Each railcar is retrievable; however, because the railcars are stored on a single, dead-end railroad track, the railcars can be removed only in reverse order (i.e., last in, first out).

Construction of Tunnel Number 1 was completed in 1956 and consists of three areas: the water-fillable door, the storage area, and the vent shaft. The water-fillable door is located at the north end of Tunnel Number 1 and separates the storage tunnel from the PUREX railroad tunnel. The door is 7.5 meters high, 6.6 meters wide, and 2.1 meters thick, and is constructed of 1.3 centimeter steel plate. The door is hollow so that the door can be filled with water to act as a radiation shield when the door is in the down (closed) position. If the door is filled with water, the water must be pumped from the door before the door can be raised.

Above the door is a reinforced concrete structure into which the door is raised to open the tunnel. Electric hoists used for opening and closing the door are located on the top of this concrete structure.

The storage area is that portion of the tunnel that extends southward from the water-fillable door. Inside dimensions of Tunnel Number 1 are 109.1 meters long, 6.7 meters high, and 5.9 meters wide. Ceiling and walls are 35.6 centimeters thick and constructed of 30.5- by 35.6-centimeter creosote pressure-treated Douglas fir timbers arranged side by side. The first 30.5 meters of the east wall are constructed of 0.9-meter-thick reinforced concrete. A 40.8-kilogram- mineral-surface roofing material was used to cover the exterior surface of the timbers before placement of 2.4 meters of earth fill. The earth cover serves as protection from the elements and as radiation shielding. The timbers that form the walls rest on reinforced concrete footings 0.9 meter wide by 0.3 meter thick. The floor consists of a railroad track laid on a gravel bed. The space between the ties is filled to top-of-tie with gravel ballast. The tracks are on a 1.0 percent downward slope to the south to ensure that the railcars remain in their storage position. A railcar bumper is located 2.4 meters from the south end of the tracks to act as a stop. The capacity of the storage area is eight, 12.8-meter-long railcars.

In June 1960, the first two railcars were loaded with a single, approximately 12.5-meter-long, failed separation column and placed in Tunnel Number 1. Between June 1960 and January 1965, six more railcars were placed in Tunnel Number 1, filling the tunnel. After the last car was placed in the northern-most storage position (Position 8), the water-fillable door was closed, filled with water, and deactivated electrically.

Construction of Tunnel Number 2 was started and completed in 1964. Like Tunnel Number 1, Tunnel Number 2 consists of three functional areas: the water-fillable door, the storage area, and the vent shaft. Construction of Tunnel Number 2 differs from that of Tunnel Number 1 as follows.

- A combination of steel and reinforced concrete was used in the construction of the storage area for Tunnel Number 2 rather than wood timbers, as used in Tunnel Number 1.

- Tunnel Number 2 is longer, having a storage capacity of five times that of Tunnel Number 1.

- The floor of Tunnel Number 2, outboard of the railroad ties, slopes upward to a height of approximately 1.8 meters above the railroad bed, whereas the floor in Tunnel Number 1 remains flat all the way out to the side walls.

- The railroad tunnel approach to Tunnel Number 2 angles eastward then angles southward to parallel Tunnel Number 1. The approach to Tunnel Number 1 is a straight extension southward from the PUREX Plant.

Center-line to center-line distance between the two tunnels is approximately 18.3 meters.

The physical structure of the water-fillable door at the north end of Tunnel Number 2 essentially is identical to the water-fillable door for Tunnel Number 1. The water-fillable door for Tunnel Number 2 is approximately 57.9 meters south and 18.3 meters east of the water-fillable door for Tunnel Number 1. As of February 9, 1995, the door is empty and there are no plans to fill it.

The storage area of Tunnel Number 2 is that portion of the tunnel extending southward from the water-fillable door. Construction of this portion of Tunnel Number 2 consists of a 10.4-meter diameter, steel (0.5 centimeter plate), semicircular-shaped roof, supported by internal I-beam wales attached to external, reinforced concrete arches. The concrete arches are 0.4 meter thick and vary in width from 0.4 to 1.8 meters. The arches are spaced on 4.8-meter centers. This semicircular structure is supported on reinforced concrete grade beams approximately 1.8 meters wide by 1.2 meters thick (one on each side) that run the full length of Tunnel Number 2. The interior and exterior surfaces of the steel roof are coated with a bituminous coating compound to inhibit corrosion. The entire storage area is covered with 2.4 meters of earth fill to serve as radiation shielding.

The nominal inside dimensions of Tunnel Number 2 are 514.5 meters long, 7.9 meters high, and 10.4 meters wide. However, because of the arch-shaped cross-section of Tunnel Number 2 and entry clearance at the water-fillable door, the usable storage area (width and height above top-of-rail) is 6.7 meters high and 5.8 meters wide, the same dimensions as for Tunnel Number 1. The floor consists of a railroad track laid on a gravel bed. The space between ties is filled to top-of-tie with gravel ballast. Commencing at the ends of the 2.4-meter-long ties, the earth floor is sloped upward on a 1 (vertical) to 1 1/2 (horizontal) grade. The tracks are on a 1/10 of 1 percent downgrade slope to the south to ensure the railcars remain in their storage position. A railcar bumper is located 2.4 meters from the south end of the tracks to act as a stop. The capacity of the storage area is 40, 12.8-meter-long railcars.

The first railcar was placed in storage in December 1967. As of February 9, 1995, 21 railcars have been placed in Tunnel Number 2.

The only free-liquid dangerous waste stored in the tunnels is mercury. The mercury is contained within thick-walled 0.8 centimeter thermowells constructed from 7.6 centimeter Schedule 80, 304L stainless steel pipe. The top of the thermowell is closed with a 304L stainless steel nozzle plug with a metal-to-metal seal. The amount of mercury per thermowell is less than 1.7 liters.

Other liquid containers, such as large discarded process tanks or vessels, are stored in the PUREX Storage Tunnels. These containers are either empty [per WAC 173-303-160(2)(a)] or have been flushed and the final rinsate sampled and analyzed to verify that the residual heel is not a dangerous waste.

The only stored dangerous waste that is either reactive or ignitable is silver nitrate in the silver reactors, which is designated as ignitable (D001) [WAC 173-303-090(5)]. The potential for ignition is considered to be negligible because this material is dispersed on ceramic packing and is physically isolated from contact with any combustible material or ignition source.

1.1 PROCESS AND ACTIVITIES

The function of the PUREX Tunnels is to store mixed waste until the waste can be processed for final disposal. When waste is to be placed in the storage tunnels, a work plan, describing the overall transfer activities and a storage tunnel checklist are prepared. The work plan and storage tunnel checklist are routed for review and concurrence by key personnel and forwarded to management for approval.

1.2 PHYSICAL CHARACTERIZATION OF MATERIAL TO BE STORED

Physical characterization of waste includes an evaluation of the following physical properties:

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

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 waste material. Such information also is used to design and fabricate, if required, supports on the railcar.

Before removal from service, the equipment could be flushed to minimize loss of products, to reduce radioactive contamination, and to reduce dangerous waste constituents present in a residual heel to nonregulated levels. If equipment is flushed, analysis of the rinsate is used to determine when these goals have been achieved.

1.3 IDENTIFICATION/CLASSIFICATION AND QUANTITIES OF HAZARDOUS WASTE MANAGED WITHIN THE PUREX STORAGE TUNNELS

Because the dangerous waste is an integral part of radioactively contaminated material, the dangerous waste is managed as mixed waste. Table 1 contains an inventory of waste stored within the PUREX Storage Tunnels, as of February 1995.

2.0 WASTE ANALYSIS PARAMETERS

Analytical requirements were selected on the basis of knowledge required for the safe handling and storage of the waste within the PUREX Storage Tunnels for operational compliance, including any operational issues.

2.1 WASTE IDENTIFICATION

A prerequisite step in proper waste management is to adequately address whether waste being considered for management within the PUREX Storage Tunnels falls within the scope of this facility's permit. This includes identifying any hazardous waste in accordance with regulatory and permit requirements and applicability of any land disposal restricted waste.

This chapter provides information on how the chemical and physical characteristics of the mixed waste currently stored in the PUREX Storage Tunnels were determined so the dangerous waste is stored and managed properly.

Material presently stored in the PUREX Storage Tunnels contains the following dangerous waste:

- Lead
- Mercury
- Silver
- Chromium
- Cadmium.

Dangerous waste generally is either attached to or contained within some materials in the storage tunnels. Because the dangerous waste is an integral part of radioactively contaminated material, this material is managed as a mixed waste. Table 1 provides an approximation of the total amount of dangerous waste contained in the PUREX Storage Tunnels as of February 1995.

Storage of non-PUREX waste is reviewed on a case-by-case basis. Sampling, chemical analysis, and/or process knowledge (as discussed in the following section) are required to confirm the characteristics and quantities of dangerous waste to be stored. Future waste and dangerous constituents might not be in the same configuration or form as described in the following sections.

2.1.1 Lead

Lead stored was used in various capacities during past Hanford Facility operations. Primary functions of lead included use as weights, counterweights, and radiation shielding. Often the lead is encased in steel (carbon or stainless) to facilitate its attachment to various types of equipment.

Lead exhibits the characteristic of toxicity as determined by the toxicity characteristics leaching procedure and is designated D008 [WAC 173-303-090(8)]. The quantity of lead present could produce an extract greater than 500 milligrams per liter should the lead be exposed to a leachate. However, because the bulk of the lead is encased in steel, is stored inside a weather-tight structure, and is elevated above floor level on railcars that isolate the lead from other materials stored, the potential for exposure of bare lead to a leachate is considered to be negligible.

Sampling and chemical analysis is not performed on lead associated with the material placed in the PUREX Storage Tunnels. The quantity of lead is determined from a review of the fabrication drawings for material removed from the PUREX Plant, or from manifests and/or sample analyses provided from onsite sources before receipt of waste. Therefore, the accuracy of the estimate of the amount of lead presently stored in each tunnel is limited to the data available from existing fabrication drawings. The estimated quantity of lead (Table 1) accounts only for the lead that has been removed from the PUREX Plant. Counterweights on equipment dunnage and lead used for shielding cannot be quantified by existing historical records and are not included in the amount of lead listed. However, following removal, the material will be examined and any suspect attachments will be removed, evaluated, and disposed of in accordance with established procedures.

2.1.2 Mercury

Mercury is sealed inside thermowells that are an integral part of irradiated reactor fuel dissolvers used at the PUREX Plant. The dissolvers are large 304L stainless steel process vessels that are approximately 2.7 meters in diameter, 7.3 meters tall, and weigh approximately 26,309 kilograms. The outer shell is constructed of a 1-centimeter-thick plate. The dissolvers were used in decladding and dissolution of irradiated reactor fuel in the PUREX Plant.

Depending on the specific dissolver in question, 19.1 or 45.4 kilograms of mercury (1.4 or 1.77 liters) were poured into each thermowell (38.1 or 45.4 kilograms total per dissolver) following vertical installation of the dissolvers inside the PUREX canyon and before it was installed in a process cell. The mercury served to transfer heat from the dissolver interior to the thermohm temperature sensor mounted within the thermowell. This mercury remains within the thermowells of discarded dissolvers. In preparation for storage, the thermohms were removed and the upper end of each thermowell was sealed with a 304L stainless steel nozzle plug. In storage, the discarded dissolver rests in an inclined position in a cradle on the railcar. The mercury contained in the thermowells remains in the lower portion of each thermowell and, under normal conditions, is never in contact with the mechanical closure on the nozzle end of the thermowell.

Mercury exhibits the characteristic of toxicity as determined by the toxicity characteristics leaching procedure and is designated D009 [WAC 173-303-090(8)].

The potential for mercury to become exposed to leachate is considered to be negligible. The PUREX Storage Tunnels are designed and constructed as weather-tight structures. Further, the mercury is encased in a stainless steel pipe within a stainless steel vessel that is stored on a railcar above the floor level of the tunnels. Therefore, exposure of the mercury stored in the tunnels to leachate is not considered to be a credible occurrence.

Sampling and chemical analysis is not performed on mercury associated with the dissolvers stored in Tunnel Number 2. The quantity of mercury present in each thermowell is documented on Table 1. Because the thermowells are sealed, the quantity of mercury present will not decrease with time due to evaporation.

2.1.3 Silver

Silver, mostly in the form of silver salts deposited on unglazed ceramic packing, is contained within the discarded silver reactors stored in Tunnel Number 2. The silver reactors were used to remove radioactive iodine from the offgas streams of the irradiated reactor fuel dissolvers. The reactor vessel is approximately 1.4 meters in diameter by 4.1 meters tall and is constructed of 1-centimeter 304L stainless steel. The vessel contains two 1.2-meter-deep beds of packing. Each bed consists of a 30.5-centimeter depth of 2.5-centimeter unglazed ceramic saddles topped with a 0.6-meter depth of 1.3-centimeter unglazed ceramic saddles. The two beds are separated vertically by a distance of about 0.6 meter, and each bed rests on a support made of stainless steel angles and coarse screen. The packing was coated initially with 113.4 kilograms of silver nitrate used for iodine retention. Nozzles on the top of the reactor were provided to allow flushing and/or regeneration of the packing with silver nitrate solution as the need arose.

Because of competing reactions, which include conversion of silver nitrate to silver iodide, reduction of silver nitrate to metallic silver, and formation of silver chloride, the packing of a stored silver reactor contains a mixture of silver nitrate, silver halides, and silver fines.

Silver salts exhibit the characteristics of toxicity as determined by the toxicity characteristics leaching procedure and are designated D011 [WAC 173-303-090(8)]. In addition, nitrates exhibit the characteristic of ignitability and also are designated as D001 [WAC 173-303-090(5)].

The potential of silver, including silver salts, stored in the PUREX Storage Tunnels to become exposed to leachate is considered negligible. Silver is contained within a stainless steel vessel, stored inside a weather-tight structure, and elevated above floor level on a railcar. Therefore, exposure of the silver stored in the tunnels to leachate is not considered to be a credible occurrence. Also, the contained silver is isolated from contact with any combustibles; therefore, the possibility of ignition is considered to be extremely remote.

Provisions for taking samples of the packing were not provided in the design of the vessels. Therefore, sampling and chemical analysis is not performed for silver salts before placing a silver reactor in storage. However, for accountability purposes, the total silver content (Table 1) is considered to be silver nitrate, the salt that exhibits the characteristics of both ignitability and toxicity.

The quantity of silver salts contained within a discarded silver reactor is a function of silver salts regeneration history. Operating records (process knowledge) of regenerations and flushes are used to estimate the total accumulation of silver within each reactor.

2.1.4 Chromium

Presently, chromium stored in Tunnel Number 2 is contained within a failed concentrator. The concentrator is a vertical tube structure that was used to concentrate aqueous streams from the final uranium cycle, final plutonium cycles, final neptunium cycles, and condensate from the acid recovery system for recycle. Following service, the concentrator was inspected and found to contain silicate solids and high levels of chromium from the corrosion of stainless steel.

Chromium exhibits the characteristic of toxicity as determined by the toxicity characteristics leaching procedure and is designated D007 [WAC 173-303-090(8)].

The potential for the chromium stored in Tunnel Number 2 to become exposed to leachate is considered negligible. Tunnel Number 2 is designed and constructed to be weather-tight. Further, the chromium is encased within a 304L stainless steel vessel that is stored on a railcar above the floor level of the tunnel. Therefore, exposure of the chromium stored in the tunnel to leachate is not considered to be a credible occurrence.

The quantity of chromium within the concentrator was estimated by calculating the volume of silicate solids and the percentage of chromium within the silicate solids.

2.1.5 Cadmium

Presently, cadmium stored in the PUREX Storage Tunnel Number 2 is associated with radiation shielding and with a dissolver moderator. The cadmium was used to shield equipment from radiation and consists of sheets of the metal attached to lead, both of which could be encased in steel.

The dissolvers are annular vessels that are geometrically favorable for criticality safety. The dissolvers were placed over cadmium lined (neutron absorbers) moderators for additional criticality safety. The moderator is a centrally located, cylindrical, cadmium-jacketed 0.08-centimeter-thick concrete 15.2-centimeter-thick neutron absorber. The moderators are approximately 4.4 meters tall by approximately 1.5 meters outer diameter.

Cadmium exhibits the characteristic of toxicity as determined by the toxicity characteristics leaching procedure and is designated D006 [WAC 173-303-090(8)]. If exposed to a leachate, the quantity of cadmium present could produce an extract having less than 100 milligrams per liter; therefore, the mixed waste is managed as a WT02 [WAC 173-303-100(5)], dangerous waste, and is designated further as WC02 [WAC 173-303-100(7)].

The potential for the cadmium stored in Tunnel Number 2 to become exposed to leachate is considered negligible. Tunnel Number 2 is designed and constructed to be weather-tight. Further, the cadmium is stored on a railcar above the floor level of the tunnel.

The quantity of cadmium is determined from a review of the fabrication drawings for material removed from the PUREX Plant or from manifests provided from other onsite sources before receipt of waste. The estimated quantity of cadmium (Table 1) accounts only for the cadmium removed from PUREX Plant.

2.1.6 Identification of Incompatible Waste

The next step was to ensure that sufficient information has been provided concerning the waste so the waste can be managed properly. This included identifying incompatible waste. These safety issues primarily are related to prevention of unwanted chemical reactions that could create a catastrophic situation, such as a fire, an explosion, or a large chemical release.

2.1.7 Operational Considerations

Sufficient information must be available to ensure that incoming waste meets operational acceptance limits, e.g., physical size, radiation limits and permit conditions. These operating specifications are limits and controls imposed on a process or operation that, if violated, could jeopardize the safety of personnel, and could damage equipment, facilities, or the environment. Operating specifications have been established from operating experience, process knowledge and calculations.

2.2 PARAMETER AND RATIONALE SELECTION PROCESS

This WAP describes the process to ensure that the dangerous waste components of the material stored in the tunnels are properly characterized and designated so that dangerous and mixed waste is managed properly.

The parameters considered for waste designation under WAC 173-303-070(3) and the rationale for their application are discussed in the following sections.

2.2.1 Discarded Chemical Products

The first category of dangerous waste designation is "Discarded Chemical Products" (WAC 173-303-081). The waste stored in the tunnels does not fit the definitions in WAC 173-303-081 for a discarded chemical product. Therefore, the dangerous waste stored in the PUREX Storage Tunnels is not designated as a discarded chemical product.

2.2.2 Dangerous Waste Sources

The second category of dangerous waste designation is "Dangerous Waste Sources" (WAC 173-303-082). The waste stored in the tunnels is not listed on the "Dangerous Waste Sources List" (WAC 173-303-9904). Therefore, the dangerous waste stored in the PUREX Storage Tunnels is not designated as a dangerous waste source.

2.2.3 Dangerous Waste Characteristics

The third category of dangerous waste designation is "Dangerous Waste Characteristics" (WAC 173-303-090). The characteristics are as follows.

- Characteristic of Ignitability--Although the solid silver nitrate has not been tested in accordance with Appendix F of 49 CFR 173, the waste is assumed to be an oxidizer as specified in 49 CFR 173.127(a). Therefore, the silver nitrate waste is assumed to exhibit the characteristic of ignitability under WAC 173-303-090(5) and is designated as D001.

- Characteristic of Corrosivity--Some of the material stored within the tunnels either has contained or has been in contact with corrosive liquids. The standard operating procedure has been to flush vessels with water to recover as much special nuclear material as practical. Also, flushing removes much of the radioactive contamination, minimizing the spread of contamination during handling. Currently, the final aqueous rinse is sampled and analyzed to confirm that the Ph is greater than 2 and less than 12.5. Therefore, the waste stored in the PUREX Storage Tunnels is not designated as corrosive waste.

- Characteristic of Reactivity--The waste stored in the tunnels does not meet any of the definitions of reactivity as defined in WAC 173-303-090(7). The waste material is not unstable, does not react violently with water, does not form explosive mixtures, or does not generate toxic gases. Therefore, the waste stored in the PUREX Storage Tunnels is not designated as reactive waste.

- Characteristic of Toxicity--Lead, mercury, silver, chromium, and cadmium are identified on the Toxicity Characteristics list. The quantity of these materials stored in the tunnels is sufficient that, should the substances come in contact with a leachate (an event considered unlikely), the concentration of the extract could be above the limits identified in the list. Therefore, this waste is designated D006, D007, D008, D009, and D011.

The PUREX Storage Tunnels also are permitted for barium (D005), and selenium (D010). Currently, there is no waste stored in the tunnels that is designated for D005 or D010; however, there is a potential for waste with these waste numbers to be stored within the tunnels.

2.2.4 Dangerous Waste Criteria

The fourth category of dangerous waste designation is "Dangerous Waste Criteria" (WAC 173-303-100). The criteria are as follows:

- Toxicity Criteria--Cadmium meets the toxicity criteria in WAC 173-303-100(5) when performing a book designation. Because of the concentrations present, the waste containing these constituents is designated as dangerous waste (DW) and is assigned the dangerous waste number of WT02.

- Persistence Criteria--Currently, no waste stored in the tunnels has been designated as persistent per WAC 173-303-100(6).

- Carcinogenic Criteria--Cadmium meets the carcinogenic criteria in WAC 173-303-100(7) when performing a book designation. Because of the concentration, waste containing cadmium is designated as a dangerous waste and is assigned the dangerous waste number WC02.

2.2.5 Waste Designation Summary

The mixed waste currently stored in the PUREX Storage Tunnels is designated as follows:

- Lead--D008; EHW
- Mercury--D009; EHW
- Silver--D001, D011; EHW
- Chromium--D007; EHW
- Cadmium--D006, WT02, WC02; DW.

2.3 RATIONALE FOR PARAMETER SELECTION

Refer to Section 2.2.

2.4 SPECIAL PARAMETER SELECTION

Refer to Section 2.2.

3.0 SELECTION OF SAMPLING PROCEDURES

The following sections discuss the sampling methods and procedures that will be used. Sampling usually will be in accordance with requirements contained in the pertinent sampling analysis plan, data quality objectives, procedures, and/or other documents that specify sampling and analysis parameters.

3.1 SAMPLING STRATEGIES

The only test method presently used in support of the PUREX Storage Tunnels operation is a corrosivity check on the final in-place aqueous rinse of discarded vessels before the vessels are released for storage. The pH is determined by a pH meter using U.S. Environmental Protection Agency (EPA) Test Method 9040 or 9041 in *Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods* (EPA 1986).

There is a potential for the PUREX Storage Tunnels to receive waste that is not generated at the PUREX Facility. Any required sampling strategies associated with this waste will be developed on a case-by-case basis.

3.1.1 Sampling Methods

Process knowledge of the characteristics and the quantities of the dangerous waste to be stored in the PUREX Storage Tunnels is considered sufficient to properly designate and manage the stored waste.

The waste currently stored in the tunnels is lead, mercury, chromium, cadmium, and silver. Sampling and chemical analysis of the lead, mercury, cadmium, or chromium to confirm their presence would not provide additional data beneficial to proper management of the waste and would not be in compliance with as low as reasonably achievable (ALARA) principles. The silver salts are nonuniformly distributed on ceramic packing contained within a large stainless steel reactor vessel. Representative sampling of the packing in place is not considered to be practical and therefore is not performed.

If sampling is required for operation of the PUREX Storage Tunnels, representative sampling methods listed in WAC 173-303-110 or some other method approved by the Washington State Department of Ecology (Ecology) will be used.

In the event the PUREX Storage Tunnels receive waste from other Hanford Facility activities, sampling, chemical analysis, and/or process knowledge will be required to confirm the characteristics and quantities of mixed waste to be stored. Storage of non-PUREX Facility waste will be reviewed on a case-by-case basis.

3.1.2 Frequency of Analyses

Because the dangerous waste components of mixed waste stored in the PUREX Storage Tunnels are stable and will remain undisturbed for a long time, the waste designations and quantities present will remain the same as assigned at the time of storage. Therefore, repeated analysis is not considered necessary to ensure that waste designation data are representative.

In the event the PUREX Storage Tunnels receive waste from other Hanford Facility activities, this waste also will remain undisturbed and the designations and quantities will be consistent with those at the time of storage, making repeated analysis unnecessary.

3.2 SELECTION OF SAMPLING EQUIPMENT

The only test method presently used in support of the PUREX Storage Tunnels operation is a corrosivity check on the final in-place aqueous rinse of discarded vessels before the vessels are released for storage. The pH is determined by Method 9040 or 9041 (SW-846).

3.3 MAINTAINING AND DECONTAMINATING FIELD EQUIPMENT

All equipment used to collect and transport samples must be free of contamination that could alter test results. Equipment used to obtain and contain samples must be clean. Acceptable cleaning procedures for sample bottles and equipment include, but are not limited to, washing with soap or solvent, and steam cleaning. After cleaning, cleaning residues must be removed from all equipment that could come into contact with the waste. One method to remove these residues would be a solvent (acetone or other suitable solvent) rinse followed by a final rinse with deionized water. Equipment must be cleaned before use for another sampling event.

After completion of sampling, equipment should be cleaned as indicated previously. If decontamination of the equipment is not feasible, the sampling equipment should be disposed of properly.

3.4 SAMPLE PRESERVATION AND STORAGE

Sample preservation follows those procedures set forth for the specific analysis identified. Preservation will be in accordance with the methods stated in SW-846 or any of the test methods adopted by the Hanford Facility that meet WAC 173-303 requirements. No preservation method will be used when there are ALARA concerns.

3.5 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

The only test method presently used in support of the PUREX Storage Tunnels operation is a corrosivity check on the final in-place aqueous rinse of discarded vessels before the vessels are released for storage. Field duplicates, field blanks, trip blanks, and equipment blanks will not be taken. Split samples could be taken at the request of the EPA or Ecology.

Generally, quality assurance and quality control (QA/QC) requirements for sampling will be divided between paperwork requirements, such as chain-of-custody, and sampling and analysis activities. This section addresses sampling QA/QC requirements. Analytical QA/QC is discussed in Section 4.0.

A chain-of-custody procedure is required for all sampling identified by this WAP. At a minimum, the chain of custody must include the following: (1) description of waste collected, (2) names and signatures of samplers, (3) date and time of collection and number of containers in the sample, and (4) names and signatures of persons involved in transferring the samples.

3.6 HEALTH AND SAFETY PROTOCOLS

The safety and health protocol requirements established for the Hanford Site must be followed for all sampling activities required by this WAP.

4.0 LABORATORY SELECTION AND TESTING AND ANALYTICAL METHODS

This section discusses laboratory selection and the types of acceptable analytical methods.

4.1 LABORATORY SELECTION

Laboratory selection is limited as only a few laboratories are equipped to handle mixed waste because of the special equipment and procedures that must be used to minimize personnel exposure. Laboratory selection will depend on laboratory capability, nature of the sample, timing requirements, and cost. At a minimum, the selected laboratory must have the following:

- A comprehensive QA/QC program (both qualitative and quantitative)
- Technical analytical expertise
- An effective information management system.

These requirements will be met if the selected laboratory follows the pertinent requirements contained in the *Hanford Analytical Services Quality Assurance Plan* (DOE/RL-94-55). The selected laboratory also can meet these requirements by having some other type of QA/QC program as long as equivalent data quality is achieved.

4.2 TESTING AND ANALYTICAL METHODS

Testing and analytical methods will depend on the analysis being sought and the reason for needing the information. Analytical methods will be selected from those that routinely are used by the various onsite analytical laboratories. These methods will in some cases deviate from SW-846 and American Society for Testing and Materials-accepted specifications for holding times, sample preservation, and other specific analytical procedures. These deviations are discussed in *Analytical Methods for Mixed Waste Analyses at the Hanford Site* (DOE/RL-94-97).

5.0 WASTE RE-EVALUATION FREQUENCIES

Re-evaluation of waste within the PUREX Tunnels will not occur because of high radiation levels and the way the railcars are positioned in the tunnels. The waste is expected to remain stable.

6.0 SPECIAL PROCEDURAL REQUIREMENTS

The following sections describe special procedural requirements associated with waste in the PUREX Storage Tunnels.

6.1 PROCEDURES FOR RECEIVING WASTES GENERATED OFFSITE

The PUREX Storage Tunnels do not accept waste generated off the Hanford Site.

6.2 PROCEDURES FOR IGNITABLE, REACTIVE, AND INCOMPATIBLE WASTE

Presently, the only ignitable, reactive, or incompatible dangerous waste stored in the PUREX Storage Tunnels is the silver nitrate coating on the ceramic packing inside the silver reactors. This material is confined to the interior of a large stainless steel vessel (Section 2.1.3) that separates this material from all other waste material stored in the tunnel. The requirements in WAC 173-303-395(1)(a) require 'No Smoking' signs be conspicuously placed wherever there is a hazard present from ignitable or dangerous waste. 'No Smoking' signs are not considered appropriate at the PUREX Storage Tunnels because the tunnels are a designated radiation area. Smoking is not allowed in any radiation area on the Hanford Site and rules prohibiting smoking are strictly enforced. Because the posting of radiation area barriers serves to achieve the no smoking intent of WAC 173-303-395(1)(a), posting and maintaining 'No Smoking' signs are not considered appropriate.

Isolated areas within the PUREX Storage Tunnels have radiation levels in excess of 5 roentgen per hour. Personnel entry into such radiation areas to make periodic inspections [e.g., an annual fire inspection as required by WAC 173-303-395(1)(d) for storage areas containing ignitable waste] would be inconsistent with ALARA guidelines of the *Atomic Energy Act of 1954*.

Therefore, such inspections are not performed. The rationale for operations associated with the PUREX Storage Tunnels are addressed further in a petition for rulemaking submitted to Ecology (Freeberg 1989), in fulfillment of a Tri-Party Agreement milestone (Milestone M-22-01) (Ecology et al. 1994).

6.3 PROVISIONS FOR COMPLYING WITH LAND DISPOSAL RESTRICTION REQUIREMENTS

Operation of the PUREX Storage Tunnels does not involve land disposal or treatment of dangerous waste. The information provided by the generating unit regarding land disposal restrictions of dangerous waste is sufficient to operate the PUREX Storage Tunnels in compliance with land disposal restriction requirements. When final disposition of the waste occurs, this information will be passed on for final treatment or disposal of the waste.

6.4 DEVIATIONS FROM THE REQUIREMENTS OF THIS PLAN

Management may approve deviations from this plan if special circumstances arise that make this prudent. These deviations must be documented in writing with a copy to be to retained by the management.

7.0 RECORDKEEPING

Records associated with this waste analysis plan and waste verification program are maintained by PUREX Regulatory Compliance personnel. These records will be maintained until closure of the PUREX Storage Tunnels. Records associated with the waste inventory will be maintained for 5 years.

8.0 REFERENCES

DOE/RL-94-55, *Hanford Analytical Services Quality Assurance Plan*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-94-97, *Analytical Methods for Mixed Waste Analyses at the Hanford Site*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, EPA, and DOE, 1994, *Hanford Federal Facility Agreement and Consent Order*, Vols. 1 and 2, Washington State Department of Ecology, U.S. Environmental Protection Agency, U.S. Department of Energy, Olympia, Washington.

EPA, 1986, *Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods*, SW-846, 3rd ed., U.S. Environmental Protection Agency, Washington, D.C.

Freeberg, R. D., 1989, *Proposed Petitions for Rulemaking Changes for Interim Milestone M-22-01*, Correspondence dated September 27, 1989, Number 8955715, U.S. Department of Energy-Richland Operations Office, Richland, Washington.

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Table 1. PUREX Storage Tunnels Inventory. (sheet 1 of 3)

PUREX #1 STORAGE TUNNEL (218-E-14)

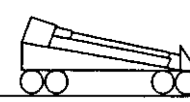
TUNNEL IS AT ITS CAPACITY AS OF 1/22/65

PUREX #1 Storage Tunnel is located at the southeast end of the PUREX Plant and is an extention of the railroad tunnel. The storage area is approximately 109 meters long, 6.9 meters high and 5.8 meters wide. The tracks have a one percent downgrade toward the south end of the tunnel. The capacity of the Storage Tunnel is eight modified railroad cars, 12.8 meters long.

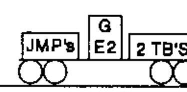
position

1. & 2. HA COLUMN AND MISC JUMPERS IN BOX
PLACED IN TUNNEL #1 ON 6/60
HA 4,700 CU. FT., 400 CURIES, 5 rem/hr. @ 60',
JUMPRS 2,190 CU. FT., 2,000 CURIES, Pb - ~115 Kg.

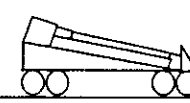
3. E-F11 #1 (1WW WASTE) CONCENTRATOR FAILED 7/24/60.
PLACED IN TUNNEL #1 ON 7/29/60, 12.5 rem/hr. @ 100',
1,900 CU. FT., 40, 000 CURIES AFTER FIFTY-FIVE MONTHS SERVICE.



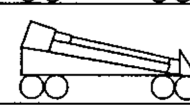
4. G-E2 CENTRIFUGE. MISC JUMPERS IN BOX AND TWO TUBE BUNDLES.
PLACED IN TUNNEL #1 ON 12/24/60 (FUG SER# 762)
2,465 CU. FT., 3,000 CURIES, Pb - ~115 Kg., 1.5 rem/hr. @ 150'.



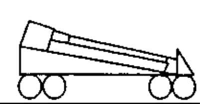
5. E-H4 (3WB) CONCENTRATOR FAILED 1/4/61.
PLACED IN TUNNEL #1 ON 1/4/61, 150 mrem/hr. @ 50',
2,336 CU. FT., 1,000 CURIES. AFTER FIVE YEARS SERVICE.



6. E-F6 (2WW WASTE) ORIGINAL CONCENTRATOR FAILED 4/21/61.
PLACED IN TUNNEL #1 ON 4/21/61, 5 rem/hr. @ 20',
2,336 CU. FT., 700 CURIES. AFTER FIVE YEARS FOUR MONTHS SERVICE.



7. E-F11 (1WW WASTE) #2 CONCENTRATOR FAILED 2/1/62.
PLACED IN TUNNEL #1 ON 2/8/62, 25 rem/hr. @ 150',
2,336 CU. FT., 40,000 CURIES. AFTER EIGHTEEN MONTHS SERVICE.



8. E-F6 (2WW WASTE) #3 SPARE CONCENTRATOR FAILED 5/23/64.
PLACED IN TUNNEL #1 ON 1/22/65 FLAT CAR 3621.
2,400 CU. FT., 700 CURIES, 5 rem/hr. @ 20'.

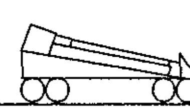


Table 1. PUREX Storage Tunnels Inventory. (sheet 2 of 3)

PUREX #2 STORAGE TUNNEL (218-E-15)

PUREX #2 Storage Tunnel is located at the southeast end of the PUREX Plant and is an extention of the railroad tunnel. The storage area is approximately 514.5 meters long, 7.9 meters high and 10.4 meters wide. The tracks have a one percent down-grade toward the south end of the tunnel. The capacity of the Storage Tunnel is 38-40 modified railroad cars, 12.8 meters long. The Tunnel contains 21 cars as of 2/95.

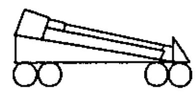
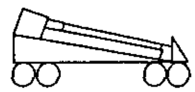
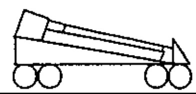
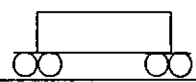
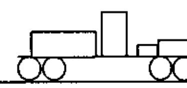
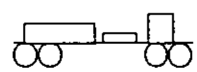
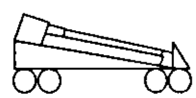
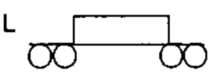
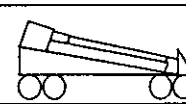
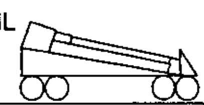
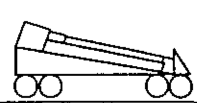
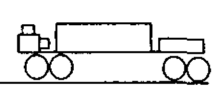
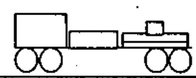
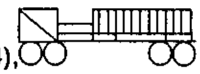
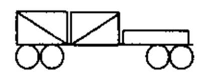
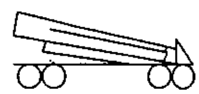
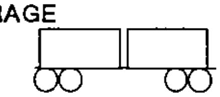
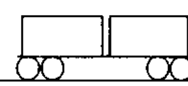
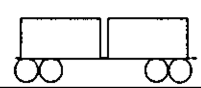
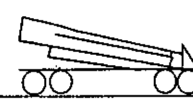
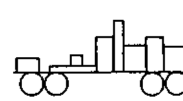
position		
1.	E-F6 # (2WW WASTE) CONCENTRATOR, TK F 15-2, ONE TUBE BUNDLE AND AGITATOR MOTORS PLACED IN TUNNEL ON 12/12/67 ON CAR 61439 2,400 CU. FT., 700 CURIES, 1.3 rem/hr. @ 100'.	
2.	E-F6 #5 (E-H4 3WB) CONCENTRATOR, TWO TUBE BUNDLES PLACED IN TUNNEL ON 3/26/69 ON CAR MILW 60883 2,400 CU. FT., 500 CURIES, 800 mrem/hr. @ 2'.	
3.	E-F6 #6 (2WW WASTE) CONCENTRATOR, TWO TUBE BUNDLES FAILED PLACED IN TUNNEL ON 3/19/70 ON CAR 3612. 2, 400 CU. FT., 700 CURIES, 500 rem/hr. @ 2'.	
4.	L CELL PACKAGE IN A SEALED STEEL BOX (H2-66012) PLACED IN TUNNEL ON 12/30/70 ON CAR MILW 60033 2,400 CU. FT., 500 GRMS PU, 200 mrem/hr. @ CONTACT.	
5.	F2 SILVER REACTOR, F6 DEMISTER, VESSEL VENT LINE STEEL CAT-WALK AND GUARD RAILS. PLACED IN TUNNEL ON 2/26/71 ON GONDOLA CAR 4610. 2,400 CU. FT., 20 CURIES, Ag - ~625 Kg, 2 rem/hr. @ CONTACT.	
6.	MODIFIED A3-1 TOWER, SCRUBBER, LID AND VAPOR LINE PLACED IN TUNNEL ON 12/12/71 ON GONDOLA CAR 4611. 2,400CU. FT., 10 CURIES, 1 rem/hr. @ CONTACT.	
7.	A3 DISSOLVER PLACED IN TUNNEL ON 12/22/71 ON NINE FT. SHORTENED CAR B58 2,400 CU.FT., 50 CURIES, Hg - ~45 Kg, 5 rem/hr. @ 5'.	
8.	A1W1 FUEL ENDS IN STEEL LINER BOX AND NPR FUEL HANDLING EQUIPT. USED WITH THE SUSPECTED CANISTERS, ON CAR 19808 PLACED IN TUNNEL ON 8/29/72. 800 CU. FT., 17,500 CURIES, 10 rem/hr. @ 150'.	
9.	C3 DISSOLVER PLACED IN TUNNEL ON 9/30/72 ON CAR 19811 1590 CU. FT., 50 CURIES, Hg - ~45 Kg., 5 rem/hr. @ 5'.	
10.	E-H4 (3WB) CONCENTRATOR, #61 TUBE BUNDLE, PROTOTYPE COOLING COIL AND A F-F1 FILTER TANK. PLACED IN TUNNEL 8/30/83 ON CAR CDX-1. 2,400 CU. FT., 500 CURIES, Hg - ~40 Kg., Cd - ~43 Kg., 800 mrem/hr. @ 2'.	
11.	A3 DISSOLVER (VESSEL #10 AND HEATER VESSEL #6) PLACED IN TUNNEL ON 1/18/86 ON CAR 3613 3,960 CU. FT., 0.81 CURIES, Hg - ~40 Kg., Cd - ~43 Kg., 3 mrem/hr. @ 3'.	
12.	WHITE BOX (H2-58456) CONTAINING EIGHT TUBE BUNDLES #S 57, 60, 62, 64, 67, 68, 74, AND 76 PULSER #5 AND OLD HEATER DISS LID OLD STYLE DUMPING TRUNNIONS (9), PLACED IN TUNNEL ON 1/20/86 ON CAR 3611 5,438 CU. FT., 540 CURIES, 2 rem/hr. @ 3'.	

Table 1. PURE Storage Tunnels Inventory. (sheet 3 of 3)

PUREX #2 STORAGE TUNNEL (218-E-15)

position		
13.	J5 TANK (VESSEL #30). F1 COND (VESSEL #13) AND F12-B CELL BLK. OLD FOUR-WAY DUMPER. DISS YOKE AND FLANGE PLATE, 3 rem/hr. @ 1'. PLACED IN TUNNEL ON 1/21/86 ON CAR 19806. 2,500 CU. FT., 90 CURIES.	
14.	L-1 PULSER, 2-COLUMN CARTRIDGES, 1-JUMPER CUTTER, 3-JUMPER ALIGNMENT TOOLS, 9-EXTERIOR DUMPING TRUNNIONS, 10-PUMPS, 3-AGITATORS, 4-TUBE BUNDLES, 2-VENT JUMPERS AND 7-YOKES. PLACED IN TUNNEL ON 11/18/87 ON CAR PX-10 (10A-19380) & RACK H2-96629.50. 50 TONS, 3,600 CU. FT., 33,740 CURIES(REF:LETTER 12110-88-074), FLUOROTHENE - ~180 Kg., Pb - ~2540 Kg., 5 rem/hr. @ 15'.	
15.	SILVER REACTOR, E-F2 STEAM HEATER AND STORAGE LINER (H2-65095) FULL OF CUT UP JUMPERS PLACED IN TUNNEL ON 5/13/88 ON CAR PX-9 (10A-19809) & S/R CRADLE SK-GLR-11-2-87. 20 TONS, 2,775 CU. FT., 240 CURIES (REF: LETTER 12110-88-074), Cd - ~13 Kg., Ag - ~115 Kg., Pb - ~230 Kg., 20 mrem/hr. @ 20'.	
16.	E-J8-1 UNITIZED CONCENTRATOR VESS #1 H2-52477, FAILED 3/11/89 PLACED ON STORAGE CAR H2-99608, PX-6 (10A-19028) AND INTO #2 TUNNEL 4/6/89 GRAVEYARDS. EST. 42 TONS, 6,000 CU. FT. 1.5 CURIES (REF: LETTER 12113-89-027), 0.5 mrem/hr. @ 10'.	
17.	NORTH STORAGE LINER H2-65095 CONTAINING SIX PUMPS, ONE AGITATOR AND CUT UP JUMPER (14 TONS). SOUTH STORAGE LINER H2-65095 CONTAINING ONE PUMP, ONE #15 YOKE AND CUT UP JUMPERS (11.5 TONS). PLACED ON STORAGE CAR PX-19 (10A-19030) AND INTO #2 TUNNEL 8/5/89 DAYS. EST 25.5 TONS, 2,574 CU. FT. 3.0 CURIES (REF: LETTER 12113-89-051), 80 mrem/hr. @ 1'.	
18.	T-F5 ACID ABSORBER, ID#1-T-F5/F-168713, H2-52535 AND H2-52487/488. PLACED ON STORAGE CAR PX-2 AND INTO #2 TUNNEL 4/8/94. EST 22 TONS, 835 CU. FT., 185 CURIES, 90 mrem/hr. @ CONTACT.	
19.	FOUR METAL LINER STORAGE BOXES H-2-65095-3/H-2-100187-0 CONTAINING FAILED JUMPERS AND MISCELLANEOUS OBSOLETE CANYON EQUIPMENT ITEMS. PLACED ON STORAGE CAR PX-23 AND INTO #2 TUNNEL 9/16/94. EST 60 TONS, 4032 CU. FT., 927 CURIES, 30 mrem/hr. @ 2'.	
20.	E-H4-1 UNITIZED CONCENTRATOR (H-2-52477/56213)/(E-H4-1). PLACED IN TUNNEL ON 1/27/95 ON CAR PX-28. EST 40 TONS, 5,760 CU. FT., 3,070 CURIES, Cr - ~8 Kg., 1000 mrem/hr. @ 5'.	
21.	TANK E-5 (H-2-52453)/(F-166955), LEAD STORAGE BOX ASSEMBLY (H-2-131629)/(H-2-131629-1), H4 CONCENTRATOR TOWER (H-2-58102)/(F-223017-CBT-4), HOT SHOP COVER PLATE (H-2-52222)/("Q"), TUBE BUNDLE WASH CAPSULE (H-2-58647), DISSOLVER CHARGING INSERT (H-2-75875)/(H-2-75875-1), LIFTING YOKE #7A (H-2-96837), LIFTING YOKE #9 (H-2-52458). PLACED IN TUNNEL ON 2/8/95 ON CAR PX-3609. EST 44 TONS, 3,457 CU. FT., 26,000 CURIES, Pb - ~1930 Kg., 1000 mrem/hr. @ 4'.	

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Project Title/Work Order		EDT No. 613548
PUREX Storage Tunnels Waste Analysis Plan		ECN No. N/A

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Halftone

Recto	Verso
Dist	—
~~RA~~ EDT	—
~~EDT~~ RA	—
SD Cov	—
iii	iv
v	vi
1	2
↓	↓
17	18
T-1.1	T-1.2
T-1.3	—

4
4
18
3
29
-3
26

29
+4
33

Foldout

Recto	Verso

Reduction

Recto	Verso