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Estimation of PUREX Equipment and Materials That are Candidates for Removal and Waste Processing During PUREX Plant Closure

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Westinghouse Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

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ESTIMATION OF PUREX EQUIPMENT AND MATERIALS THAT ARE CANDIDATES FOR REMOVAL AND WASTE PROCESSING DURING PUREX PLANT CLOSURE

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LIST OF TERMS

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
AMU	aqueous makeup unit
CFR	*Code of Federal Regulations*
cm	centimeter
CVI	certified vendor information
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
ft	feet
ft^3	cubic feet
gal	gallon
HAW	high-level aqueous waste
HEPA	high-efficiency particulate air (filter)
HNO_3	nitric acid
HVAC	heating, ventilation, and air conditioning
in.	inch
kg	kilogram
kg/m^3	kilogram per cubic meter
L	liter
lb	pound
lb/ft^3	pound per cubic feet
LLMW	low-level mixed waste
LLW	low-level waste
m	meter
<u>M</u>	Molar
m^3/yr	cubic meter per year
MW	mixed waste
nCi/g	nanocuries per gram
NPH	normal paraffin hydrocarbon
NPR	new production reactor (N Reactor)
OD	outer diameter
oz/gal	ounce per gallon
ppm	parts per million
PuO_2	plutonium oxide
PUREX	Plutonium-Uranium Extraction (Plant)
RCRA	*Resource Conservation and Recovery Act of 1976*
RL	Richland Operations Office
SNM	special nuclear material
SW	solid waste (denotes nonradioactive, nonhazardous solid waste)
TBP	tributyl phosphate
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TRU	transuranic
TRUMW	transuranic mixed waste
TSD	treatment, storage, and disposal
UO_3	Uranium-Trioxide (Plant)
vol%	volume percent
WAC	*Washington Administrative Code*
WHC	Westinghouse Hanford Company

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EXECUTIVE SUMMARY

In December 1992, the U.S. Department of Energy authorized plans to terminate the Plutonium-Uranium Extraction (PUREX) Plant and directed its Richland Operations Office to proceed with closure planning. The primary objective of this study was to develop an estimate of the equipment and other materials in the PUREX Plant that are candidates for removal and processing as solid waste during plant closure activities.

Plant closure consists of two phases: the deactivation phase and the decontamination and decommissioning (D&D) phase. During the deactivation phase, the major remaining radioactive sources and hazardous chemicals within the PUREX Plant will be removed, reduced, and/or stabilized, and utilities and effluents will be shut down. The current plants for the deactivation project are in the *Draft PUREX/UO$_3$ Deactivation Project Management Plan*, WHC-SP-1011D (WHC 1993). This document forms the basis for the discussion of the anticipated amounts and general characteristics of waste expected to be generated during deactivation, which is found in Section 2.0.

The PUREX Plant will be transferred to the Hanford Surplus Facilities Program pending eventual D&D subsequent to the completion of deactivation. Final D&D will include closure of secondary containment; the end-state of the equipment, systems, and materials left in place; final disposition of the vessels and equipment in the tunnels; and closure of the tunnels. To identify the potential volumes of equipment and other materials that may be subject to removal and processing as solid waste during the D&D phase, the PUREX tunnels and operational areas were considered separately. All removable equipment,

piping, jumpers, and similar items were considered potential candidates for treatment, storage, and disposal as solid waste during the D&D phase.

Two PUREX tunnels, tunnel 1 and tunnel 2, were used for interim storage to shelter failed or obsolete process equipment. The process equipment, bulky and highly radioactive, could not be removed from the PUREX Plant. Tunnel 1 is filled to capacity with eight railcars that contain approximately 20,800 cubic feet (ft^3) of unsegregated radioactive waste. This waste is characterized in greater detail in Section 3.1. It is estimated that about 45 percent (%) of the waste could be classified as transuranic (TRU) waste, while the remainder is low-level waste (LLW). About 500 pounds (lb) of lead is stored in tunnel 1.

Tunnel 2, which currently holds 17 railcars, contains about 48,500 ft^3 of unsegregated radioactive waste. Approximately 30% of the unsegregated radioactive waste is estimated to be TRU. This tunnel also contains about 284 lb of mercury, 1,625 lb of silver salts (as silver nitrate), and 6,084 lb of lead. Section 3.2 describes the equipment stored in Tunnel 2.

The PUREX Plant consists of the main fuels reprocessing building, 202A, and a number of ancillary buildings. Section 4.0 describes the many process vessels, chemical storage tanks, and other types of equipment that are potential candidates for removal and processing as solid waste. The total volume for the approximately 425 items of PUREX operating equipment is 341,000 ft^3. The total weight for these items is an estimated 2.3 million lb.

On a volume basis, 29% of this material is not radioactively contaminated, while 60% falls into the LLW, 7% in the TRU waste, and 6% or less into the mixed waste categories.

The PUREX Plant also contains a large number of pipes and jumpers. A preliminary estimate of the piping volume at PUREX is 3,900 ft^3. This preliminary estimate is probably low, however, a thorough review of the piping diagrams for hot pipe trench and process cells still remains to be done. The majority of the piping will probably be classified as Category 1 LLW.

The closure of the PUREX Plant will provide a model for the subsequent closure of other canyon-type facilities at the Hanford Site. This study may provide the basis for similar studies of B Plant, U Plant, and the S Plant (Reduction-Oxidation Plant).

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1.0 INTRODUCTION

This section describes the purpose, background, and scope of the current study, which identifies the equipment and other materials in the Plutonium-Uranium Extraction (PUREX) Plant that are candidates for removal and subsequent processing in a solid waste facility.

1.1 PURPOSE

The primary objective of this study was to develop an estimate of the equipment and other materials in the PUREX Plant that are candidates for removal and subsequent processing as solid waste. This estimate includes equipment that currently is retrievably stored in the two PUREX tunnels and equipment in the canyons, hot cells, and other operating areas. Equipment items have been categorized into the following groups, which correspond to potential processing options:

1. **Transuranic (TRU) Waste**--Regardless of source or form, TRU waste is waste that is contaminated with alpha-emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than 100 nanocuries per gram (nCi/g) of waste matrix. Transuranium radionuclides are radionuclides having an atomic number greater than 92. In addition to TRU radionuclides, radium sources and ^{233}U in concentrations greater than 100 nCi/g of the waste matrix are managed as TRU waste.

2. **TRU Mixed Waste**--TRU mixed waste meets the definition above for TRU waste, contains dangerous waste, and radioactive components. Dangerous wastes are defined in the *Washington Administrative Code* (WAC) 173-303-040.

3. **Low-Level Waste (LLW)**--LLW, as defined in U.S. Department of Energy (DOE) Orders 5820.2A and 5400.3, is radioactive waste not defined as high-level waste, TRU waste, spent nuclear fuel, or byproduct material. All LLW is classified according to Category 1, 3, and greater than Category 3 concentration limits. These limits, which are discussed in more detail in Section 2.0, are based on the waste classification system developed by the U.S. Nuclear Regulatory Commission in Title 10 *Code of Federal Regulations* (CFR) Part 61.

4. **Low-Level Mixed Waste**--Low-level mixed waste is LLW that contains dangerous waste, as defined in WAC 173-303-040.

5. **Nonradioactive Dangerous Waste**--Any nonradioactive solid waste that has been contaminated by hazardous chemicals, as defined in WAC 173-303.

A secondary objective of the study was to assess the applicability of this effort to the estimation of potential equipment candidates for removal and waste processing at similar canyon-type facilities.

1.2 BACKGROUND

The PUREX Plant consists of the 202-A Canyon facility and a number of ancillary buildings. The canyon in 1,005 feet (ft) long and houses a single row of 12 process cells. The PUREX Plant was started up in 1956 to recover uranium and weapons grade plutonium from irradiated aluminum-clad uranium metal fuel from the Hanford Site reactors. In 1967, the PUREX Plant was modified to reprocess zirconium alloy clad fuel from N Reactor to recover plutonium, uranium, and neptunium. Appendix A provides an overview of the PUREX process. Appendix B provides a brief history of PUREX operations.

In October 1990, DOE, Richland Operations Office (RL) directed Westinghouse Hanford Company (WHC) to initiate transition-to-standby activities for PUREX. The standby condition was achieved in September 1992. In December 1992, the Assistant Secretary for Environmental Restoration and Waste Management authorized plans to terminate the PUREX Plant and directed RL to proceed with shutdown planning and terminal cleanout activities.

At the completion of the Stabilization Campaign in 1990, the feedstock left in PUREX from the 1988 shutdown had been processed and removed from the plant. Bulk chemicals, solutions used to test the processing equipment, the PUREX process solvent, recovered nitric acid, and a small quantity of pre-1972 reactor fuel were left in the plant. During the subsequent transition-to-standby phase, these materials were left untouched.

The deactivation project will remove, reduce, and/or stabilize the major remaining radioactive sources and hazardous chemicals within the PUREX Plant. Completing these activities will reduce the risk to workers and the public and will allow for a reduced level of surveillance during the extended surveillance period following deactivation. After deactivation, the PUREX Plant will be transferred to the Hanford Surplus Facilities Program pending eventual decontamination and decommissioning (D&D) (WHC 1993).

Final D&D will include closure of secondary containment; the end-state of the equipment, systems and material left in place, including material in the "containment building;" final disposition of the vessels and equipment in the tunnels; and closure of the tunnels (WHC 1993).

1.3 SCOPE

PUREX Plant closure will proceed in two phases: the deactivation phase and the subsequent D&D phase. Section 2.0 summarizes the solid wastes that are expected to be generated during the deactivation phase of PUREX closure. Information about deactivation phase waste generation, which was obtained from the *Draft PUREX/UO_3 Deactivation Project Management Plan* (WHC 1993).

To identify the potential volumes of equipment and other materials that might be subject to removal and processing as solid waste during the D&D phase, the PUREX Plant was considered to have two distinct areas: the two tunnels and the operational areas of the PUREX Plant. Section 3.0 covers the equipment currently stored in the PUREX tunnels. Section 3.1 discusses

Tunnel 1 and Section 3.2 discusses Tunnel 2. Both Sections 3.1 and 3.2 discuss the hazardous and radiological components of the tunnel waste and provide detailed descriptions for each equipment item stored in the tunnels.

Section 4.0 addresses the equipment and other materials expected to remain in the PUREX Plant once the facility has been officially deactivated. A brief description of the PUREX Plant and the primary cells (Section 4.1) is followed by a discussion of the equipment items that are candidates for removal and processing as solid waste during the D&D phase (Section 4.2). Section 4.3 summarizes the piping that could potentially be removed during D&D. Section 4.4 discusses the removal of materials from the cell floors.

This study helps determine the general applicability of the data gathered for the PUREX Plant to other similar canyon facilities that will eventually undergo D&D. This topic is the subject of Section 5.0.

Section 6.0 lists the references used to create this report.

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2.0 SOLID WASTES EXPECTED TO BE GENERATED DURING DEACTIVATION SUMMARY

The Plutonium-Uranium Extraction (PUREX) Plant currently generates two types of nonradioactive wastes: nondangerous waste, such as office and packing trash, and dangerous waste. Additionally, four types of radioactive waste generated are transuranic (TRU) waste, TRU mixed waste (MW), low-level waste (LLW), and low-level mixed waste.

This section provides an overview of the anticipated amounts and general characteristics of wastes expected to be generated during the deactivation phase. The information on deactivation wastes was based on the *Draft PUREX/UO_3 Deactivation Project Management Plan* (WHC 1993).

The goals for the deactivation of the PUREX Plant are described in the *Draft PUREX/UO_3 Deactivation Project Management Plan* (WHC 1993). These goals include the removal, reduction, and/or stabilization of hazardous and radioactive materials.

Hazardous and radioactive materials will be removed from the plants or stabilized sufficiently to ensure long-term PUREX Plant safety and regulatory compliance, enable plant classification as a non-occupied facility, and enable subsequent successful decontamination and decommissioning (D&D). This effort will ensure that the plant complies with WHC-CM-1-6, *Radiological Control Manual*, as applicable to a non-occupied facility after completion of deactivation. As a general guide, "as-left" contamination and radiation levels in plant areas will not be greater than the levels encountered during normal operation and occupancy of the plant.

To ensure long-term safety and regulatory compliance, the following requirements apply.

- Permanent radiation zones to be entered for surveillance shall be decontaminated and released or the surface contamination levels reduced or stabilized to minimize re-suspension and/or migration of loose contamination. Temporary radiation zones inside and outside of buildings shall be eliminated.

- Packaged radioactive and MW with identified final disposition shall be removed and disposed of. Wastes that are not removed shall be identified and characterized and documented.

- Accessible interior glovebox surfaces shall be decontaminated or the surface contamination stabilized. Openings to gloveboxes shall be sealed in a manner that ensures confinement of remaining contamination.

- Loose or damaged friable asbestos in areas expected to be entered during surveillance shall be removed or stabilized.

- Fissile materials shall be removed sufficiently to eliminate the potential for a nuclear criticality excursion and the need for a criticality alarm system.

- Tanks, vessels, and drums shall be drained using installed equipment and features. Heels shall not contain material classified as hazardous waste.

- Hazardous materials used for deactivation and cleanup work shall be collected and disposed of.

- Emergency lighting and associated batteries from the facilities shall be removed and disposed of.

Table 2-1 outlines the expected status of the PUREX facility at the end of deactivation. PUREX deactivation is scheduled to be completed by the end of fiscal year 1998 (WHC 1993).

2.1 MINIMIZATION OF SOLID WASTES

Although deactivation activities will generate increased volumes of solid wastes, waste minimization programs will continue to be implemented at the PUREX Plant.

The following waste minimization objectives for deactivation include:

- Avoid generating waste.
- Minimize the waste generated.
- Recycle the waste that is minimized.
- Treat the waste that cannot be recycled.

The waste minimization objectives will be applied sequentially to the work.

Practical waste minimization efforts include eliminating characteristic hazardous waste, segregating wastes into compatible categories, and compacting solid waste.

2.1.1 Nonradioactive Hazardous Waste Minimization

The most successful waste minimization effort to date has been the sale of the remaining PUREX bulk process chemicals to the private sector. About 924,000 kilograms (kg) (2.04 million pounds [lb]) of chemicals have been recycled to private industry. Of the original 1.04-million kg (2.3 million lb) inventory, 105,000 kg (232,000 lb) remains unsold. About 136,000 kg (300,000 lb) of ammonium fluoride-ammonium nitrate, a specialty chemical, have been disposed of as waste.

Most of the remaining PUREX bulk process chemicals are expected to be sold. During deactivation, the chemicals will continue to be offered for sale until it is determined that no market demand exists. At that time, the leftover chemicals will be disposed of as waste.

Table 2-1. PUREX Status After Deactivation. (2 sheets)

Facility area	Area status description
Canyon	• Mobile quantities of special nuclear materials (SNM) removed • Fuels removed • Process vessels emptied and flushed • Some process equipment disassembled to remove inventory • SNM inventory reconciled • Process cells flushed • Failed equipment/jumpers removed from canyon deck as appropriate • Canyon piping to external facility interfaces (tank farms, 216-B-3/Pond, out-of-service cribs, etc.) isolated
Storage gallery	• Supplies removed • Shop equipment de-energized • Fire foam system deactivated • High-radiation areas mitigated
Sample gallery	• Samplers, including D5 Cave, flushed • Sample gallery area flushed • Hood exhaust ductwork removed • Floor drains plugged
Pipe and operating gallery	• Gallery flushed • Mobile equipment removed • White room repainted • White room floor resurfaced • Headers drained and flushed • Floor drains plugged
Cranes	• Cranes parked on maintenance platforms and shut down as is
Aqueous makeup unit	• Chemical inventory removed • Tanks and supply headers flushed
Analytical laboratory	• All chemical inventory removed • Hoods decontaminated • Equipment de-energized
Shop areas	• Supplies removed • Equipment de-energized
Control rooms	• All instrument and equipment controls de-energized, expect control of canyon exhaust. These functions will be consolidated at a single remote monitoring location
Office/change rooms, mobile offices	• Personnel relocated • Furniture and files removed

Table 2-1. PUREX Status After Deactivation. (2 sheets)

Facility area	Area status description
211-A Area	• Chemical inventory removed • Demineralizers isolated with resin disposed • Vessels flushed • Utilities isolated • Surfaces decontaminated of hazardous materials and resurfaced as necessary
203-A Area	• Tanks emptied and flushed • Utilities isolated • Acid solutions removed • Surfaces decontaminated and resurfaced as necessary
U Cell/Fractionator	• Recovered acid removed • Vessels flushed • Coverblocks sealed
Heating, ventilation, and air conditioning (HVAC) services	• HVAC systems consolidated to limit gaseous effluent discharge and monitoring points to 291-A-1 Canyon exhaust stack • Steam, water, and compressed air service eliminated • Electrical systems consolidated • Emergency loads minimized or eliminated • Electrical service provided for selected lighting panels • Alternative source of backup power to canyon fans • Monitoring functions consolidated at a single monitoring location
Effluents	• Liquid and gaseous effluent streams eliminated, expect 291-A-1 Canyon stack discharge • Buildings decontaminated and locked • Effluent piping isolated
N Cell, product removal room, and Q Cell	• Gloveboxes decontaminated and residual contamination fixed
R Cell vault	• Organic solvent removed • Vessels and vault flushed • Coverblocks sealed
Ancillary buildings	• Portable and/or mobile equipment and materials removed • Piping with external interfaces isolated • Utilities and HVAC isolated • Surfaces and piping vessels flushed • Asbestos stabilized

2.1.2 Radioactive Waste Minimization

Solid waste volumes will be minimized by incorporating the waste minimization objectives in the planning phase; by segregating waste by type to prevent category crossover; and, by using waste compaction and size reduction to reduce void space in the waste packages.

2.2 SOLID WASTE TYPES

The following section provides an estimate of the types and amounts of solid waste that are anticipated to be generated during Deactivation. These estimates are taken from the *Draft PUREX/UO_3 Deactivation Project Management Plan* (WHC 1993).

2.2.1 Nonradioactive, Nondangerous Solid Waste

This waste consists mainly of trash, nonrecyclable waste paper and other throwaway materials. This waste, which is not managed by the solid waste program, is transported from the PUREX Plant to the Hanford Site central landfill for disposal.

2.2.2 Nonradioactive, Dangerous Solid Waste

PUREX Plant nonradioactive dangerous waste typically consists of fluorescent lamp ballasts, expired chemicals, solvent-wetted rags, batteries, aerosol cans, waste oil, residual paint, and chemically contaminated equipment.

One of the goals for deactivation is the elimination of hazardous wastes at PUREX.

Most of the remaining PUREX bulk process chemicals are expected to be sold. During deactivation, the chemicals will continue to be offered for sale until it is determined that no market demand exists. At that time, all leftover chemicals will be disposed as waste.

Following removal of bulk liquid chemicals from storage tanks, all remaining heels will be characterized for resale potential. Residual heels will be removed as waste or sold as product, as appropriate. The tanks will then be flushed using a commercially available high-pressure spray wand, and the associated piping will be flushed back into the tank from appropriate termination points in the aqueous makeup unit area. Flushes will be performed until the waste no longer exhibits dangerous waste characteristics (pH between 2 and 12.5).

A certified hazardous waste disposal company will be subcontracted to remove rinsate from the tanks. The tanks will be emptied to the maximum extent possible within existing equipment capabilities. The aqueous makeup unit area will then be deactivated and isolated from the 211-A area and other process interfaces, as appropriate.

2.2.3 Transuranic Waste

The major sources of PUREX TRU waste are N cell, the product removal room, L cell, samplers in the west end of the sample gallery, and the PUREX analytical laboratory. Typical TRU waste includes glass, paper, cloth, plastic, leather gloves, glovebox gloves, piping, ducting, conduit, glass and metal portions of gloveboxes, failed equipment, and air cleaning filters. PUREX generates about 3.5 cubic meters per year (m^3/yr) of TRU waste; however, with deactivation activities in N cell and the product removal room and the planned co-precipitation of the plutonium-uranium solution in tanks D5 and E6 into 208-liter (L) (55-gallon [gal]) drums, the TRU waste volume is predicted to peak at about 69 m^3/yr.

2.2.4 Transuranic Mixed Waste

The TRU-MW stream is PUREX waste that either contains characteristic hazardous constituents or is inherently hazardous. The TRU-MW consists of the same kinds of items as TRU waste with the addition of equipment contaminated with nitric acid and lead-lined glovebox gloves. PUREX generates about 1.4 m^3/yr. The volume is predicted to peak at 13 m^3/yr during deactivation.

2.2.5 Low-Level Waste

The LLW stream is the major radioactive solid waste stream at PUREX. Typically, LLW consists of non-TRU contaminated waste paper, plastic, rubber, and maintenance materials. Generation rates are about 1,100 m^3/yr at PUREX and about 60 to 140 m^3/yr at the Uranium-Trioxide (UO_3) Plant.

The LLW volume will rise during deactivation, peaking at about 2,000 m^3/yr, before gradually declining to the very small volumes expected during the surveillance period (between the completion of deactivation activities and the onset of D&D activities). The peak volume in the surveillance period is expected to be about 20 percent (%) of the current generated volume.

2.2.6 Low-Level Mixed Waste

The LLW-MW stream is LLW that contains characteristic hazardous materials or is inherently hazardous. Typically, LLW-MW consists of expended laboratory chemicals, waste oils, aerosol cans, and solvent-wetted rags used for equipment decontamination. Generation rates at PUREX and UO_3 Plant are about 5.4 and 3.3 m^3/yr, respectively.

2.3 DANGEROUS WASTE REGULATIONS COMPLIANCE

Deactivation will be carried out in close cooperation with regulatory agencies and in accordance with all required permits. Any approvals and notifications that are required will be done as part of the Project. The unique aspect of the Project is that deactivation represents phase I closure, and decommissioning phase II, or final closure. Accordingly, a *Resource Conservation and Recovery Act of 1976* (RCRA) closure plan describing the deactivation of interim status systems will be developed for near-term submittal to the regulatory agencies. This plan will be modified in the long term to include final closure activities at interim status units at the time of D&D (phase II closure).

Several components of PUREX are regulated under the treatment or storage requirements of RCRA, as implemented through Washington State "Dangerous Waste Regulations," *Washington Administrative Code* (WAC) 173-303.

The following components and the use of each is shown in the unit-specific PUREX Part A Permit Application (Part A) (DOE-RL 1988):

Unit	Process code	Description
Tank E5	T01	Treatment
Concentrator E-F11	T01	Treatment
Tank F15	T01	Treatment
Tank F16	T01	Treatment
Tank F18	S02/T01	Storage/treatment
Tank G7	T01	Treatment
Tank U3	S02/T01	Storage/treatment
Tank U4	S02/T01	Storage/treatment
Containment	S05	Storage

The dangerous waste components consists of the waste tank (or concentrator), ancillary equipment, and secondary containment. Treatment to meet tank farm corrosion criteria consists of adjusting the pH to greater than 12 and adding sodium nitrite to greater than 0.011 Molar (M).

The following are types of regulated dangerous waste that were stored and/or treated at PUREX during prior operations.

- Cladding Removal Waste--Corrosive MW, generated by removing the zirconium cladding from the fuel before fuel dissolution, was treated in tank E5 to meet the tank farm corrosion criteria before its transfer to tank farms.
- Ammonia Scrubber Waste--MW from the Headend Ammonia Scrubber System (tanks A3-4, B3-4, C3-4, E3-2, F12, and concentrator E-F11) was treated in tank G7 to meet tank farm corrosion criteria before its transfer to tank farms.

- Miscellaneous Headend Waste--MW from throughout the PUREX headend, including drains from the PUREX analytical laboratory, is stored and treated in tanks U3 and U4 to meet tank farm corrosion criteria before its transfer to tank farms.

- Neutralized Zirflex Acid Waste--The highly radioactive, high heat generating, MW containing the bulk of the fission products separated from the reactor fuel by the PUREX liquid-liquid extraction process was treated in tanks F15 and F16. The waste was sugar denitrated to destroy the nitric acid and then treated to meet tank farm corrosion criteria for storage in select tanks within tank farms.

- Miscellaneous Mixed Waste--Miscellaneous MW that collects in 22 process cell sumps throughout the canyon area plus the bottoms from the E-F11 concentrator are stored and treated in tank F18 to meet tank farm corrosion criteria for storage in tank farms.

- Lead and Cadmium Waste--Lead was placed on jumpers used in the PUREX canyon as counterweights so the jumpers would hang properly from a crane hook. This allowed the jumpers to be installed remotely by the crane. Lead was also used as shielding for sensitive equipment and as weights in the canyon. Cadmium, a neutron absorber, was also used to protect sensitive equipment in the canyon. Lead and cadmium are removed from the jumper or piece of equipment and maintained in the containment (canyon) over D cell.

A separate unit-specific Part A was prepared for storing failed vessels and equipment in the PUREX storage tunnels. Subsequently, a unit-specific Part B Permit Application (Part B) (DOE-RL 1991) was prepared and submitted in September 1990. The Part A permit application for this treatment, storage, and disposal (TSD) unit covered the following:

- Storage Tunnel Waste--Failed vessels and equipment are placed in railroad tunnels adjacent to PUREX for storage. Lead, silver, or mercury contained on or in some of the failed vessels or equipment is placed in the tunnels along with the associated failed vessel or piece of equipment.

Final closure of the PUREX storage tunnels will occur at the same time as, in a manner consistent with, PUREX Canyon TSD units.

A phased approach to closure will be used so deactivation and removal of process solutions from PUREX can be accomplished in a timely and cost-effective manner. Phase I closure associated with deactivation will consist of the following:

- Removing the process and other solutions from the plant so waste treatment systems can be flushed

- Flushing both the internal and external surfaces, as appropriate, of each permitted tank system

- Sampling and documenting the analytical results of the final internal rinse

- Emptying tanks as much as possible with the existing jets or pumps, and leaving the tank unsealed so that the liquid heel will evaporate
- Isolating the tanks and cells from all liquid sources
- Flushing cell walls and floors
- Emptying the cell sumps to the normal heel using the existing jets.

The flush criteria will be the reduction of dangerous waste constituent concentrations in the rinsate such that these solutions do not exhibit dangerous waste characteristics. Flushing will reduce the total quantity of dangerous waste constituents remaining in the plant, thus stabilizing or eliminating health and environmental risks during the surveillance period and follow-on activities.

The PUREX Phase I closure/deactivation calls for the storage and/or treatment of dangerous waste in a manner inconsistent with the current PUREX Part A permit. Some of the plant's process vessels currently are storing material that was considered to be a product (not a waste) when the December 1992 shutdown order was received. This has resulted in a noncompliant storage situation. Ongoing negotiations with the regulatory agencies will result in resolution of these issues. Options being considered include minor modification of Part A process descriptions; expansion of PUREX Plant interim status treatment/storage capacity and significant revisions to the Part A; and/or development of new *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1992) milestones addressing the noncompliant situation.

In-place equipment, systems and materials, and solid materials containing dangerous waste constituents for which there is no existing treatment or storage capability will be left in their current location until the time of D&D, including vessels, piping, silver reactors, dissolvers with the mercury in their thermowells, cadmium moderators, lead counterweights, shielding, equipment in the tunnels, concrete debris in the canyon, etc. No substantial upgrades (i.e., secondary containment or sampling systems for waste currently sent to the tank farms) are planned.

A RCRA closure plan describing the deactivation of interim status systems will be developed for near-term submittal to the regulatory agencies. This plan will be modified to include final closure activities (i.e., D&D of interim status systems) after the following actions have been completed:

- Adoption of the Hanford Remedial Action Environmental Impact Statement (or other future sitewide Environmental Impact Statement) and final selection of land usage for Hanford Site areas
- Development of a uniform and coordinated program for closure of TSD units in the 200 Areas and sitewide cleanup standards
- Development of necessary plans, documents (including appropriate *National Environmental Protection Act of 1969* documents), and funding for D&D and final closure.

The RCRA closure plan will include deactivation and (eventually) D&D of only interim status units. Deactivation of all other systems will be conducted in compliance with agreements reached with the regulatory agencies.

D&D will include closure of secondary containment; the end-state of equipment, systems, and materials left in place, including material in the "containment building;" final disposition of the vessels and equipment in the tunnels; and closure of the tunnels.

3.0 EQUIPMENT AND MATERIALS STORED IN PUREX TUNNELS

The Plutonium-Uranium Extraction (PUREX) Tunnels, located south of the 202A Building, are an integral part of the PUREX Plant. The tunnels are used for interim storage of failed or obsolete process equipment that was too radioactive or bulky for removal from the PUREX Plant. Equipment selected for storage in the tunnels was loaded onto old railroad cars, which serve both as a transport and storage platform while the equipment is in storage. A remote-controlled, battery-powered locomotive (Little Toot) was used to position the railcar in the tunnel. Each piece of equipment in the tunnels is retrievable. However, because the equipment is stored on a single, dead end, rail spur in each tunnel, equipment can only be removed in the reverse order of emplacement (i.e., first in, last out).

Both tunnels are built on a 0.1 percent (%) grade, sloping downward to prevent movement of the railroad cars toward the tunnel entry. The entry is blocked by water-filled doors that serve as radiation shields. These doors can be drained and raised to allow access to the tunnels. The maximum capacity of burial tunnels 1 and 2 is 8 and 40 railcars, respectively. Only Tunnel 2 is currently in use; Tunnel 1 was filled to capacity in 1964 and was closed at that time.

Figure 3-1 shows the two PUREX tunnels and their locations relative to the PUREX building.

3.1 TUNNEL 1

The 218-E-14 Tunnel, more commonly referred to as Tunnel 1, extends southward from the east end of the 202-A Building. This tunnel, constructed in 1956, is made of creosote-treated Douglas fir timbers placed side by side and is 152 meters (m) (500 feet [ft]) long by 5.8 m (19 ft) wide by 6.7 m (22 ft) high. The entire tunnel is covered with mineral roofing, a layer of tar, and 2.4 m (8 ft) of fill dirt. Figure 3-2 shows the plan, section, and elevation views of Tunnel 1. An analysis of the structural integrity of the timbers was performed in 1980. This study concluded that the strength of the beams was within the standards for new wood (RHO 1980).

A 1973 study looked at the potential for an explosion or fire in Tunnel 1. This study concluded that no danger of explosion existing and that the possibility of a fire was remote (DOI 1973). Despite this finding, an effort was made to create an inert atmosphere by isolating the tunnel and filling it with carbon dioxide. Diffusion of the carbon dioxide through the gravel bed rendered this effort unsuccessful. The duct for burial Tunnel 1 is blanked, and the door to this tunnel has been sealed so that air in the tunnel is stagnant.

Figure 3-1. Location of PUREX Tunnels.

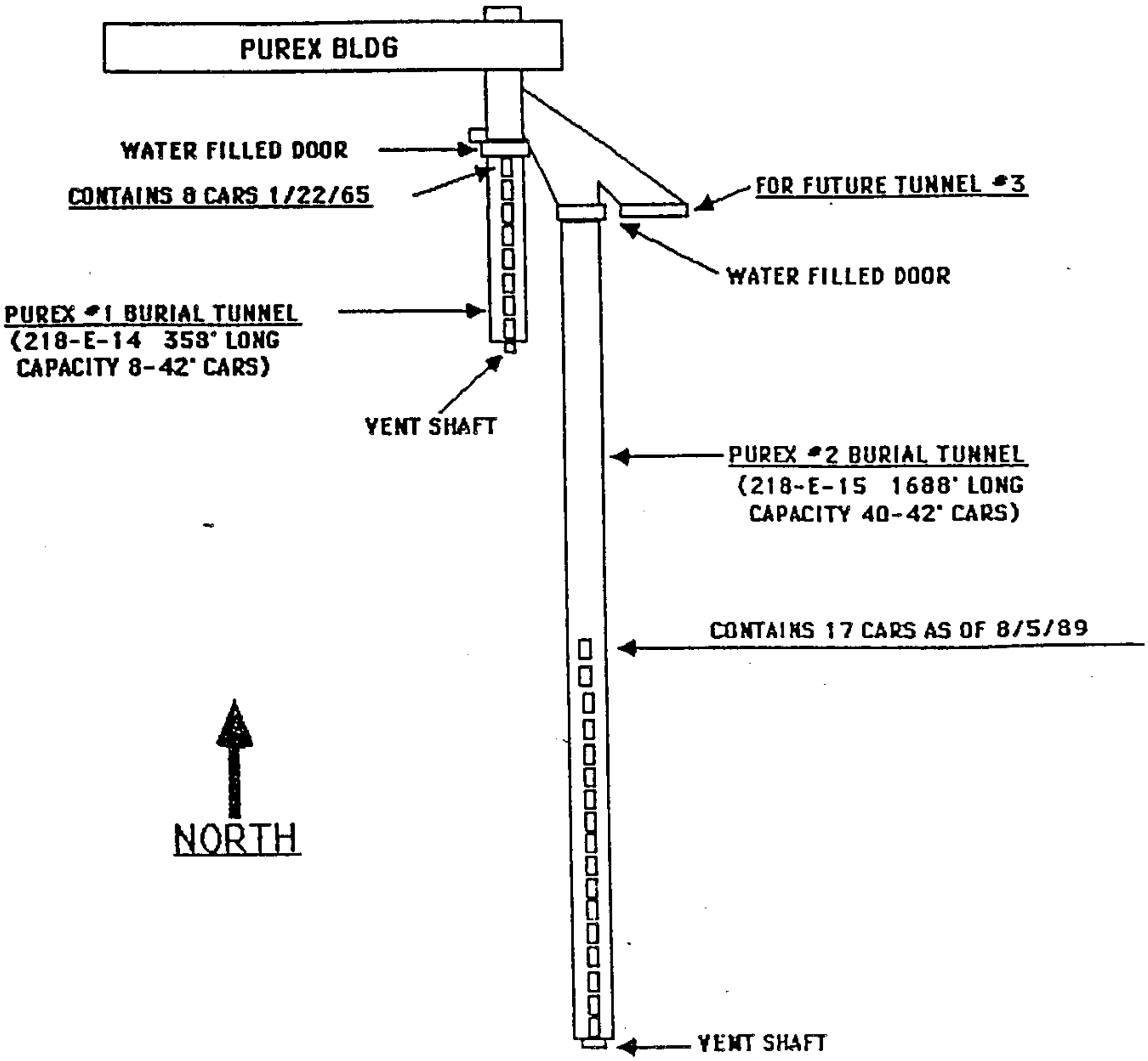
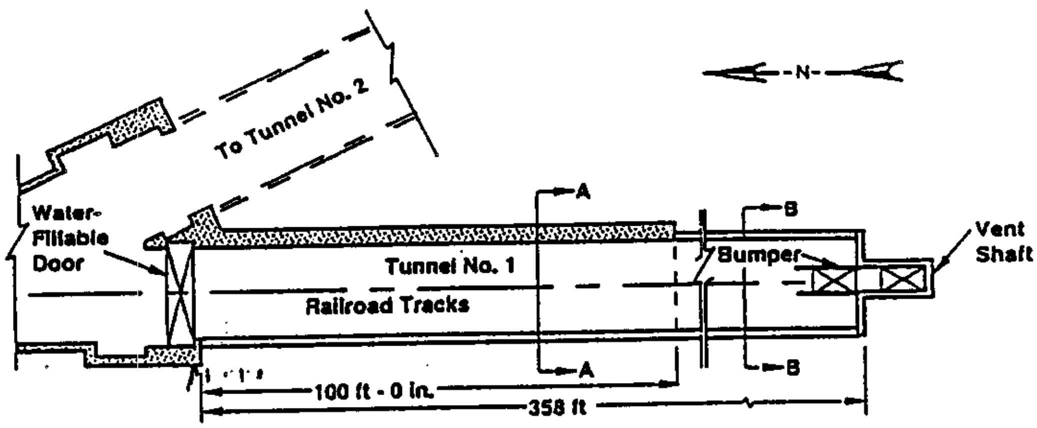
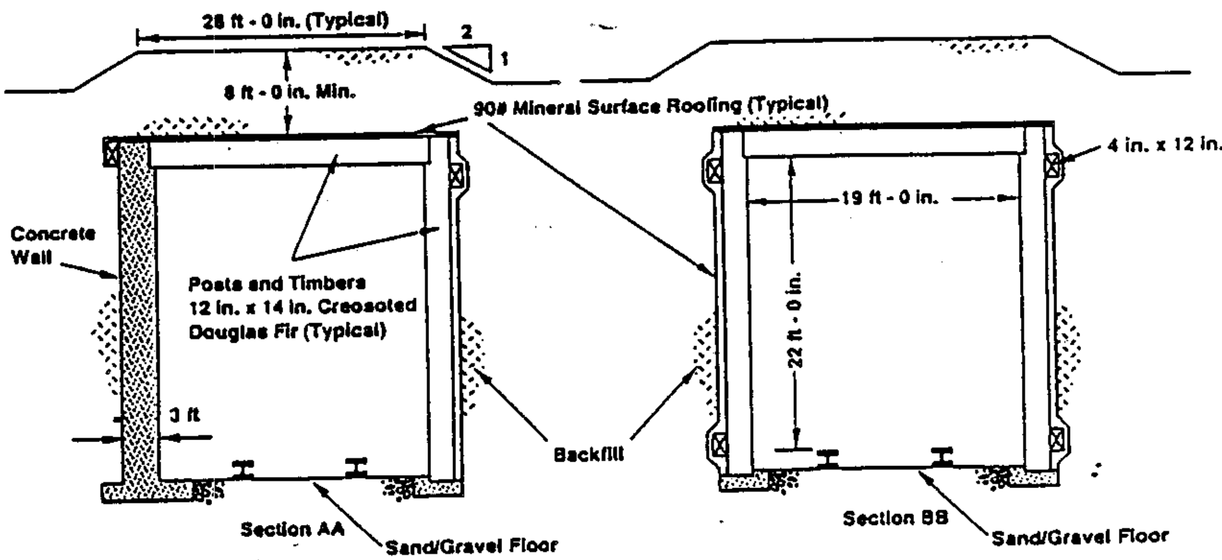


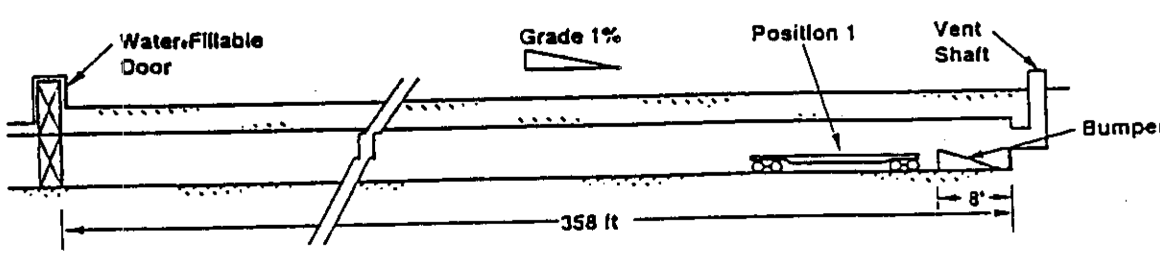
Figure 3-2. PUREX Tunnel 1 Details.



Tunnel No. 1 - Plan View



PUREX Tunnel No. 1 - Section Views



PUREX Tunnel No. 1 - Elevation View

78910032.2

3.1.1 Historical Background

Construction of Tunnel 1 was completed in 1956 as part of the PUREX construction project. The first failed equipment item to be placed in the storage tunnel was an HA column, which was approximately 41 ft long. Due to its length, two railcars coupled together were required as a transporter. This column, along with a box of miscellaneous pipe jumpers, were placed in Tunnel 1 in June 1960. The remaining six positions (total capacity eight rail cars) were filled between June 1960 and January 1965, at which time the water-fillable entry door was sealed closed and door opening hoists were deactivated electrically, as was the tunnel exhaust system. Figure 3-3 provides a brief description of the equipment stored in each position along with a simple drawing of the railcar used as a transporter.

3.1.2 Characterization of the Retrievably Stored Waste in Tunnel 1

The eight railcars that occupy Tunnel 1 are characterized in Table 3-1. Table 3-1 is taken from the *PUREX Storage Tunnel Disposal Alternatives Engineering Study* (Henckel et al. 1990) and lists the approximate sizes of the process equipment that is believed to be stored in Tunnel 1. The sizing of this equipment was based on information provided by PUREX operations because accurate records were not kept from the start of tunnel operations. (Figures for each of the suspected equipment items in this tunnel can be found later in this section.)

3.1.2.1 Hazardous Constituents. Table 3-1 also lists the suspected hazardous constituents present in Tunnel 1. A total of 500 pounds (lb) (230 kilograms [kg]) of lead is believed to be present in the two jumperboxes, which are found on the railcars in positions 2 and 4. This estimate is based on the assumption that each jumper box contains approximately 50 jumpers of which about 5% have lead counterweights that average 100 lb (45 kg) of lead per jumper. Therefore, the estimated total weight of lead per box is approximately 250 lb (113 kg) (DOE 1990).

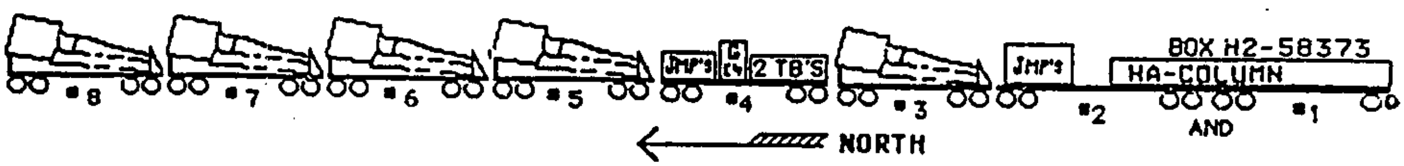
Elemental lead exhibits the characteristics of toxicity as determined by the toxicity characteristics leaching procedure and is designated D008 (WAC 173-303-090[8]). The quantity of lead present could produce an extract greater than 0.066 ounce per gallon (oz/gal) (500 milligrams per liter) should it be exposed to a leachate; therefore, the mixed waste is managed as extremely hazardous waste and is further designated as WT01 (WAC 173-303-104[3]). However, because of 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 within the tunnel, 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 radioactive discarded equipment placed in the PUREX Storage Tunnels. The quantity of lead is determined from a review of the fabrication drawings for each piece of equipment placed in storage. This approach is effective for equipment where the lead weight, counterweight, or shielding is specifically detailed. However, where only *typical* details are shown, as in Figure 3-4,

Figure 3-3. PUREX #1 Burial Tunnel (218-E-14).

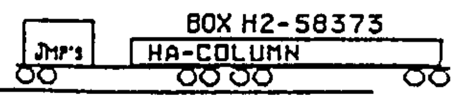
TUNNEL IS AT ITS CAPACITY AS OF 1/22/65

Purex # one Burial Tunnel is located at the southeast end of the Purex building and is an extension of the railroad tunnel. The storage area is approximately 358 feet long, 22 1/2 feet high and 19 feet wide. The tracks have a one percent down-grade toward the south end of the tunnel. The capacity of the Burial Tunnel is eight modified railroad car, 40 to 42 feet long.

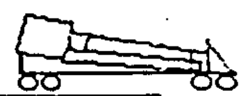


POSITION

1 & 2. HA COLUMN AND MISC JUMPERS IN BOX
BURIED IN TUNNEL #1 ON 6/60
HA 4,700 CU. FT., 400 CURIES
JMPRS 2,190 CU.FT., 2,000 CURIES



3. E-F11 #1 (1WW WASTE) CONCENTRATOR FAILED 7/24/60.
BURIED IN TUNNEL #1 ON 7/29/60
1,900 CU. FT., 40,000 CURIES AFTER FIFTYFIVE MONTHS SERVICE



4. G-E2 CENTRIFUGE. MISC JUMPERS IN BOX AND TWO TUBE BUNDLES.
BURIED IN TUNNEL #1 ON 12/24/60 (FUGE SER# 762)
2,465 CU. FT., 3,000 CURIES

5. E-H4 (3WB) CONCENTRATOR FAILED 1/4/61.
BURIED IN TUNNEL #1 ON 1/4/61
2,336 CU. FT., 1,000 CURIES. AFTER FIVE YEARS SERVICE.

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

7. E-F11 (1WW WASTE) #2 CONCENTRATOR FAILED 2/1/62.
BURIED IN TUNNEL #1 ON 2/8/62
2,336 CU. FT., 40,000 CURIES. AFTER EIGHTEEN MONTHS SERVICE.

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

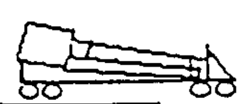


Table 3-1. Inventory and Characteristics of Equipment Stored in PUREX Tunnel 1. (2 sheets)

TUNNEL INVENTORY

Listed below are the approximate sizes of the process equipment which has been placed in the PUREX storage tunnel 1. Also listed are the suspected hazardous constituents, and radiation dose estimated. Some figure of the equipment are attached to provide sizing details.

Sizing of the equipment is based on information provided by PUREX operations. Accurate records were not kept from the start of the tunnel operations. Therefore, a number of assumptions were made about the process equipment sent to the tunnels. It is recommended that prior to attempting removal of the process equipment, remote camera and radiation survey devices be sent into the tunnels to verify the size, position, and radiation dose levels of the process equipment.

- Ci = Curies
- NA Indicates No Information is Available
- O.D. Indicates Outer Diameter
- Volume Estimates Include Only Process Equipment

TUNNEL #1 (218-E-14)

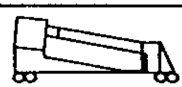
Position (Date of storage)	Layout (Assumed)	Contents	Dimensions	Estimated waste type	Initial dose reading / Estimated Ci content	Suspected hazardous constituents	Est. Volume (ft^3)	Notes
1 & 2 6/60		HA Column	40'11" x 8'2" x 6'	LLW-3	5 R/hr @ 60 ft / 400 Ci		4,700	1. Dose Conversion Supplied by PUREX Operations
		Jumper Box	18' x 8'11-1/4" x 8'3/4"	TRU	2,000 Ci	Lead ~250 lb	2,190	2. Assumptions: 50 Jumpers/Box, 100 lb Lead/Jmp, 5% jumper have lead, ∴ ~250 lb
3 7/29/60		E-F11 Concentrator	29'8" x 6'	LLW-1	12.5 R/hr @ 100 ft / 40,000 Ci		1,900	Tower removable, could take 12'6" from height
4 12/24/60		G-E2 Centrifuge	3' x 5' O.D.	LLW-1	1.5 R/hr @ 150 ft / 3,000 Ci		2,465	If G-E2 Centrifuge was stored with the motor, its dimensions are 7" x 10' x 13"
		Jumper Box	18' x 8'11-1/4" x 8'3/4"	LLMW		Lead ~250 lb		
		(2) Tube Bundles	Each @ 12'6" x 4'3"	LLW				

Table 3-1. Inventory and Characteristics of Equipment Stored in PUREX Tunnel 1. (2 sheets)

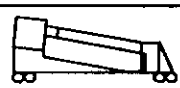
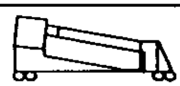
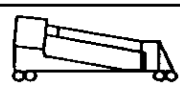
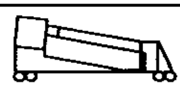
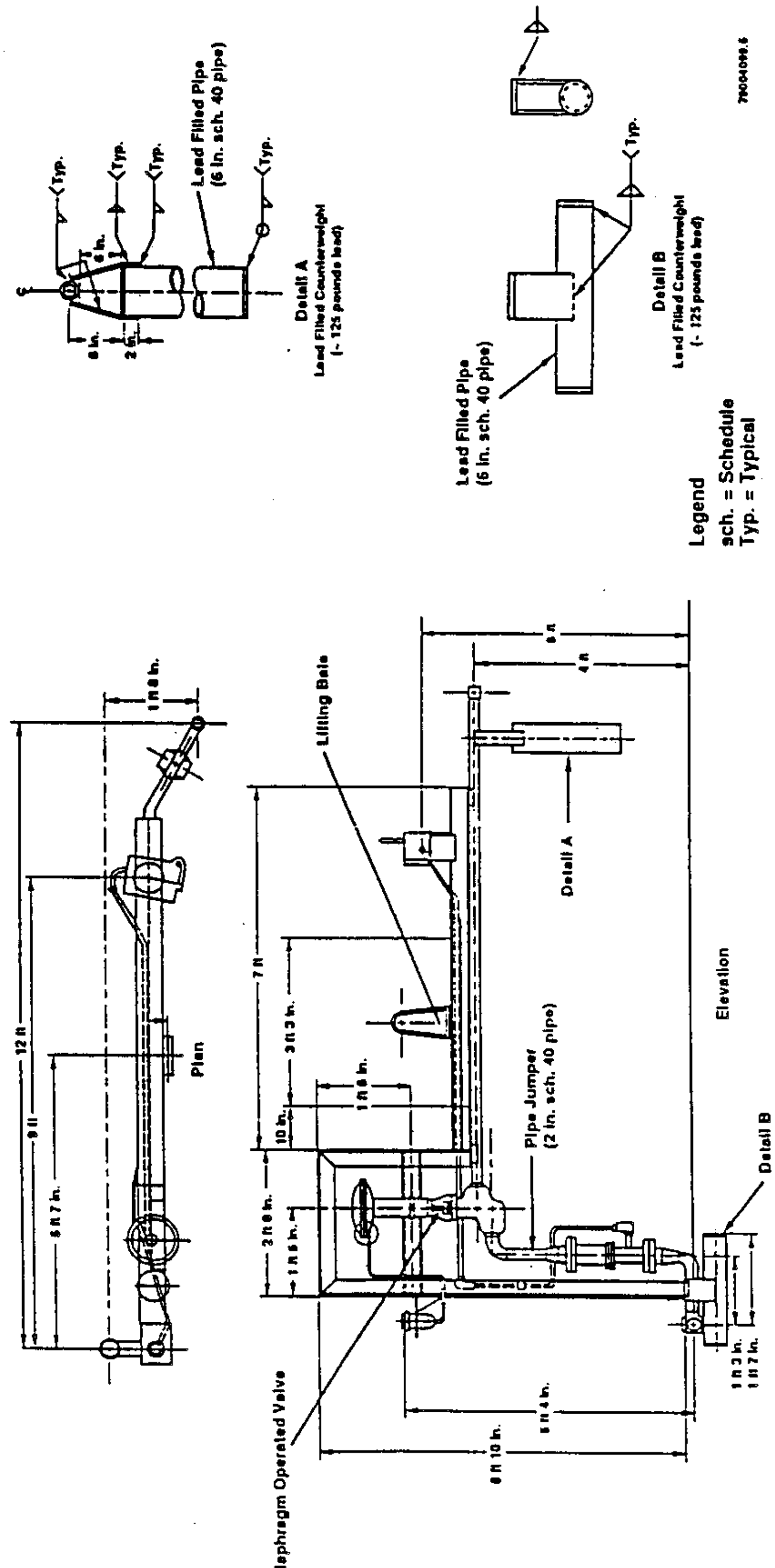
Position (Date of storage)	Layout (Assumed)	Contents	Dimensions	Estimated waste type	Initial dose reading --------- Estimated Ci content	Suspected hazardous constituents	Est. Volume (ft^3)	Notes
5 1/4/61		E-H4 Concentrator	29'8" x 16'6" x 6'	TRU	150 R/hr @ 50 ft ------------- 3,000 Ci		2,465	See Position 3
6 4/21/61		E-F6 Concentrator	36'6" x 15' x 6'	TRU	5 R/hr @ 20 ft ------------- 700 Ci		2,338	
7 2/8/62		E-F11 Concentrator	29'6" x 6'	LLW-1	25 R/hr @ 150 ft ------------- 40,000 Ci		2,338	Portions Possibly Removed: De-entrainment Assembly, 7' x 5' O.D., Tower, 12'6" x 5'6" O.D.
8 1/22/65		E-F6 Concentrator	36'6" x 15' x 6'	TRU	700 Ci		2,400	See Position 6.

Figure 3-4. Jumper Assembly with Counterweight (Typical).



the amount of lead had to be estimated. The addition of counterweights was a field fit operation and the size and location of each counterweight (if attached) was not recorded on the final 'as-built' assembly drawings. Therefore, the accuracy of the estimate of the amount of lead stored in each tunnel is limited to the data available from existing fabrication drawings. The estimated quantity of lead listed in Table 3-1 accounts for the lead in alignment tools and jumper counterweights. 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.

Historically, elemental lead was used as weight, counterweight, and radiation shielding in the fabrication of process equipment used at the PUREX Plant. Elemental lead was selected for use because of its high density {[710 pounds per cubic foot (lb/ft^3)] [11,373 kilograms per cubic meter (kg/m^3)] as compared to 489 lb/ft^3 [7,833 kg/m^3] for steel} and because it was readily available in various physical shapes (shot, sheet, bars, or poured shapes). Generally the lead was encased in steel (carbon or stainless) to facilitate its attachment to the process equipment.

Figure 3-5 shows a typical process pipe jumper design using lead-filled carbon steel pipe counterweights. Counterweight jumper assemblies are used to facilitate remote installation of in-cell process and service piping. Figure 3-4 shows a typical lead counterweight used with equipment dunnage (carbon steel support structure). It is imperative that the equipment assembly be balances vertically to facilitate remote handling with the overhead crane during installation and removal.

A jumper alignment tool (Figure 3-6) might contain as much as 1,500 lb (680.4 kg) of lead. This tool is used as a weight to pull down the free end of a jumper so that the connecting parts are aligned vertically and the connection can be made. Restricted work space between equipment in the process cells makes the use of a high-density material, such as lead, a necessity. Similarly, the space restrictions around certain diaphragm-operated valves limit the selection of radiation-shielding materials to those of high-density materials, such as lead. Operations experience has shown that the useful life of the diaphragm material can be extended by shielding it from external radiation sources. Figure 3-7 shows a typical shielding arrangement for a diaphragm-operated valve.

3.1.2.2 Radioactive Constituents. Table 3-2 provides the estimated radioactivity for the major pieces of equipment stored in Tunnel 1. An estimate of the activity in curies at the time of storage is given in Henckel et al. (1991). The equipment in Tunnel 1 was emplaced over an eight-year period. Because the identity for most of the equipment items is known, the activity distribution of fission products and actinides was based on an analysis of current process vessels, which is explained further in Appendix C. Where vessel identification was unclear, a distribution of activity types equal to the average distribution over all the process vessels was assumed.

Figure 3-5. Equipment Dunnage Lead Counterweight (Typical).

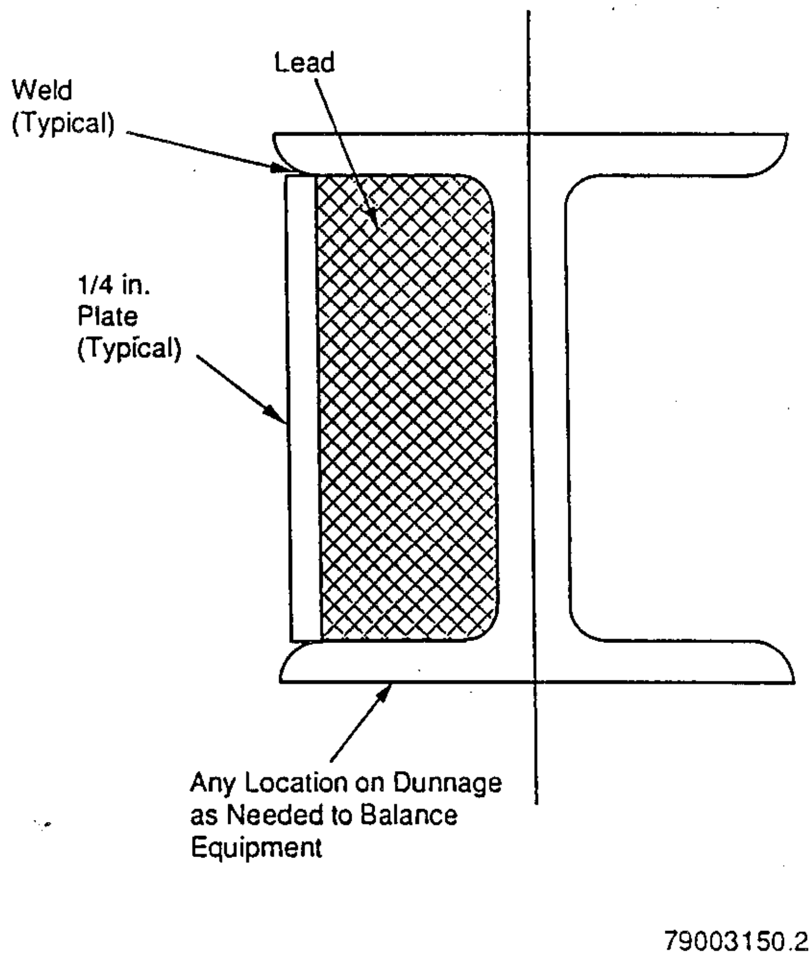


Figure 3-6. Jumper Alignment Tool.

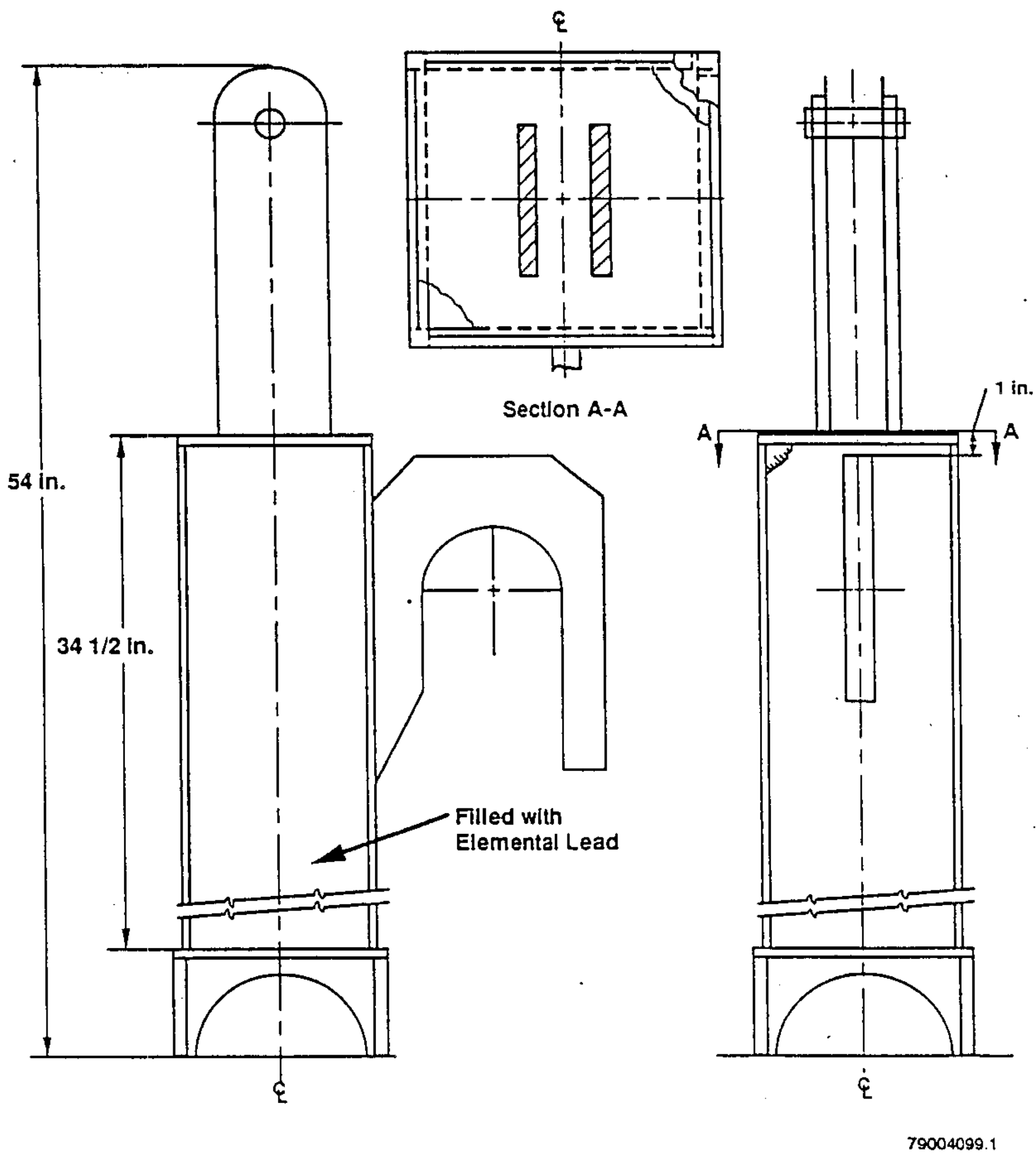


Figure 3-7. Diaphragm-Operated Valve Shielding.

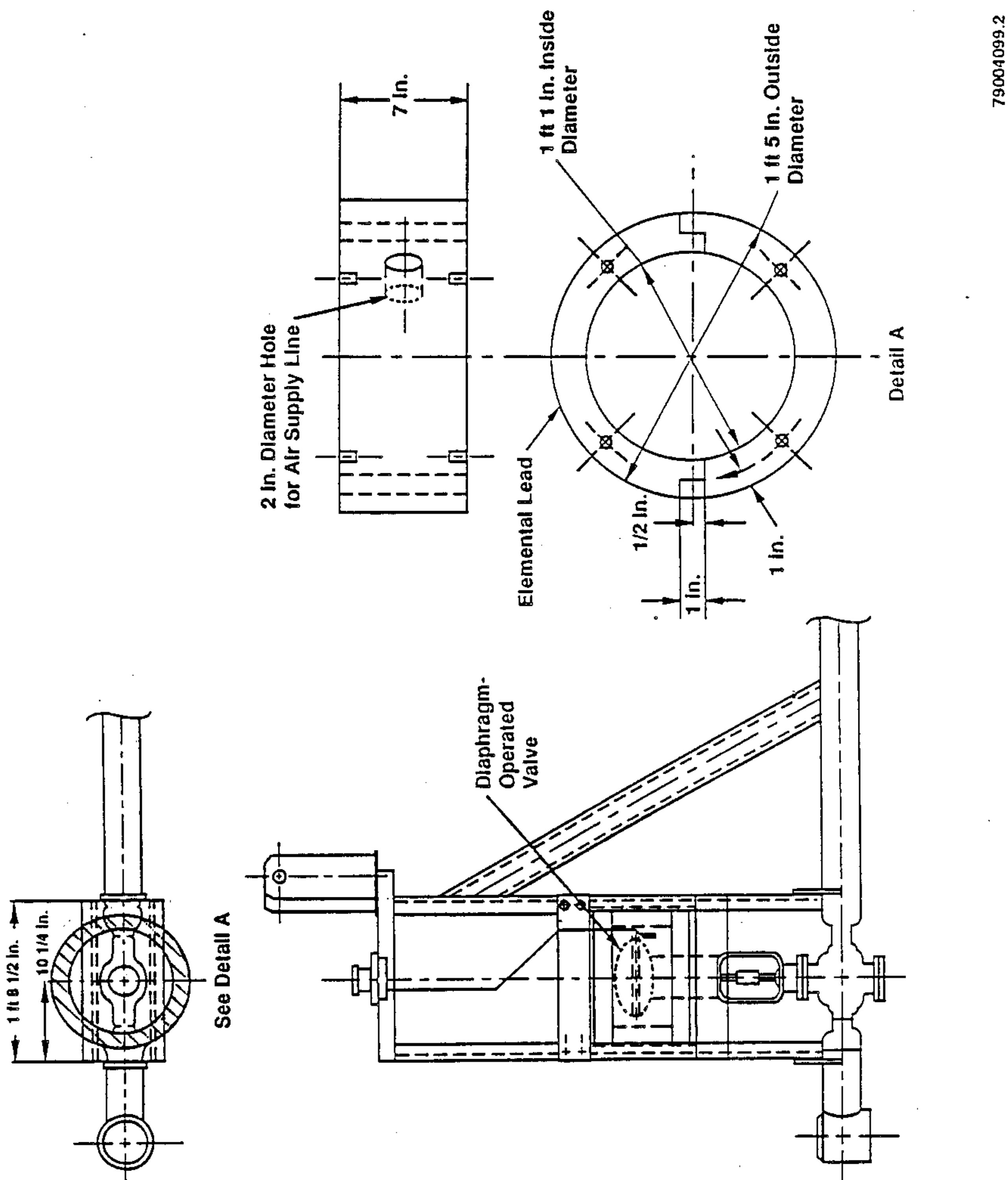


Table 3-2. Estimated Radioactivity for Major Equipment Stored in PUREX Tunnel 1.

Storage date	Item	Assume 180 days initial (Ci)	Estimated radiation type percent of curies	Age end of 1993 (years)	Actinides 180 day (Ci)	FP + AP 180 day (Ci)	Actinides 1993 (Ci)	FP + AP 1993 (Ci)
Railroad Tunnel #1 (218-E-14)								
June 1960	HA Column	400	8% actinides 92% FP	34	32	368	7.95 E+00	7.68 E+00
June 1960	Jumper Box	2,000	16% actinides 83% FP 1% AP	34	320	1,680	7.95 E+01	3.46 E+01
7/29/60	E-F11 Concentrator	40,000	RuRh-106	34	0	40,000	0	3.70 E-05
12/24/60	G-E2 Centrifuge/ jumper box/tube bundles	3,000	1% actinides 6% FP 93% AP	34	30	2,970	7.45 E+00	5.40 E+00
1/4/61	E-H4 Concentrator	3,000	0.04% U 67% Pu 33% FP	34	2,011	990	4.59 E+02	2.07 E+01
4/21/61	E-F6 Concentrator	700	8% actinides 92% FP	33	56	644	1.44 E+01	1.37 E+01
2/8/62	E-F11 Concentrator	40,000	RuRh-106	32	0	40,000	0	E.93 E-05
1/22/65	E-F6 Concentrator	700	8% actinides 92% FP	29	56	644	1.66 E+01	1.51 E+01

FP = Fission products
AP = Activation products.

3.1.3 Description of Specific Equipment Items Stored in Tunnel 1

The equipment items stored in Tunnel 1 are described below according to their relative positions in the tunnel. The railcar occupying Position 1 was emplaced in June 1960, while the railcar in Position 8 was emplaced in January 1965. It is important to keep in mind that retrieval of the equipment in the tunnel will proceed in reverse order of emplacement, i.e., Position 8 equipment will have to be retrieved before retrieving Position 7 equipment, etc.

Table 3-3 lists the cell arrangement and construction drawings for each of the equipment items discussed below. This table also indicates the process and inlet and outlet streams for each item when that item was in use.

3.1.3.1 Positions 1 and 2: HA Column (T-HA) and Jumper Box, disposed June 1960. HA Column. Pulse columns were the primary equipment pieces of the PUREX Plant. In this column, a solvent extraction process was used to separate uranium, plutonium, and neptunium from fission products and metallic impurities for recovery as concentrated nitrate product solutions. The organic solvent consisted of 25 volume percent (vol%) tributyl phosphate (TBP) with normal paraffin hydrocarbon (NPH) diluent. The NPH consisted of a very pure mixture of n-dodecane to n-pentadecane.

This pulse column, shown in Figure 3-8, was a 33-ft vertical contacting device with a series of stationary, perforated stainless steel plates of various designs that provide the desired mixing and flow characteristics. The plates are assembled into cartridges, which could be installed and removed remotely by the canyon crane. Louver-plate phase redistributors were provided at selected locations in the sieve plate cartridges to break up channeling. Pulse generators were used to create an up-and-down pulsing motion to the solutions so intimate mixing occurs and the countercurrent flow of aqueous and organic phases through the plate perforations increase.

The columns were constructed according to specifications for Class I vessels. The material of construction was Type 304-L stainless steel, with welds made with Type 347 stainless-steel welding rod. The wall thickness of the column shell was 0.25-inches (in.); that of the disengaging section ranged from 0.25 to 0.37-in. for the cylindrical and slab-type disengaging section to 0.5-in. for the box-type disengaging sections.

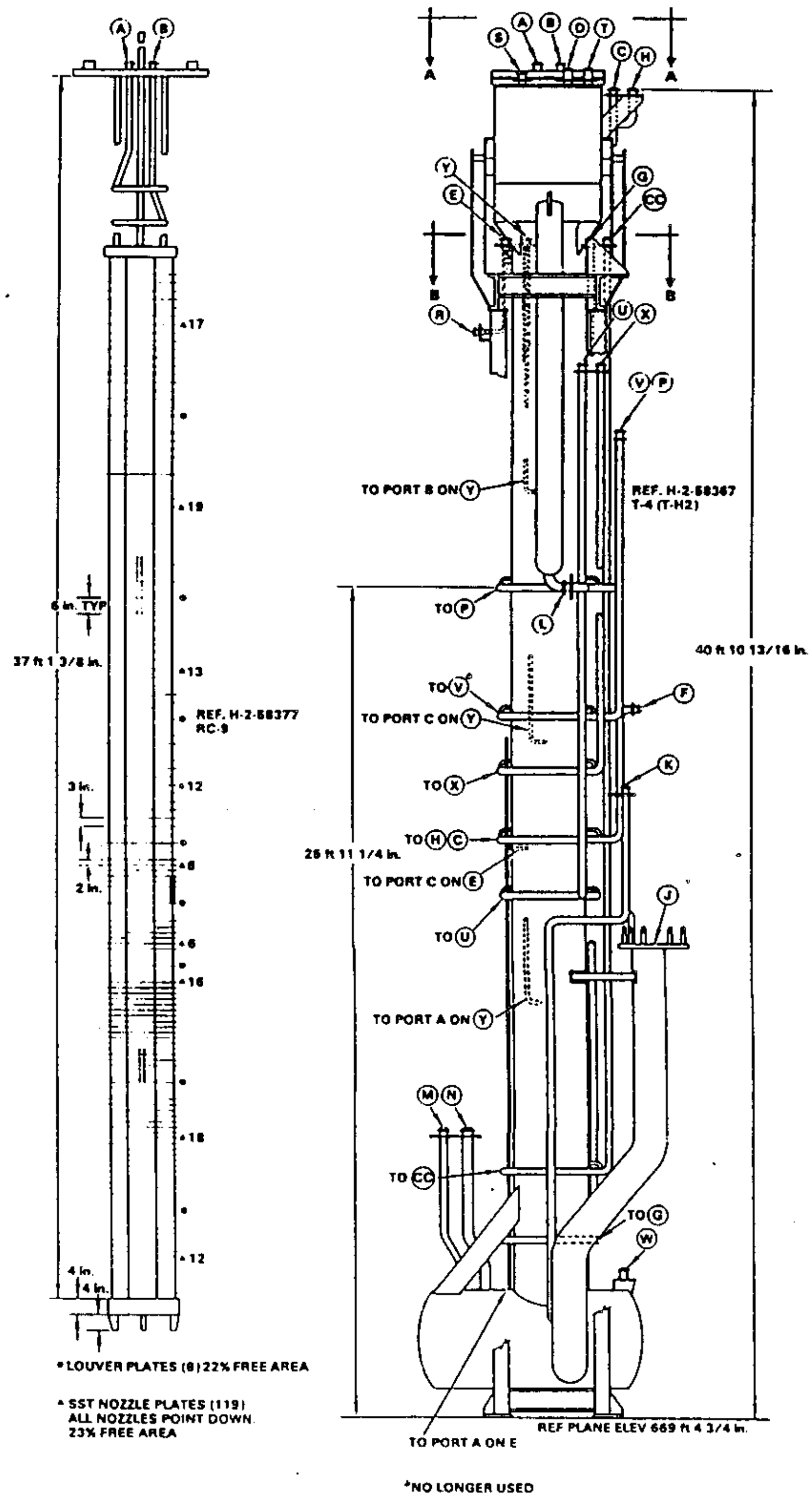
Figure 3-9 shows a sketch of the typical column support. It is not known how much of the supporting structure was removed with this column.

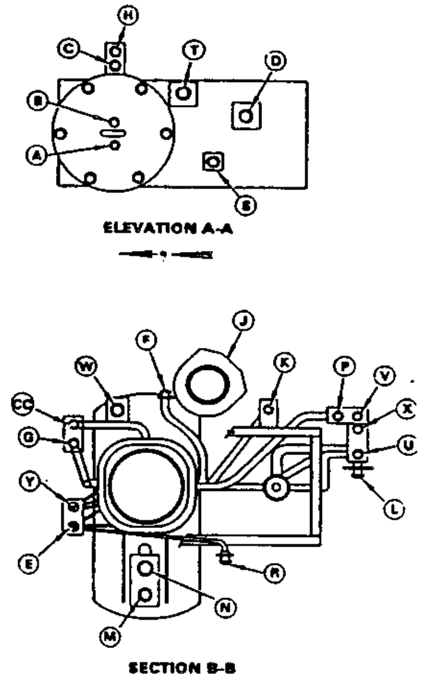
Feed solution (HAF) from the feed preparation section was continuously fed to the intermediate feed point of the HA column. Feed solution contained uranium, plutonium, neptunium, fission products, and nitric acid (salting agent). Countercurrent flow of TBP in NPH (HAX stream) rose through the aqueous phase in the column and extracted the uranium, plutonium, and neptunium into the solvent phase. The backcycle waste stream (3WB), containing some product from other column waste streams and nitric acid, was added to the HA column just below the feed point to provide most of the salting strength.

Table 3-3. Tunnel 1 Drawing Numbers and Process Information.

Car Number (Date)	Equipment Name	Cell Arrangement Drawing	Construction Drawing	Process	Inlet Streams	Outlet Streams
1 and 2 (06/60)	HA Column (T-H2)	H-2-53520	H-2-56753	First Decontamination and Partition Cycle (1st D&PC)	CRD, HAS, HAF, 3WB-HA, HAX, Rec HNO_3, and H_2	HAP and HAW
3 (07/29/60)	E-F11 Concentrator CB-1, UT-1 Acid Service	H-2-53512	H-2-56213	Metal Dissolution and Feed Preparation (MD and FP)	ASF and NaOH	ASW and Offgas
4 (12/24/60)	G-E2 Centrifuge	H-2-53505	H-2-52965 H-2-52995	MD and FP	Offgas, Decladding Waste, and Spent Metathesis Solution	Slurried Centrifuge Cake, Decladding Waste, and Centrifuged Spent Metathesis Solution
5 (01/04/61)	E-H4 Concentrator CB-5, UT-1	H-2-53521	H-2-66046	Backcycle Waste (BW)	3WF	3WW and Offgas
6 (04/21/61)	E-F6 Concentrator CB-2, AF-1 Acid Waste Service	H-2-53510	H-2-56213	Waste Concentration and Treatment (WC&T)	1WF, 1WR, H_2O_3, and Offgas from 1WW Denitration	Offgas and 1WW
7 (02/08/62)	E-F11 Concentrator	H-2-53512	H-2-56213	MD & FP	ASF and NaOH	ASW and Offgas
8 (01/22/65)	E-F6 Concentrator	H-2-53510	H-2-56213	WC&T	1WF, 1WR, H_2O_3, and Offgas from 1WW Denitration	Offgas and 1WW

Figure 3-8. HA Column and Cartridge.

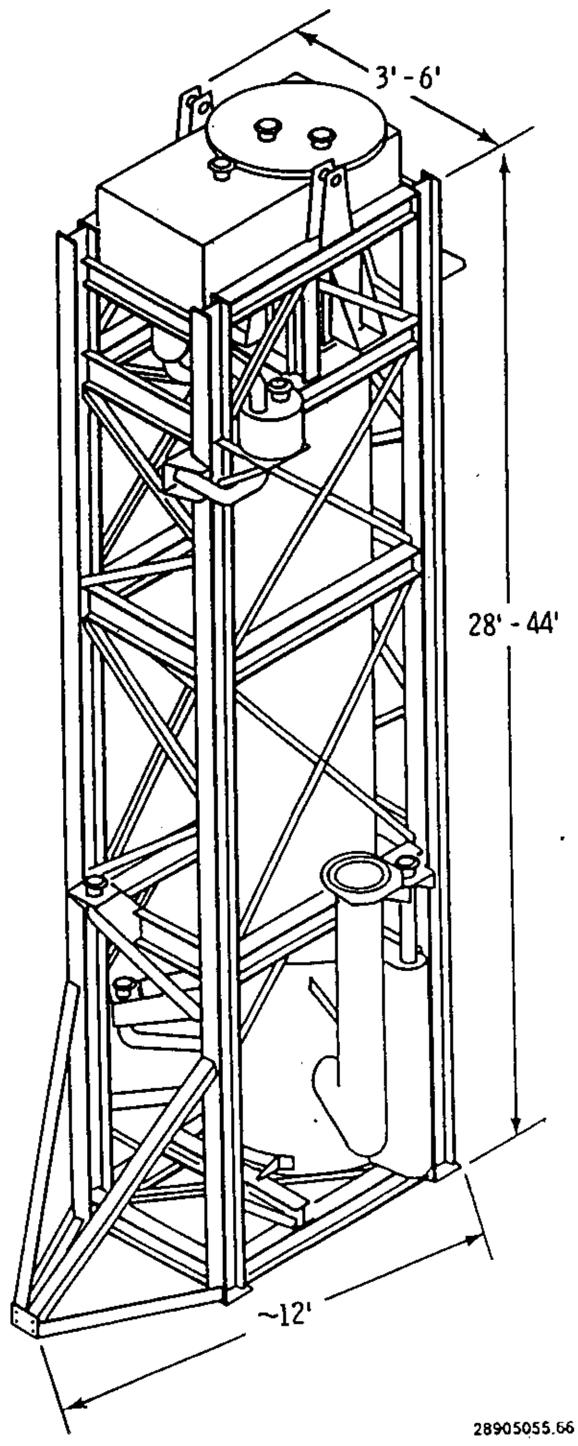




NOZZLE IDENTIFICATION		
NOZZLE	SIZE	FUNCTION
A	2 in.	HAS
B	2 in.	HAS SPARE
C	2 in.	HAF SPARE
CC	2 in.	HA-NO_2
D	3 in.	VENT
E	2 in. (3-WAY)	STATIC PRESSURE
F	2 in.	HAO SPARE
G	2 in.	SPARE
H	2 in.	HAF
J	12 in. FLANGE	PULSE LEG
K	2 in.	HAX
L	3 in.	HAP
M	2 in.	COLUMN JET OUT
N	3 in.	HAW
P	2 in.	SPARE
R	2 in. (3-WAY)	AIR TO HAW SAMPLER DOV
S	2 in.	SPARE
T	3 in.	SPEC. GRAV.
U	2 in.	3WB
V	2 in.	HAO*
W	3 in.	INTERFACE FLOAT
X	2 in.	SPARE
Y	2 in. (3-WAY)	STATIC PRESS. SPARE

* NO LONGER USED

Figure 3-9. Typical Column Support.



The aqueous scrub stream (HAS), introduced at the top of the column, further decontaminated uranium, plutonium, and neptunium by washing fission products back from the solvent to the aqueous phase. The uranium was in +6 valence state. The plutonium was in the +4 valence state. A small sodium nitrate stream was added near the bottom to oxidize neptunium to +6. The organic stream (HAP) containing uranium, plutonium, and neptunium, overflowed to the feed tank of the partition cycle.

The design capacity for the original pulse columns was a nominal instantaneous processing rate of ten tons or uranium per day (HAPO 1955).

Pipe Jumpers. Jumpers are piping or electrical connectors used to connect process equipment to cell walls or to other pieces of equipment. Jumpers failed periodically due to problems such as broken or corroded head parts, shorted wiring, corroded or deformed piping, or failure of a diaphragm operated valve or flowmeter contained within the jumper. There were approximately 3,000 jumpers in the PUREX Plant.

3.1.3.2 Position 3: E-F11 Concentrator, disposed July 29, 1960. There were five large concentrators used in the PUREX process to boil off liquids from various acid or water streams at approximately 100 to 125 °Celsius (C). The most failure-prone parts were the tube bundles. Occasionally, a concentrator can fail due to corrosion, erosion, weld decay or dunnage failure. This concentrator was installed in January 1956.

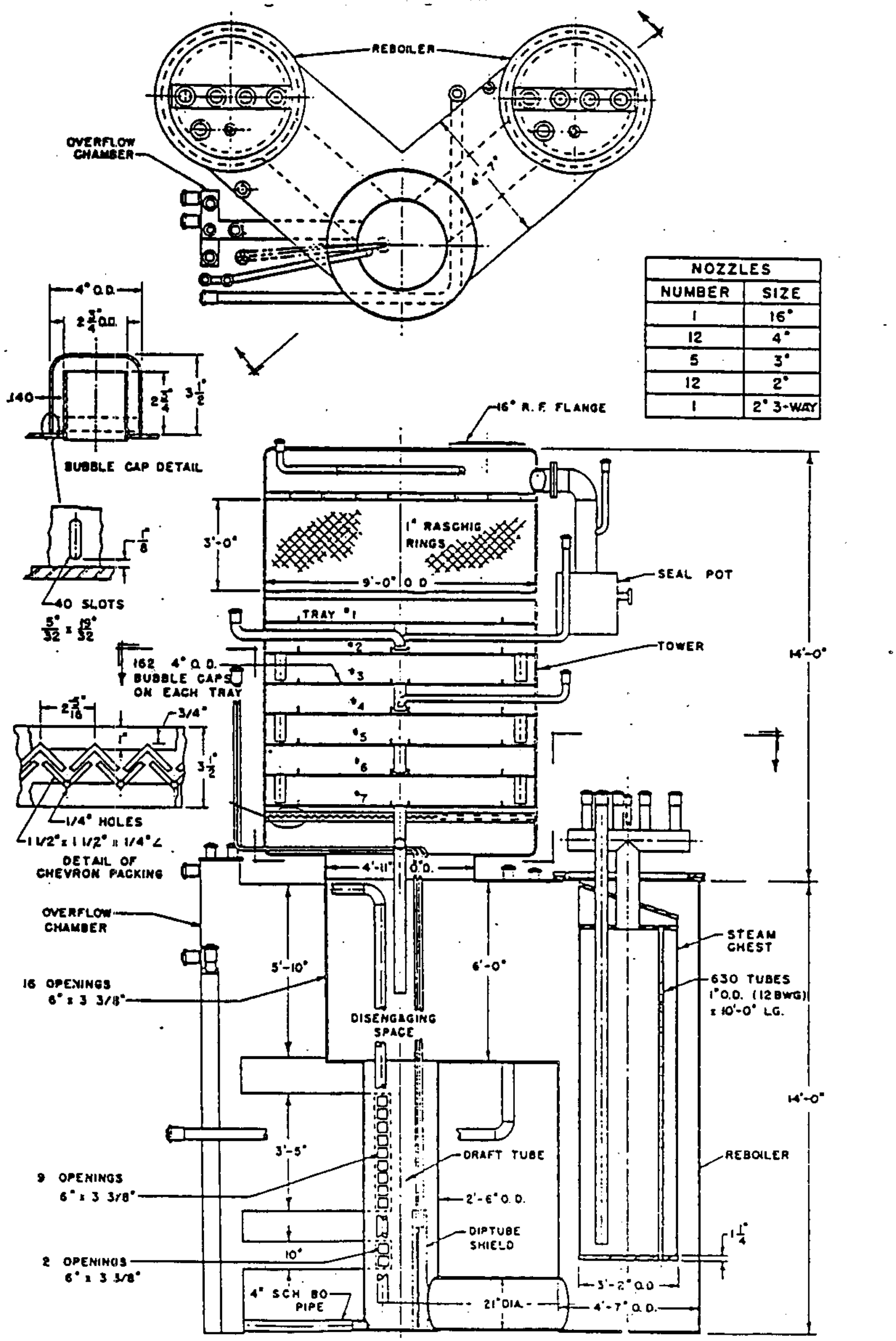
Figure 3-10 shows the large concentrator, was a vertical-tube thermal-recirculation steam-heated evaporator, containing 1,260 one-inch-outer diameter (OD) tubes in two 10-ft-long tube bundles, surmounted by a 9-ft-diameter, 14-ft-high bubble-cap column and packed section. Operation was continuous; concentrated liquid overflowed from the evaporator while the vapors passed through the tower to a condenser. For acid concentration the feed entered the evaporator; the tower served as a de-entrainment section for the distillate. The entire assembly was insulated to minimize reflux.

The lower portion of the concentrator body was a draft tube 2-ft 6-in. in diameter and 8 ft high. Each of the two remotable tube bundles (630 1-in. OD by 10-ft-long tubes encased in a steam canister 3-ft 2-in. in diameter) was immersed in the liquid contained in a cylindrical shell, 4-ft 7 in. in diameter piped at the bottom and by 4-ft 7-in. by 6-ft rectangular ducts at the top.

The stripping and de-entrainment tower was 9-ft OD by 14-ft high. It rested on the ducts that joined the side cylinders to the top of the draft tube. The tower had 7 trays, each with 162 four-inch-OD bubble caps on 6.125-in. center-to-center equilateral triangular spacing. Weirs and down-comers were arranged for double, cross flow (both ways from a diameter to chords or vice versa). Above the top tray was a 3-ft-high section packed with 1-in. Raschig rings. A 16-in. flanged nozzle at the top of the tower was the vapor outlet.

During the 1950's and 1960's, the E-F11 concentrator was used for acid wastes.

Figure 3-10. Large Concentrator.



NOZZLES	
NUMBER	SIZE
1	16"
12	4"
5	3"
12	2"
1	2" 3-WAY

3.1.3.3 Position 4: G-E2 Centrifuge, Jumper Box and Tube Bundles, Disposed December 24, 1960. G-E2 Centrifuge. There were two types of Bird solid-bowl, 48-in.-diameter centrifuges used in the PUREX process. The G-E2 centrifuge was used for clarification of dissolver solution prior to its makeup into the HAF stream.

Principle components of the centrifuge included: (a) a solid cylindrical bowl, (b) a vertical spindle from which the bowl was axially suspended, (c) an electric motor, direct connected to the spindle, and (d) the outer cylindrical case enclosing the rotating bowl. The components were rigidly supported by a structural steel frame measuring 7-ft by 10-ft by 13-ft high. The entire assembly was designed for remote operation and maintenance. All parts that came in contact with process solutions or fumes were stainless steel. Figure 3-11 provides a drawing of the G-E2 centrifuge.

The centrifuge bowl measured 48-in. (inner diameter) by 24-in. high and was open at the top except for an annular 34-in.-inner diameter overflow lip. Three horizontal annular baffles, 35-in. inner diameter, divided the bowl into compartments. The bowl was of all-welded construction and was fabricated according to specifications for Class I vessels.

Important centrifuge auxiliaries included a hydraulically operated skimmer, for reducing liquid holdup in the rotating bowl; a hydraulically operated plow, for dislodging centrifuged solids from internal surfaces; and the bowl spray for dislodging or washing down the solids.

In operation, centrifuge feed was introduced via a dip tube near the bottom of the rotating bowl and flows to the bowl wall. Over an extended period of operation, solids collected on the bowl wall, while liquids escaped to the centrifuge case over the bowl lip or through specially designed passages, for the aqueous phase of a solvent centrifuge. Liquid held up in the rotating bowl was removed by operation of skimmer. Solids are removed by dislodging with the plow or spray, slurring, and jetting.

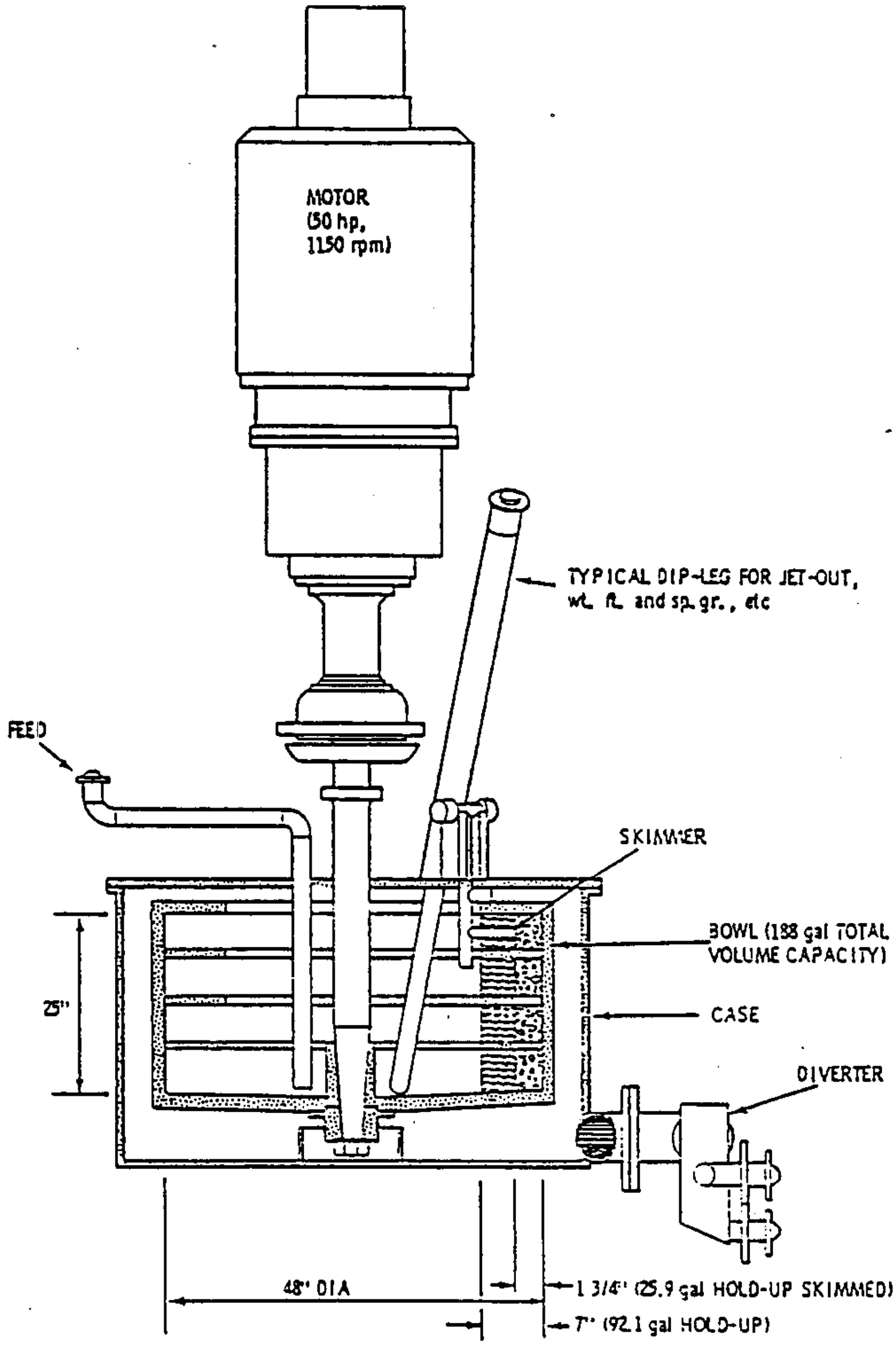
This centrifuge was used to remove the uranium and plutonium containing solids (primarily uranium tetrafluoride) from coating waste. The uranium solids were then metathesized to hydrated uranium dioxide, dissolved, and transferred to solvent extraction feed.

Jumper Box. Section 3.1.3.1 describes jumpers.

Tube Bundles. PUREX has five concentrators for evaporating various process solutions. The steam heated tube bundles (two per concentrator) are remotely replaceable due to higher corrosion rates compared to other concentrator parts.

Although the specific concentrator the tube bundles stored in position 4 came from is unknown, records show that 18 tube bundles failed in 1957 through 1960. The majority, eight, were from the F6 concentrator, followed by five, four, and one from F11, H4, and H8 concentrators, respectively (Schofield 1989). Section 3.1.3.5 describes the F6 concentrator. Section 3.1.3.2 discusses the F11 concentrator. Section 3.1.3.4 addresses the H4 concentrator. The J8 Uranium Concentrator is identical to the H4 Backcycle Waste Concentrator.

Figure 3-11. G-E2 Centrifuge.



3.1.3.4 Position 5: E-H4 Concentrator, Disposed January 4, 1961. The E-H4 concentrator was installed in the E-H4-1 position in January 1956. The concentrator failed on January 4, 1961. It was used for uranium service for half (2 years 6 months) of the 5-year period.

Originally, the design for all of the five "large" concentrators were identical. The E-H4 concentrator stored in this position was exactly like the E-F11 concentrator stored in position 3 of tunnel 1 and described earlier in Section 3.1.3.2. Figure 3-10 depicts a diagram showing the large concentrator's original design.

Aqueous waste streams from the Final Uranium Cycle, Final Plutonium Cycles, Final Neptunium Cycles, and condensate from the Acid Recovery System are concentrated for recycle in Vessel E-H4-1.

3.1.3.5 Position 6: E-F6 Concentrator, Disposed April 21, 1961. This concentrator was installed in the E-F6-1 position in January 1956. The concentrator failed on April 21, 1961.

The original design of the E-F11 concentrator was identical to the E-H4 and E-F11 concentrators discussed above. See Section 3.1.3.2 and Figure 3-10.

In Concentrator E-F6-1 the high-level aqueous waste (HAW), containing nearly all of the fission products, was boiled to recover the nitric acid and to reduce the volume of the remaining solution that was processed in the waste management facilities.

3.1.3.6 Position 7: E-F11 Concentrator, Disposed February 8, 1962. Installed in the E-F-11-1 position in July 1960, this concentrator failed on February 1, 1962. A description of the original E-F11 concentrator design was provided above in Section 3.1.3.2.

3.1.3.7 Position 8: E-F6 Concentrator, Disposed January 22, 1965. This concentrator was installed in the E-F6-1 position in April 1961, and it failed May 23, 1964. A description of the early design for E-F6 concentrator was provided above in Section 3.1.3.5.

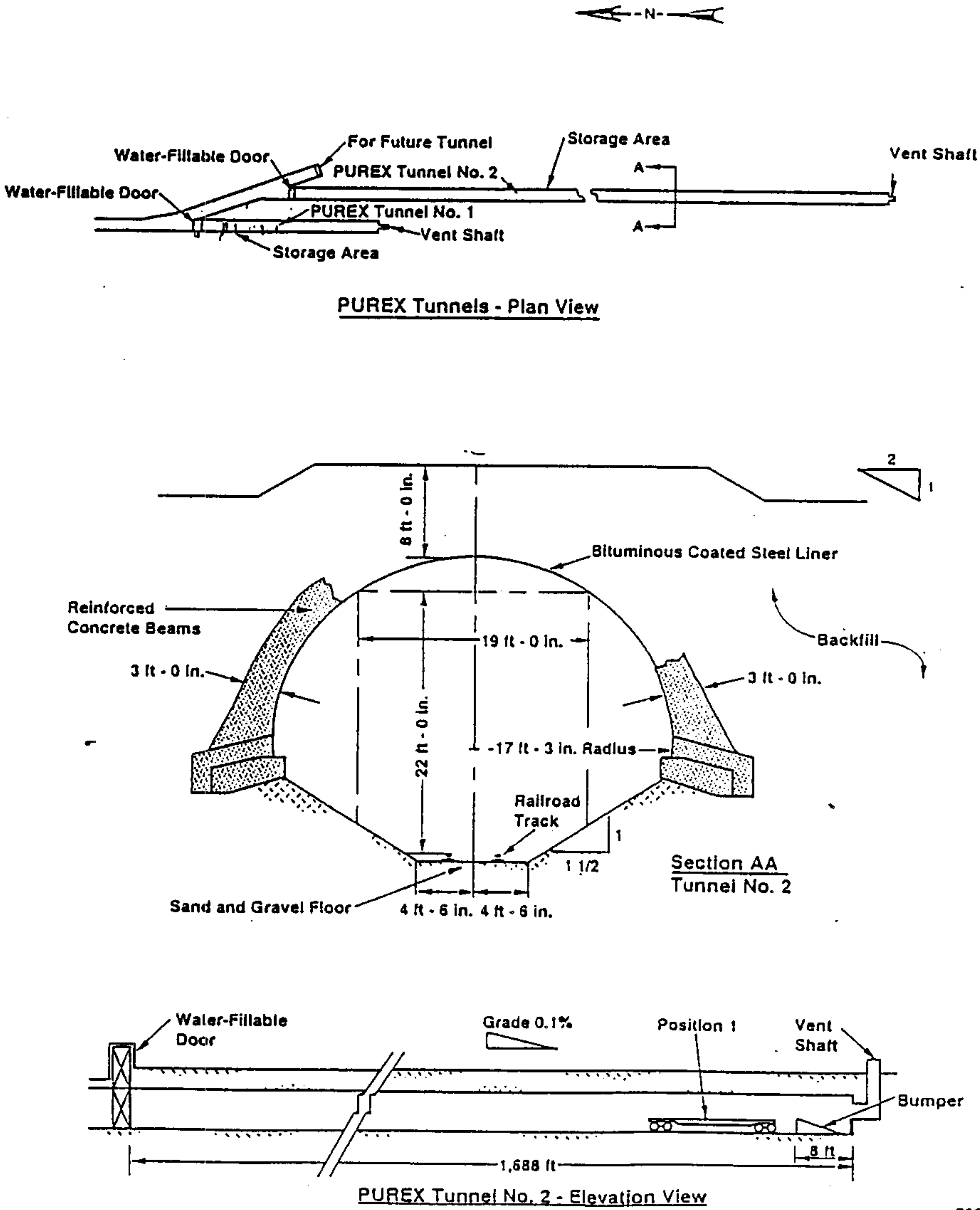
3.2 TUNNEL 2

Tunnel 218-E-15, more commonly referred to as Tunnel 2, was constructed in 1964. The tunnel is 514.5 m (1,688 ft) long by 10.4 m (34 ft) wide by 6.7 m (22 ft) high. The roof is made of corrugated steel, and cement arches are placed at regular intervals along the tunnel roof to add strength. There is an overburden of 2.4 m (8 ft) of fill dirt covering the tunnel roof. Plan, sectional, and elevation views of Tunnel 2 are shown in Figure 3-12.

3.2.1 Historical Background

The capacity of Tunnel 2 is 40 railcars. The first storage position was filled in December 1967; the most recent waste emplacement occurred in August 1989. At the present time, a total of 17 railcars have been placed in

Figure 3-12. Burial Tunnel 2 (218-E-15).



78910032.1

the tunnel. Figure 3-13 provides an overview of the equipment stored in each position.

3.2.2 Characterization of Retrievably Stored Waste in Tunnel 2

The characteristics of the 17 railcars stored in Tunnel 2 are presented in Table 3-4, which is taken from Henckel et al. (1990). Because accurate records were not kept early in the operation of the tunnels some of the sizes listed for various equipment items in this table were based on information provided by PUREX Operations.

3.2.2.1 Hazardous Constituents. Table 3-4 lists the hazardous waste constituents believed to be present in Tunnel 2 and their probable quantities. Lead, mercury, and silver salts are all suspected to be present.

Lead. The 6,084 lb (2,760 kg) of lead estimated for Tunnel 2 is expected to be found on the railcars at positions 14 and 15 in the waste packages containing jumper counterweights and jumper alignment tools.

The lead content of these items is based on take-offs from fabrication drawings of the actual equipment in storage. Jumpers and associated lead parts are described in detail in Section 3.1.2

Since early 1987, the use of lead in the design and fabrication of new or replacement equipment for the PUREX Plant has been discontinued where feasible.

Mercury. About 284 lb of elemental mercury is expected to be stored in equipment on railcars in positions 7, 9, and 11. The elemental mercury stored in the PUREX Storage Tunnels 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 (Figure 3-14), which are approximately 9 ft (2.7 m) in diameter, 24 ft (7.3 m) tall, and weigh approximately 58,000 lb (26,309 kg). The outer shell is constructed of a 0.375-in.-thick (1-centimeter- [cm] thick) plate. Dissolvers are used in decladding and dissolution of irradiated reactor fuel in the PUREX Plant.

There are two thermowells per dissolver located diametrically opposite each other (Figure 3-14). Each thermowell consists of a 9-ft 5-in. length (2.9 m) of 3-in. (7.6 cm) Schedule 80, 304L stainless steel pipe with a 7.5-in. (19.1-cm) right angle lateral extension welded to the downside end. The lower end butts up against the outer surface of the internal slotted bar screen that separated the undissolved nuclear fuel elements from the outer solution chamber of the annular dissolver. Depending on the specific dissolver in question, 42 or 50 lb (19.1 or 45.4 kg) of mercury (0.375 or 0.437 gal [1.4 or 1.77 L]) were poured into each thermowell (84 or 100 lb [38.1 or 45.4 kg] total per dissolver). The mercury was added after the new dissolver was positioned vertically 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

Figure 3-13. PUREX #2 Burial Tunnel (218-E-15). (2 sheets)

Purex # two Burial Tunnel is located at the southeast end of the Purex building and is an extention of the railroad tunnel. The storage area is approximately 1688 feet long, 22 feet high and 34 feet wide. The tracks have a one percent downgrade toward the south end of the tunnel. The capacity of the Burial Tunnel is 38 -40 modified railroad cars, 40-42 feet long. The Tunnel contains 16 cars as of 4/6/88.

position

1. E-F6 # 1 (2WW WASTE) CONCENTRATOR, TK F15-2, ONE TUBE BUNDLE AND AGITATOR MOTORS. BURIED IN TUNNEL ON 12/12/67 ON CAR 61439. 2,400 CU. FT., 700 CURIES.
2. E-F6 #5 (E-H4 3WB) CONCENTRATOR, TWO TUBE BUNDLES BURIED IN TUNNEL ON 3/26/69 ON CAR MILW 60883. 2,400 CU. FT., 500 CURIES.
3. E-F6 #6 (2WW WASTE) CONCENTRATOR, TWO TUBE BUNDLES FAILED BURIED IN TUNNEL ON 3/19/70 ON CAR 3612. 2,400 CU. FT., 700 CURIES.
4. L CELL PACKAGE IN A SEALED STEEL BOX (H2-66012) BURIED IN TUNNEL ON 12/30/70 ON CAR MILW 60033 2,400 CU. FT., 500 GRMS PU.
5. F2 SILVER REACTOR, F6 DEMISTER, VESSEL VENT LINE STELL CAT-WALK AND GUARD RAILS. BURIED IN TUNNEL ON 2/26/71 ON GONDOLA CAR 4610. 2,400 CU. FT., 20 CURIES.
6. MODIFIED A3-1 TOWER, SCRUBBER, LID AND VAPOR LINE BURIED IN TUNNEL ON 12/12/71 ON GONDOLA CAR 4611. 2,400 CU. FT., 10 CURIES.
7. A3 DISSOLVER BURIED IN TUNNEL ON 12/22/71 ON NINE FT. SHORTENED CAR 858 2,400 CU. FT., 50 CURIES.
8. A1W1 FUEL ENDS IN STEEL LINER BOX AND NPR FUEL HANDLING EQUIPT. USED WITH THE SUSPECTED CANISTERS, ON CAR 19808 BURIED IN TUNNEL ON 8/29/72. 800 CU. FT., 17,500 CURIES.
9. C3 DISSOLVER BURIED IN TUNNEL ON 9/30/72 ON CAR 19811 1590 CU. FT., 50 CURIES.
10. E-H4 (3WB) CONCENTRATOR, #61 TUBE BUNDLE, PROTOTYPE COOLING COIL AND A F-F1 FILTER TANK. BURIED IN TUNNEL 8/30/83 ON CAR CDX-1. 2,400 CU. FT., 500 CURIES.
11. A3 DISSOLVER (VESSEL # 10 AND HEATER (VESSEL #6) BURIED IN TUNNEL ON 1/18/86 ON CAR 3613 3,960 CU.FT., 0.81 CURIES.
12. WHITE BOX (H2-58456) CONTAINING EIGHT TUBE BUNDLES #'S 57, 60, 62, 64, 67, 68, 74, AND 76. PULSER #S AND OLD HEATER. DISS LID OLD STYLE DUMPING TRUNNIONS(9). BURIED IN TUNNEL ON 1/20/86 ON CAR 3611, 5,438 CU. FT., 540 CURIES.
13. J5 TANK (VESSEL #30), F1 COND (VESSEL #13) AND F12-B CELL BLK. OLD FOUR-WAY DUMPER. DISS YOKE AND FLANGE PLATE. BURIED IN TUNNEL ON 1/21/86 ON CAR 19806. 2,500 CU. FT., 90 CURIES.

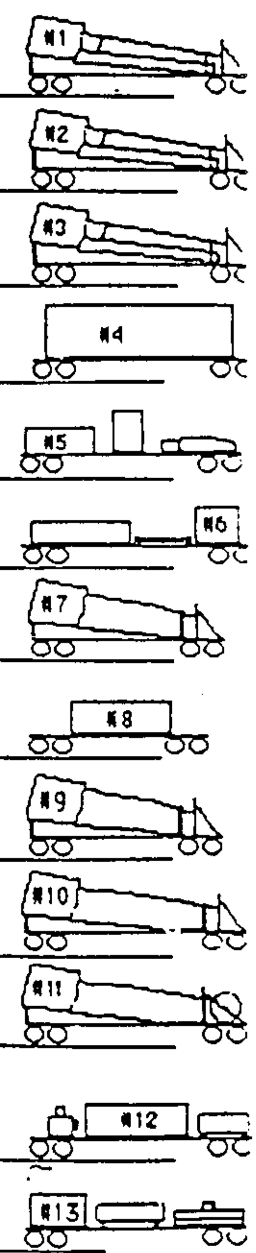


Figure 3-13. PUREX #2 Burial Tunnel (218-E-15). (2 sheets)

POSITION

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. BURIED IN TUNNEL ON 11/18/87 ON CAR PX-10 (10A-19380) & RACK H2-96629. 50 TONS, 3,600 CU. FT., 33.750 CURIE (REF: LETTER 12110-88-074).

15. SILVER REACTOR, E-F2 STEAM HEATER AND BURIAL LINER(H2-65095) FULL OF CUT UP JUMPERS BURIED IN TUNNEL ON 5/13/88 ON CAR PX-9 (10A-19809) & S/R CRADLE SK-OLR-11-2-87. 20 TONS, 2,775 CU. FT., 240 CURIES (REF: LETTER 12110-88-074).

16. E-J8-1 UNITIZED CONCENTRATOR VESSEL #1 H2-52477, FAILED 3/11/89 PLACED ON BURIAL 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).

17. NORTH BURIAL LINER H2-65095 CONTAINING SIX PUMPS, ONE AGITATOR AND CUT UP JUMPERS (14 TONS). SOUTH BURIAL LINER H2-65095 CONTAINING ONE PUMP, ONE #15 YOKE AND CUT UP JUMPERS (11.5 TONS). PLACED ON BURIAL 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)

Table 3-4. Inventory and Characteristics of Equipment Stored in PUREX Tunnel 2. (5 sheets)

TUNNEL INVENTORY

Listed below are the approximate sizes of the process equipment which has been placed in the PUREX storage tunnel 2. Also listed are the suspected hazardous constituents, and radiation dose estimated. Some figure of the equipment are attached to provide sizing details.

Sizing of the equipment is based on information provided by PUREX operations. Accurate records were not kept from the start of the tunnel operations.

Therefore, a number of assumptions were made about the process equipment sent to the tunnels. It is recommended that prior to attempting removal of the process equipment, remote camera and radiation survey devices be sent into the tunnels to verify the size, position, and radiation dose levels of the process equipment.

Tunnel #2 (218-E-15)

- Ci = Curies
- NA Indicates No Information is Available
- O.D. Indicates Outer Diameter
- Volume Estimates Include Only Process Equipment

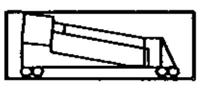
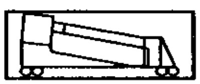
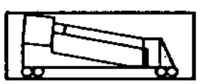
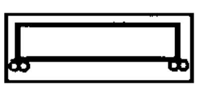
Position (Date of storage)	Layout (Assumed)	Contents	Dimensions	Estimated waste type	Initial dose reading / Estimated Ci Content	Suspected hazardous constituents	Est. Volume (ft^3)	Notes
1 12/12/67		E-F6 Concentrator	36'6" x 15' x 6'	TRU	1.3 R/hr @ 100 ft 5 R/hr @ 50 ft / 700 Ci		2,400	See Tunnel #1, Position 6
		Tube Bundles	12'6" x 4'3" O.D.	TRU				
		Agitator Motor	NA	LLW				
2 3/26/69		E-F6 Concentrator	36'6" x 15' x 6'	TRU	800 R/hr @ Coupling / 500 Ci		2,400	See Tunnel #1, Position 6 This Car Could Also Contain Tank F15-2. No information on This Tank is Available.
		(2) Tube Bundles	Each @ 12'6" x 4'3" O.D.	TRU				
3 3/19/70		E-F6 Concentrator	36'6" x 15' x 6'	TRU	10 R/hr F 500 R/hr @ 2 ft / 700 Ci		2,400	
		(2) Tube Bundles	Each @ 12'6" x 4'3" O.D.	TRU				
4 12/30/70		L Cell Package	14'8" x 16'8" x 36'	TRU	10-200 mR/hr	< 500g Pu	2,400	

Table 3-4. Inventory and Characteristics of Equipment Stored in PUREX Tunnel 2. (5 sheets)

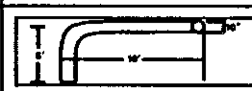
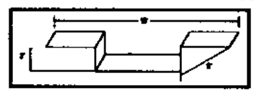
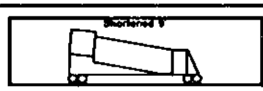
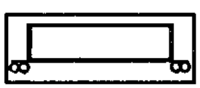
Position (Date of storage)	Layout (Assumed)	Contents	Dimensions	Estimated waste type	Initial dose reading / Estimated Ci Content	Suspected hazardous constituents	Est. Volume (ft^3)	Notes
5 2/26/71		F2 Silver Reactor	13'5" x 4'6" O.D.	LLMW >3	East 300 Mr/hr @ 2 ft West 2 R/hr @ 2 ft 20 Ci	1,375 lb Silver Salts as Silver Nitrate	2,400	The Silver Salts are a Mixture of Silver Nitrate, Silver Hallides, and Silver Fines
		F6 Demister	NA	TRU				
		Vessel Vent		TRU				
		Steel		LLW				
		Guard Rails		LLW				
6 12/12/71		Modified A3-1 Tower	19'7" x 4'4" O.D.	LLW-1	1 R/hr @ F Max @ Side 10 Ci		2,400	Distributer Ring, 6'6" O.D.
		Scrubber	12' x 2'6" O.D.	LLW-1				
		Lid & Vapor Line	7' O.D. Disk 6" x 10" O.D.	LLW-1				
7 12/22/71		A3 Dissolver	15'6" x 9'3" O.D.	LLMW	5 R/hr @ 5 ft 50 Ci	100 lb Mercury	2,400	
8 8/29/72		Steel Liner Box	18' x 8'11-1/4" x 8'3/4"	?	17,500 Ci		800	Fuel Ends and Fuel Handling Equipment are Contained in the Steel Liner Box
		AIWI Fuel Rods	7" x 7" x 6" 7" x 27" O.D.	HLW				
		NPR Fuel Handling Equipment	(2) 72" x 8" O.D. ~ 10" x 12' O.D.	TRU				

Table 3-4. Inventory and Characteristics of Equipment Stored in PUREX Tunnel 2. (5 sheets)

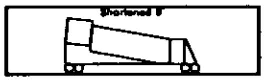
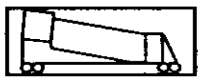
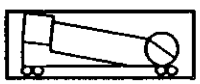
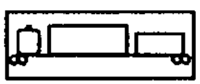
Position (Date of storage)	Layout (Assumed)	Contents	Dimensions	Estimated waste type	Initial dose reading / Estimated Ci Content	Suspected hazardous constituents	Est. Volume (ft^3)	Notes
9 9/30/72		C3 Dissolver	15'6" x 9'3" O.D.	LLW	50 Ci	100 lb Mercury	1,590	
10 8/30/83		E-H4 Concentrator	27'11" x 9'3" O.D.	TRU	500 Ci		2,400	
		Tube Bundles	12'6" x 4'3" O.D.	TRU				
		Cooling Coil	~15' x 5' O.D.					
		F-F1 Filter Tank	~ 10' x 10' O.D.	LLW				
11 1/18/86		A3 Dissolver Vessel	15'6" x 9'6" O.D.	LLMW	3 mR/hr @ 3 ft	84 lb Mercury	3,960	Wt. ~ 40 Tons Tipping Cradle was Welded to Rail Car
		Heater (Vessel #6)	11' x 5'10" x 2'8"	LLW	.81 Ci			
12 1/20/86		White Box (8 Tube Bundles)	~ 12'4" x 26' x 14'6"	LLW	2 R/hr @ Coupling ~3'		5,438	Wt ~ 60 Tons
		Pulser #3 Old Heater Dissolver Lid Trunnions	N/A	LLW	540 Ci			These Items Could be in the White Box, or Sitting on the Rail Car Bed.
13 1/21/86		J5 Tank Vessel	~ 10' x 12' O.D.	LLW	3 R/hr @ 1 ft		2,500	Outer Dimensions on the Equipment Account for the Largest Area Needed to Contain the Equipment. Equipment may Have Been Considerably Downsized by Removing Protruding Nozzles, Vent Lines, etc. Wt ~ 75 Tons
		F1 Condenser	~ 8' x 11' x 7'	LLW	90 Ci			
		F12-B Cell Block	15' x 10' x 3'	LLW				
		Dissolver 4-Way Dumper	Drawing NA	LLW				
		Dissolver Yoke	~ 10' x 12'	LLW				Depth of Yoke Not Available

Table 3-4. Inventory and Characteristics of Equipment Stored in PUREX Tunnel 2. (5 sheets)

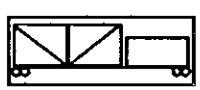
Position (Date of storage)	Layout (Assumed)	Contents	Dimensions	Estimated waste type	Initial dose reading --------- Estimated Ci Content	Suspected hazardous constituents	Est. Volume (ft^3)	Notes
13 1/21/86 Cont.		Flange Plate	2' x 2' O.D.	LLW				
14 11/18/87		L-1 Pulser (#53)	~ 9' x 5' x 5.5'	TRU	5 R/hr @ 15 ft ------------ - 33,750 Ci	5,584 lb Lead	3,600	Wt. ~ 50 Tons
		(2) Column Cartridges	~ 21' x 41' O.D.	LLW				
		Jumper Cutter and Storage Rack	~ 7' x 3' x 5'	LLMW				
		(3) Jumper Alignment Tools	1' x 1', 1' x 2', 1' x 3'	LLW				
		(9) Exterior Dumping Trunnions	~ 2'3" x 1'4" x 5'5"	LLW				
		(10) Pumps	~ 2' x 15' each	LLW				
		(3) Agitators	~ 2' x 15' each	LLW				
		(4) Tube Bundles	12'6" x 4'3"	LLW				
		(2) Vent Jumpers	8' x 8' x 2' 10' x 4' x 4'	LLW				
		(7) Yokes	See Notes	LLW				Dimensions Vary H(4'-12')xW(6'-'10)xD(2'-5')
15 5/13/88		Silver Reactor	13'5' x 4'6"	LLMW >3	20 Mr/hr @ 20 ft ------------ - 240 Ci	250 Lb. Silver Salts as Silver Nitrate 500 lb Lead	2,775	The Silver Salts are a Mixture of Silver Nitrate, Silver Hallides, and Silver Fines
		E-F2 Steam Heater (E-A2 #5)	11' x 5'10" x 2'8"	LLW				
		Burial Liner with Jumpers	8'3/4" x 18" x 8'11-1/4"	LLW				Wt. 20 Tons

Table 3-4. Inventory and Characteristics of Equipment Stored in PUREX Tunnel 2. (5 sheets)

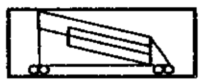
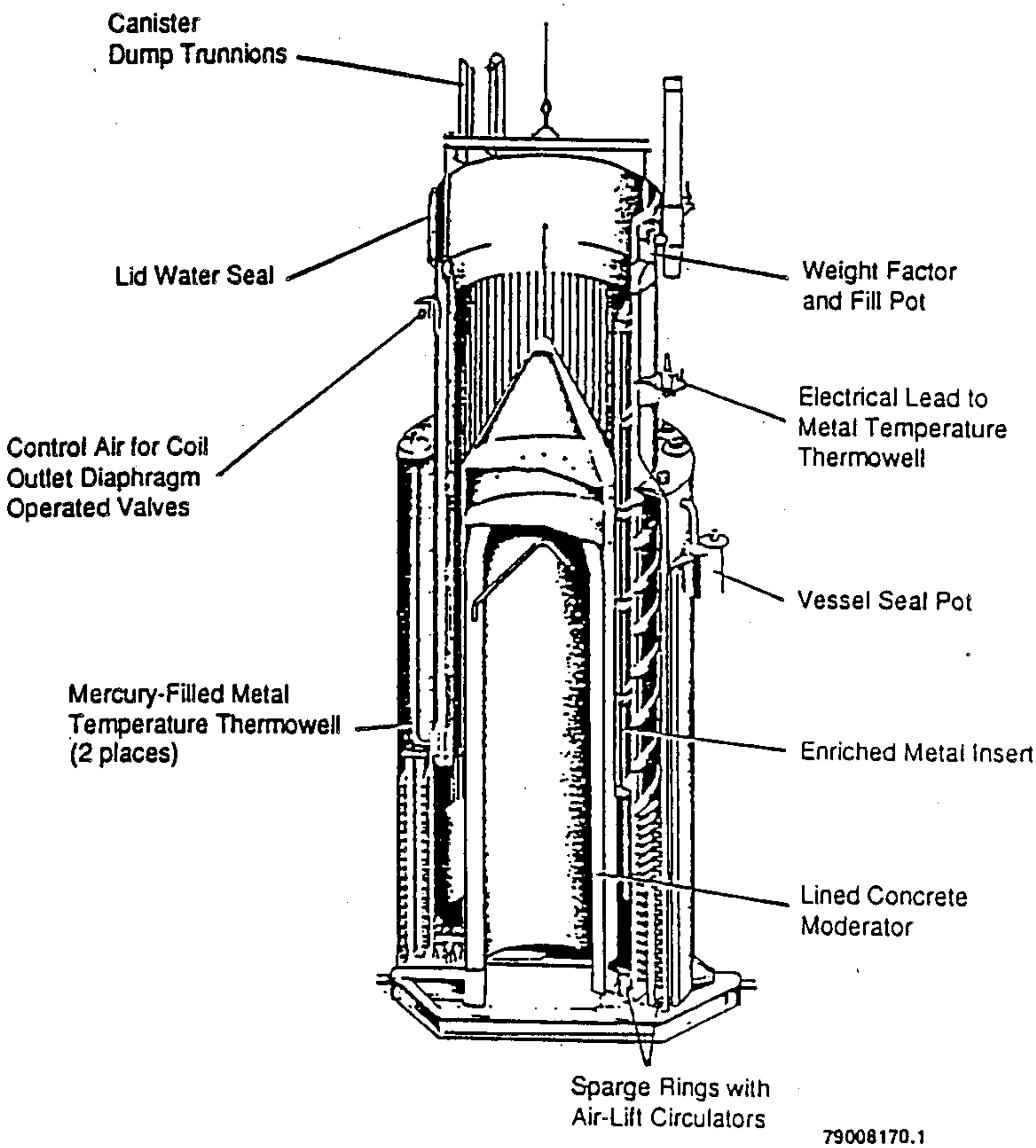
Position (Date of storage)	Layout (Assumed)	Contents	Dimensions	Estimated waste type	Initial dose reading --------- Estimated Ci Content	Suspected hazardous constituents	Est. Volume (ft^3)	Notes
15 5/13/88 Cont.		S/R Cradle SK-GLR-11-2-87		LLW				
16 4/6/89		E-J8-1 Unitized Concentrator Vessel	28' x ~16' X ~17"	LLW	0.5 Mr/Hr @ 10 ft ------------ --- 1.5 Ci		6,000	Wt. 42 Tons, Car Also Contains Yoke Type 19, Lifting Rod and Hooks
17 8/5/89		North Burial Liner with Misc. Waste	8'3/4" x 18' x 8'11-1/4"	LLW	80 Mr/hr @ 1 ft ------------ - 3 Ci		2,574	North ~ 14 Tons South ~ 11.5 Tons
		South Burial Liner with Misc. Waste	8'3/4" x 18' x 8'11-1/4"	LLW				

Figure 3-14. A PUREX Plant Annular Dissolver.



Approximately 9 ft diameter, 24 ft tall, and 58,000 lbs.

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 of the nozzle end of the thermowell.

Elemental mercury exhibits the characteristics of toxicity as determined by the toxicity characteristics leaching procedure and is designated D009 [WAC 173-303-090[8][c]). If exposed to a leachate, the quantity of mercury present could produce an extract greater than 0.0026 oz/gal (20 milligrams per liter); therefore, the mixed waste is managed as extremely hazardous waste and is further designated as WT01 (WAC 173-303-104[3]).

The potential for the mercury stored in the PUREX Storage Tunnels 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.

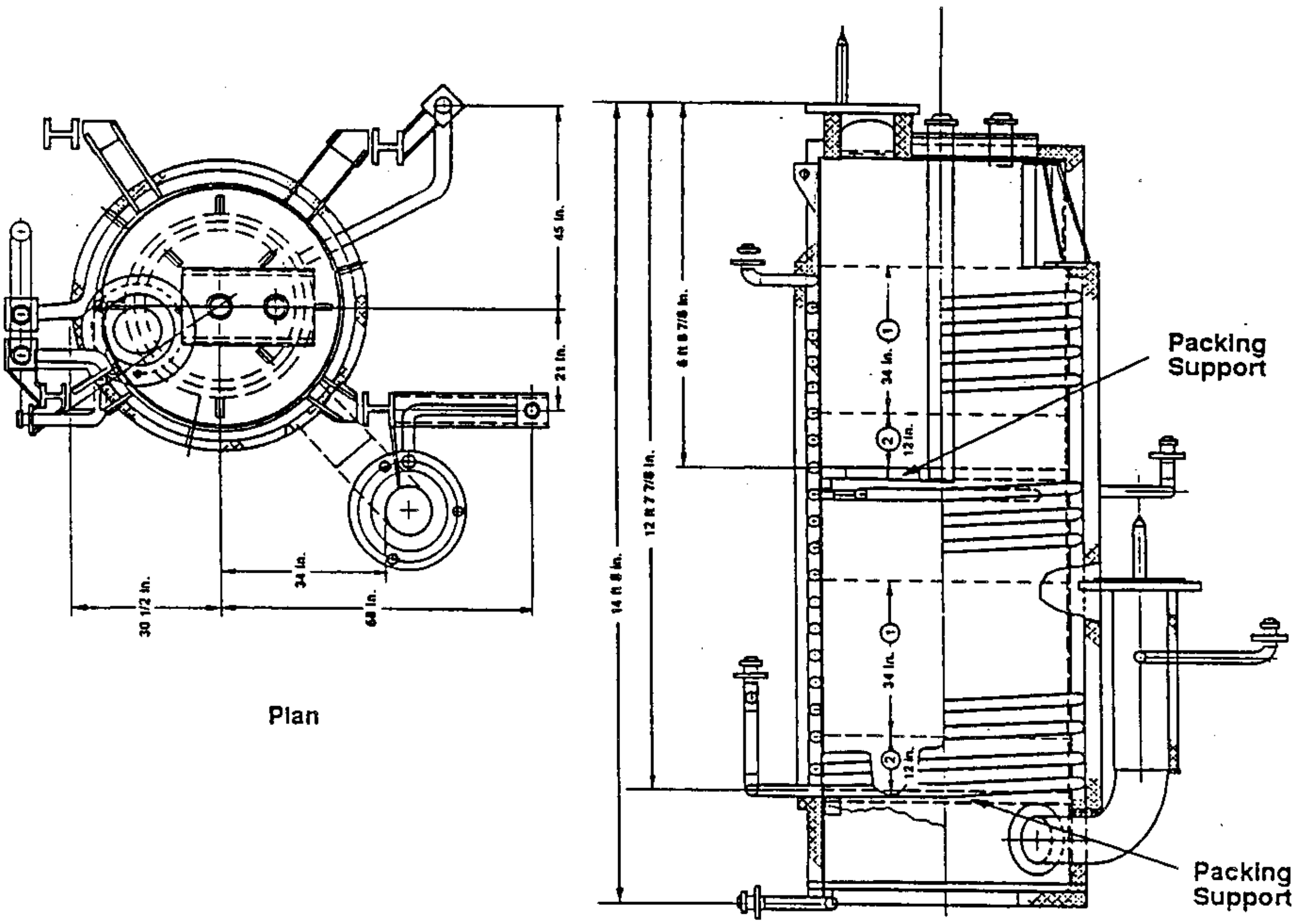
Sampling and chemical analysis is not performed on mercury associated with the dissolvers stored in Tunnel 2. The quantity of mercury present in each thermowell is documented on the fabrication drawings. Because the thermowells are sealed, the quantity of mercury present will not decrease with time due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

Silver Salts. The silver reactors stored in positions 5 and 15 in Tunnel 2 are believed to contain approximately 1,625 lb of silver salts, expressed as pounds equivalent of silver nitrate.

Silver in the form of silver salts deposited on unglazed ceramic packing is contained within the discarded silver reactors stored in Tunnel 2. The silver reactors (Figure 3-15) were used to removed radioactive iodine from the offgas streams of the irradiated reactor fuel dissolvers. The reactor vessel is approximately 4.5 ft (1.4 m) in diameter by 13.5 ft (4.1 m) tall and is constructed of 0.375-in. (1-cm) 304L stainless steel. The vessel contains two 46-in.-deep (1.2-m-deep) beds of packing. Each bed consists of 12-in. (30.5-cm) depth of 1-in. (2.5-cm) unglazed ceramic saddles topped with a 34-in. (0.6-m) depth of 0.5-in. (1.3-cm) unglazed ceramic saddles. The two beds are separated vertically by a distance of about 2 ft (0.6 m), and each bed rests on a support made of stainless steel angles and coarse screen. The packing was coated initially with 250 lb (113.4 kg) 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.

Experience has shown that, after extended use, the silver reactors lose efficiency. This loss in efficiency normally occurs when about one-half of the silver on the packing has been converted to silver iodide. Other

Figure 3-15. Silver Reactor.



(1) 1/2 in. unglazed ceramic berl saddle packing*

(2) 1 in. unglazed ceramic berl saddle packing*

* Initially Coated with Silver Nitrate

79004099.6

competing reactions such as reduction of silver nitrate to metallic silver and formation of silver chloride also occur and affect silver reactor efficiency. The chloride is introduced as an impurity in process chemicals. Therefore, regeneration of the silver reactor with fresh silver nitrate was performed periodically. The packing of a discarded silver reactor will therefore contain 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][c]). The quantity of silver present could produce an extract having greater than 0.0066 ounce of silver per gallon (500 milligrams per liter) should the salts be exposed to a leachate; therefore, the mixed waste is managed as extremely hazardous waste and is further designated as WT01 in accordance with WAC 173-303-104(3). It should be noted that silver nitrate is extremely harmful to aquatic in very low (0.01 to 0.01 parts per million [ppm]) concentrations. In addition, nitrate (per 49 CFR 173.151) exhibit the characteristic of ignitability and must also be designated as D001 (WAC 173-303-090[5]).

Silver salts are contained within a stainless steel vessel, stored inside a weather-tight structure, and elevated above floor level on a railcar. The potential for exposure of the silver salts to a leachate is considered to be negligible. Also, the contained salts are 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 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.

3.2.2.2 Radioactive Constituents. Table 3-5 provides the estimated radioactivity for the major pieces of equipment stored in Tunnel 2. An estimate of the activity in curies at the time of storage is given in Henckel et al. (1991). The equipment was emplaced in Tunnel 2 over a 22-year period. Because the identity for most of the equipment items is known, the activity distribution of fission products and actinides was based on an analysis of current process vessels. (This method is explained further in Appendix C.) Where vessel identification was unclear, a distribution of activity types equal to the average distribution over all the process vessels was assumed.

Table 3-5. Estimated Radioactivity for Major Equipment Stored in PUREX Tunnel 2. (3 sheets)

Storage Date	Item	Initial Curies (Ci)	Estimated Radiation Type % of Curies	Age End of 1993 (Years)	Actinides 180 Day (Ci)	FP + AP 180 Day (Ci)	Actinides 1993 (Ci)	FP + AP 1993 (Ci)
12/12/67	E-F6 concentrator/tube bundle/agitator motor	700	8% actinides 92% FP	25	56	644	1.97 E+01	1.68 E+01
3/26/69	E-F6 concentrator/tube bundles	500	8% actinides 92% FP	25	40	460	1.41 E+01	1.20 E+01
3/19/70	E-F6 concentrator/tube bundles	700	8% actinides 92% FP	24	56	644	2.04 E+01	1.71 E+01
12/30/70	L Cell Package	---	100% Pu	24	-	-	-	-
2/26/71	F2 Silver reactor F6 demister/vent line/catwalk/guardrails	20	I-129	23	0	20	0	20
12/12/71	A3-1 Towers/scrubber/ lid/vapor line	10	RuRh-109	23	0	10	0	1.05 E-05
12/22/71	A3 dissolver	50	8% actinides 89% FP 3% AP	23	4	46	1.51 E+00	1.21 E+00
8/29/72	Liner box/fuel ends/NPR fuel handling equipment	17,500	8% actinides 89% FP 3% AP	22	1,400	16,100	5.49 E+02	4.36 E+02
9/30/72	C3 dissolver	50	8% actinides 89% FP 3% AP	22	4	46	1.57 E+00	1.25 E+00
8/30/83	E-H4 concentrator/tube bundle/cooling coil/ F-F1 filter tank	500	0.04% actinides 67% Pu 33% FP	11	335.2	165	2.08 E+02	6.81 E+00

Table 3-5. Estimated Radioactivity for Major Equipment Stored in PUREX Tunnel 2. (3 sheets)

Storage Date	Item	Initial Curies (Ci)	Estimated Radiation Type % of Curies	Age End of 1993 (Years)	Actinides 180 Day (Ci)	FP + AP 180 Day (Ci)	Actinides 1993 (Ci)	FP + AP 1993 (Ci)
1/18/86	A3 dissolver/heater	0.81	8% actinides 89% FP 3% AP	8	0.0648	0.7452	4.58 E-02	3.73 E-02
1/20/86	White box (8 tube bundles)/pulser #5/ dissolver lid trunions	540	16% actinides 83% FP 1% AP	8	86.4	453.6	6.01 E+01	2.31 E+01
1/21/86	J5 Tank/F1 Condenser/ F12-B cell block/ dissolver 4-way dumper/ dissolver yoke/ flange plate	90	6% FP 94% Pu	8	84/6	5.4	6.00 E+01	2.77 E-01
11/18/87	L-1 pulser/2 column cartridges/jumper cutter and storage rack/ 3 jumper alignment tools/exterior dumping trunions/10 pumps/ 3 agitators/4 tube bundles/2 vent jumpers/7 yokes	33,750	16% actinides 83% FP 1% AP	7	5,400	28,350	3.98 E+03	1.56 E+03
5/13/88	silver reactor/ E-F2 steam heater/burial liner with jumpers/SR cradle	240	7.4 Ci I-129 15.5% actinides 80.5% FP 1% AP	6	37.2	202.8	2.85 E+01	1.91 E+01
4/6/89	E-J8-1 Concentrator	1.5	30% FP 46% U 23% Pu	5	1.05	0.45	9.51 E-01	2.90 E-02

Table 3-5. Estimated Radioactivity for Major Equipment Stored in PUREX Tunnel 2. (3 sheets)

Storage Date	Item	Initial Curies (Ci)	Estimated Radiation Type % of Curies	Age End of 1993 (Years)	Actinides 180 Day (Ci)	FP + AP 180 Day (Ci)	Actinides 1993 (Ci)	FP + AP 1993 (Ci)
8/5/89	2 burial liners with miscellaneous waste	3	16% actinides 83% FP 1% AP	5	0.48	2.52	3.85 E-01	1.61 E-01
Total		1.44 E+05	Total				5.53 E+03	2.21 E+03

FP = Fission products
AP = Activation products.

3.2.3 Description of Equipment Stored

The equipment stored in Tunnel 2 is described below according to each item's relative position in the tunnel. It is important to note that the retrieval of this equipment will proceed in the reverse order of emplacements.

Table 3-6 lists the cell arrangement and construction drawings for each of the equipment items in Tunnel 2. This table also indicates the process and inlet and outlet streams for each item when that item was in use.

3.2.3.1 Position 1: Disposed December 12, 1967 on Car 61439. E-F6-1 [2WW Waste] Concentrator. The E-F6 concentrator stored in Tunnel 2, Position 1 was originally installed in the E-F11-1 position in February 1962. The concentrator was taken out of service in December 1962, and it was moved to the E-F6-1 position in May 1964. The concentrator failed in June, 1965 after a total service life of 20 months.

Although the original design for the large concentrators was described earlier in Section 3.1.3.5, the design of the concentrators did undergo design changes in the ensuing years. The following description of the E-F6 Concentrator is based on the information in the 1989 *PUREX Technical Manual* (WHC 1989). The exact designs of the three E-F6 concentrators located in positions 1, 2, and 3 of Tunnel 2 are unknown.

The E-F6 Concentrator, shown in Figure 3-16, was composed of Type 304-L stainless steel and insulated with a layer of 2-in.-thick fiber-glass protected by a shield of 0.0375-in. (20-gauge) stainless steel sheet. It was a vertical-tube, thermal recirculation evaporator containing two bundles of 1.25-in. OD by 10-ft-long tubes, surmounted by a 5.5-ft OD, 12.5-ft-high tower section. Vessel E-F6-1 had a central draft tube, 2.5-ft in diameter, in the lower portion of the concentrator connected on opposite sides to two cylindrical reboilers, each 4.5-ft in diameter. The reboilers were connected to the draft tube by ducts at the top and bottom. The tower was removable as it was connected to the draft tube with a bolted flange.

The reboilers were elevated above the bottom of the draft tube, and the reboiler bottoms were dished downward for effective draining. The bottom of the draft tube was dished upward to center so that liquid heel volumes were minimized.

The east reboiler contained 630 tubes 1-in. in diameter, and the west reboiler held 687 tubes, which were 1.25-in. in diameter. All of the tubes were 10-ft-long. E-F6 concentrator tube bundles had a relatively high rate of failure in the 1950's and 1960's because of the higher acid content required for dissolution than that needed for N Reactor fuel. In the upper central section of the concentrator, a baffle made of 5-ft-long vertical strips of angle iron was mounted for impingement separation of liquid droplets from the rising vapor.

Vapor from the concentrator passed through two stages of liquid deentrainment for fission product removal before going to the T-F5 Acid Absorber for the recovery of nitric acid. The concentrator vented to the removable deentrainment tower connected to the top of the central portion of

Table 3-6. Tunnel 2 Inventory. (4 sheets)

Car Number (Date)	Equipment Name	Cell Arrangement Drawing	Construction Drawing	Process	Inlet Streams	Outlet Streams
1 (12/12/67)	E-F6 Concentrator	H-2-53510	H-2-56213	Waste Concentration and Treatment (WC&T)	1WF, 1WR, H_2O_3, and offgas from 1WW Denitration	Offgas and 1WW
2 (03/26/69)	E-F4 Concentrator or E-F6 Concentrator	H-2-53521	H-2-58101	Backcycle Waste (BW)	3WF	3WW and offgas
		H-2-53510	H-2-56213	WC&T	1WF, 1WR, H_2O_3, and offgas from 1WW Denitration	Offgas and 1WW
	TK-F15-2 Tanks (perhaps)	H-2-53514	H-2-52453	WC&T	1WW, and sugar	1WW, WRP, and offgas
3 (03/19/70)	E-F6 Concentrator	H-2-53510	H-2-56213	WC&T	1WF, 1WR, H_2O_3, and offgas from 1WW Denitration	Offgas and 1WW
4 (12/30/70)	L Cell Package	H-2-53529	H-2-63607 H-2-63624 - H-2-63628	Final Pu Cycles (FPC)	2BP, HNO_3, 3AS, 3BX, 3AF, H_2O_3, 3AX, 3BP	3AW, 3BW, PCP, offgas
5 (02/26/71)	F2 Silver Reactor	H-2-53508	H-2-52467	Process Vent System (PVS)	Vents from vessels and condensers	Vents from vessels and condensers (less free halogens)
	F6 Demister	H-2-53510	H-2-57499	WC&T	E-F6-1 Condenser Offgas, and H_2O	AAF and 1WR

Table 3-6. Tunnel 2 Inventory. (4 sheets)

Car Number (Date)	Equipment Name	Cell Arrangement Drawing	Construction Drawing	Process	Inlet Streams	Outlet Streams
6 (12/12/71)	Modified A3-1 Downdraft Dissolver Condenser Tower	H-2-53500	H-2-52468 H-2-52529 H-2-66054	Material Dissolution and Feed Preparation (MD & FP)	A3 Dissolver Offgas	Offgas to Scrubber and Acid to A3 Dissolver
	Scrubber (probably T-A3 NH_3 Scrubber)	H-2-53500	H-2-66137	MD & FP	A3-1 Tower Offgas and H_2O	Acid to A3 Dissolver, waste and Fission Prod. to NH_3 Catch Tank, and offgas to NH_3 Catch Tank and heater
7 (12/22/71)	A3 (Annular) Dissolver	H-2-53500	H-2-59925 H-2-59927	MD & FP	Zircaloy Clad Metal Chemicals(?), Rec HNO_3, and Metathesis solution	Recladding waste metathesis solution, dissolved Pu, U, or Np, and Offgas
9 (09/30/72)	C3 (Annular) Dissolver	H-2-53502	H-2-59130	MD & FP	Zircaloy Clad Metal Chemicals(?), Rec HNO_3, and Metathesis solution	Recladding waste metathesis solution, dissolved Pu, U, or Np, and offgas

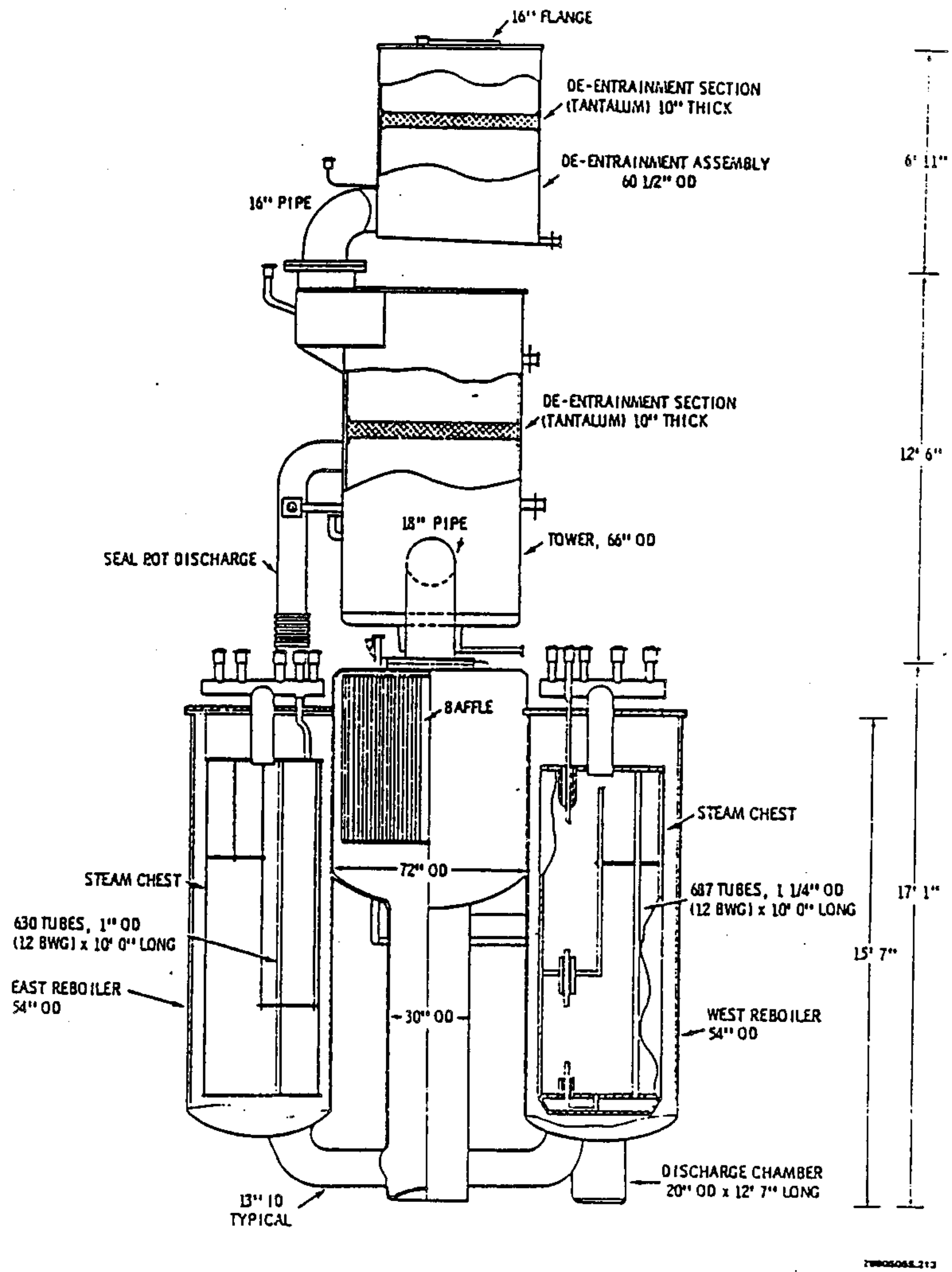
Table 3-6. Tunnel 2 Inventory. (4 sheets)

Car Number (Date)	Equipment Name	Cell Arrangement Drawing	Construction Drawing	Process	Inlet Streams	Outlet Streams
10 (08/03/83)	E-H4 Concentrator	H-2-53521	H-2-66104	BW	3WF	3WW and offgas
	F-F1 (Canyon) Filter Tank	H-2-53508	H-2-56989	PVS	Halogen free vent from Silver Reactor	Vent to building air filters
11 (01/18/86)	A3 (Annular) Dissolver Vessel	H-2-53500	H-2-68280	MD & FP	Zircaloy Clad Metal Chemicals(?), Rec HNO_3, and Metathesis Solution	Recladding waste metathesis solution, dissolved Pu, U, or Np, and offgas
	Heater Vessel #6 (E-A2) Steam Offgas Heater	H-2-53500	H-2-52473	MD & FP	NH_3 Scrubber Offgas	Hot offgas
12 (01/20/86)	Pulser #5 (PG-J6)	H-2-53524	H-2-52687	1st D&PC	1BXF	1BXF
13 (01/21/86)	(TK-J5 2A Feed Tank) JS Tank Vessel #30	H-2-53523	H-2-59968	FPC	1BP, Fresh HNO_3 and 2AF-NO_3	2AF
	F1 Condenser	H-2-53508	H-2-52480	PVS	Vents from Vessels and Condensers	Offgas and condensate to TK-F12 via TK-F1
14 (11/18/87)	L-1 Pulser	H-2-53528	H-2-56910	FPC	Serves T-LI Column which processes; 2AF, 2AX, Fresh HNO_3 and H_2O	Serves T-LI Column which makes 2AP and 2AW

Table 3-6. Tunnel 2 Inventory. (4 sheets)

Car Number (Date)	Equipment Name	Cell Arrangement Drawing	Construction Drawing	Process	Inlet Streams	Outlet Streams
15 (05/13/88)	Silver Reactor (probably E-F2)	H-2-53508	H-2-52467	PVS	Vents from Vessels and Condensers	Vents from vessels and condensers (less free halogens)
	E-F2 Steam (offgas) Heater	H-2-53508	H-2-52473	PVS	Dry Vent Gas from Condensers and Vessels	Hot dry vent gas
16 (04/06/89)	E-J8-1 Unitized Concentrator	H-2-53525	H-2-52477	1st D&PC	ICU and 3WD	1UC and offgas

Figure 3-16. E-F6 Concentrator.



the concentrator with an 18-in. flange and vent pipe. The deentrainment pad in the E-F6-1 tower was made of tantalum. An additional deentrainment section (T-F6-2) was located in the offgas line above the concentrator tower. This section, which is about 6-ft-high and 5-ft in diameter, contains a 10-in.-thick tantalum wire mesh deentrainment pad. A seal pot for pressure vessel relief was mounted on the side of the tower.

In Concentrator E-F6-1, the HAW, containing nearly all of the fission products, was boiled to recover the nitric acid and to reduce the volume of the remaining solution that was processed in the waste management facilities. The HAW, after addition of a sugar solution for suppression of ruthenium volatilization, became the 1WF stream and was fed to the center section of the concentrator. The solution circulated upward through the inside of the tubes in the reboilers while process steam condensed on the outside of the tubes in the steam chests. Concentrated solution (1WW) overflowed from the discharge chamber and was routed to a tank. **TK-F15-2.** Tank F15-2 was removed from service in 1965 due to a failed coil.

This tank was a standard 5,000-gal tank that was used in the PUREX canyon for 1WW denitration. As shown in Figure 3-17, these standard tanks were fabricated with cylindrical (or oval) shells welded to flanged, flat heads and contain coils for heating and cooling arranged in banks of concentric helixes.

Tube Bundle (1). PUREX had five concentrators that each contained two steam heated tube bundles. The tube bundles varied slightly among the concentrators. The number of tubes per bundle was either 630, 687, or 718. All tubes had a length of 10 ft, and diameters of the tubes were either 1- or 1.25-in. depending on the concentrator. These tube bundles were remotely replaceable due to the higher corrosion rates they experienced, compared to other parts of the concentrator. When tube bundles were removed from service they were generally sent to the tube bundle flush tank (TK-F17) for decontamination.

The concentrator in which this tube bundle was installed is not known; however, it is probably from either F6 or H4. This assumption is based on information found in an internal memo, dated September 1968, which indicated that the average life of tube bundles was 20 months in F6 and 15 months in H4. Concentrator J8 had only one tube bundle replaced in the period between startup and 1968; there had been no tube bundle replacements required in K4 during the same period.

Agitator Motors. Agitators were used inside and outside of the canyon in the PUREX Plant to mix and blend tank contents, to promote chemical reactions, and to improve heat transfer coefficients. Design differences between "canyon" and "non-canyon" agitators were based primarily on the criterion of removability. Canyon agitators were designed with removable electrical connectors, lifting bails, and self-lubricating seals. It is assumed that all of the agitators found in the PUREX tunnels were radioactively contaminated as a result of canyon service. Figure 3-18 shows a typical canyon agitator.

Figure 3-17. Standard 5,000-Gallon Tank.

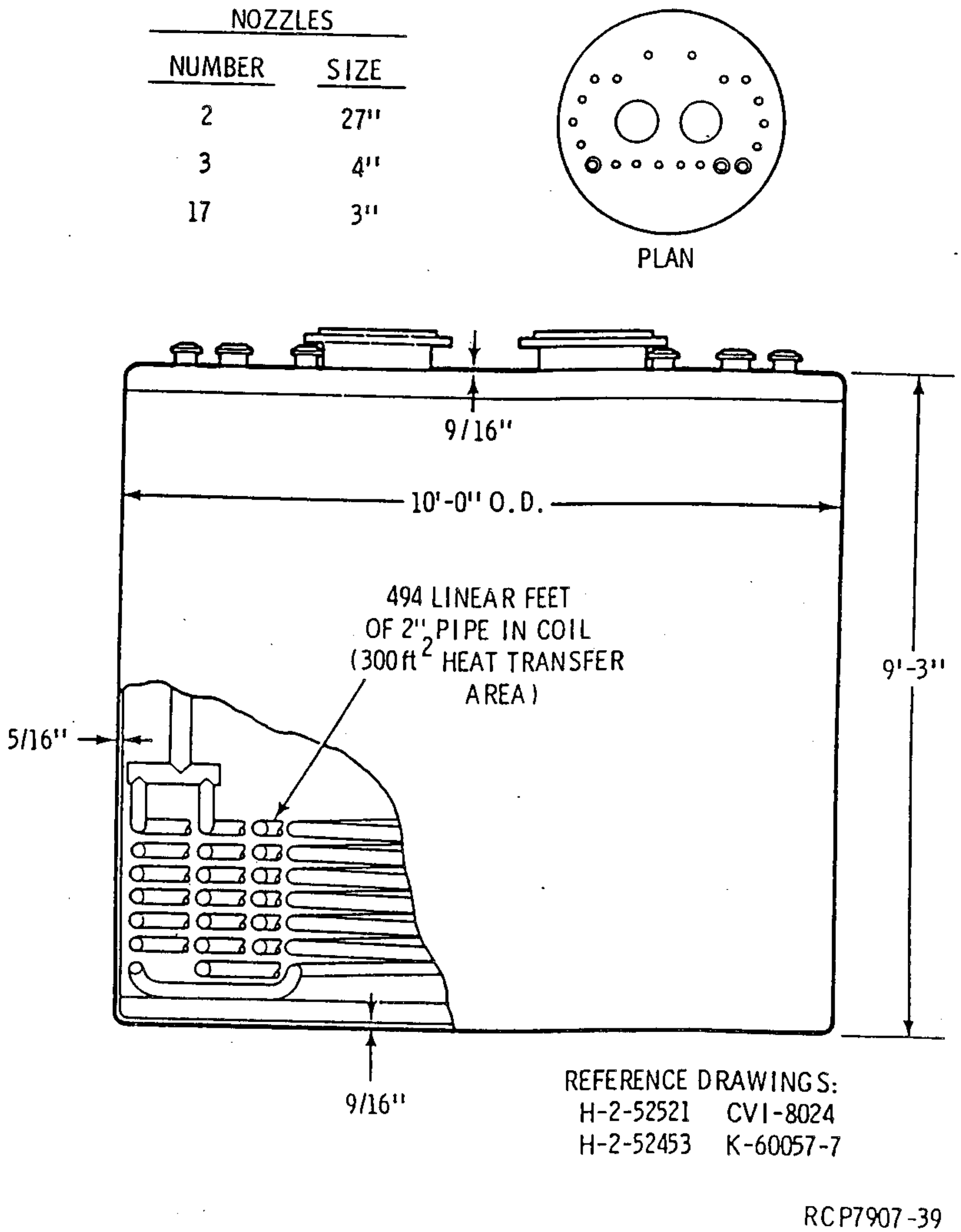
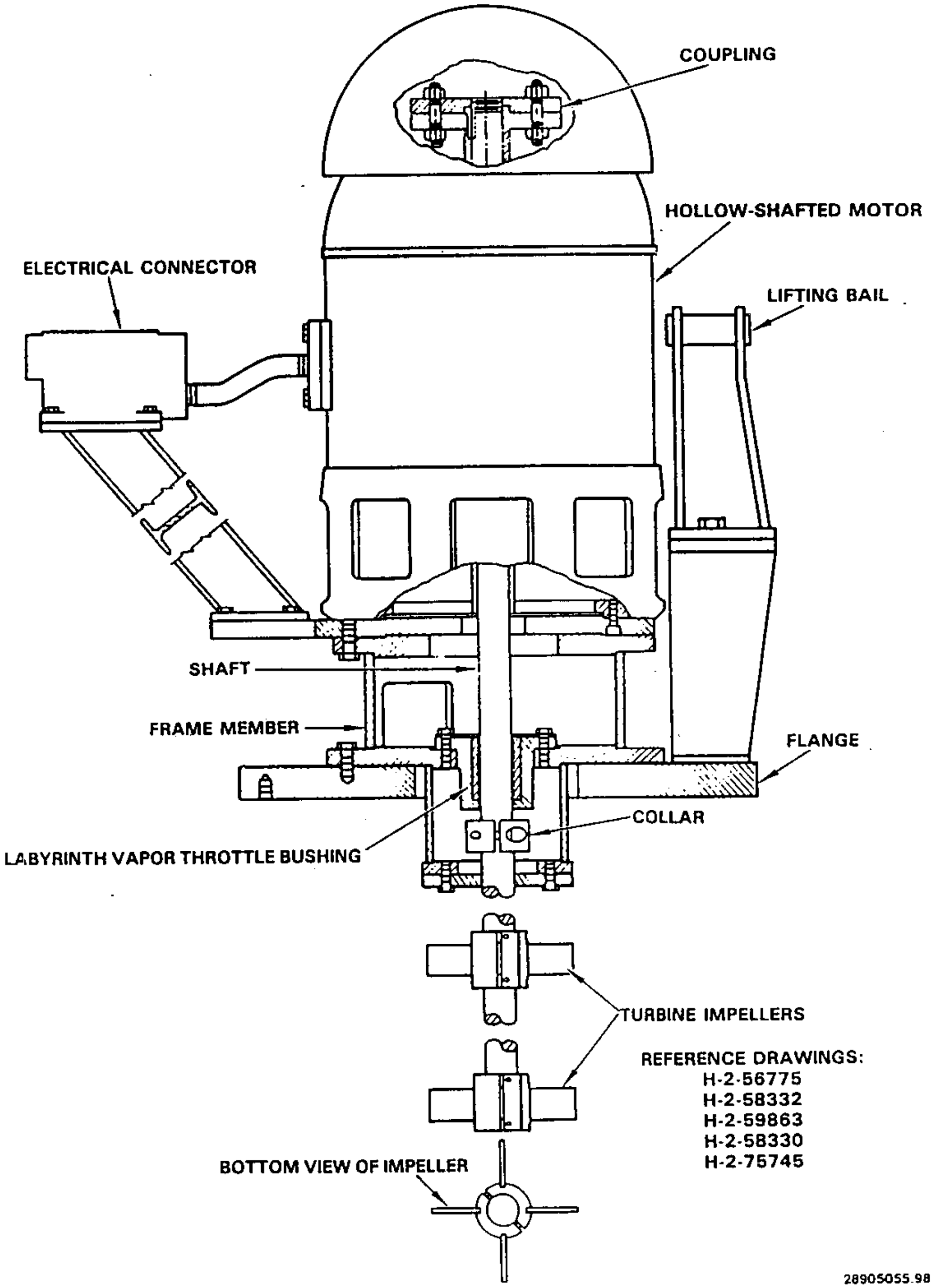


Figure 3-18. Typical Canyon Agitator.



3.2.3.2 Position 2: Disposed December 26, 1967 on Car MILW 60883. E-F6 #5 [E-H4 3WB] Concentrator. The E-F6 #5 concentrator was installed in the E-H4-1 position in February 1966, and, after springing a leak, was removed from service in August 1968. This vessel was in service for 2.5 years in the H4 position and 1 year in the 1 WW (F6) position.

The E-F6 concentrator was described previously in Section 3.2.3.1.

Two Tube Bundles. The concentrator from which these tube bundles were removed in unknown. Tube bundles were discussed earlier in Section 3.2.3.1.

3.2.3.3 Position 3: Disposed December 30, 1970 on Car 3612. E-F6 #6 [2WW Waste] Concentrator. This concentrator was installed in the E-F6-1 position in June 1965. It failed on June 10, 1969 when it sprang a leak.

The E-F6 concentrator was described previously in Section 3.2.3.1.

Two Tube Bundles. The concentrator from which these tube bundles were removed is unknown. Tube bundles were discussed earlier in Section 3.2.3.1.

3.2.3.4 Position 4: Disposed February 26, 1971 on Car MILW 60033. L Cell Package in Steel Box. Final purification and concentration of plutonium nitrate solution was accomplished in L Cell. In the original design of L Cell, the plutonium stripper (T-L3), the No. 1 and No. 2 plutonium concentrators (E-L4 and E-L7, respectively) with associated condensers, and the plutonium receiver (TK-L6) were arranged and supported as a single structural unit which was designed for remote maintenance. This original "L Cell Package" was redesigned in 1969, and it was replaced in 1971.

The plutonium stripper (T-L3) was a 28-ft-high tower for the removal of volatile material from the plutonium feed stream. The tower assembly consisted of (from the bottom up) the boiler, the stripper, and the deentrainment section. The vertical tube boiler had 13 tubes (1-in. OD by 6-ft-long) inside a 6-in. IPS steam shell. The boiler was connected top and bottom to a 6-in. (inner diameter) by 9-ft-high disengaging section. The stripper (7.0 in. inner diameter by 9.5 ft high), which contained an 8-ft-deep bed of 1-in. stainless-steel Raschig rings, was set above the disengaging section. The feed stream entered the top of the stripping section onto a distributor plate above the packing. The de-entrainment section above the stripper consisted of two parallel 7-in.-inner diameter by 4-ft-high cylinders packed 3-ft deep with 1-in. stainless-steel Raschig rings. The plutonium stripper is diagramed in Figure 3-19.

Two similar concentrators were used for the concentration of the plutonium stream and for re-evaporation of the condensate for decontamination prior to cribbing. The plutonium concentrator was 24 ft high. It consisted of a boiler, disengagement section, and de-entrainment section. The 13 tube boiler was identical to the stripper boiler described above except for the orientation of the steam nozzle. The boiler was connected top and bottom to the 6-in.-IPS by 6-ft-high disengaging section. Two parallel, 7-in.-inner diameter by 8-ft-high, de-entrainment sections surmounted the disengaging section. De-entrainment sections were packed 7 ft deep with 2-in. stainless-steel Raschig rings. The concentrator is shown in Figure 3-19.

Figure 3-19. L Cell Package Equipment. (2 sheets)

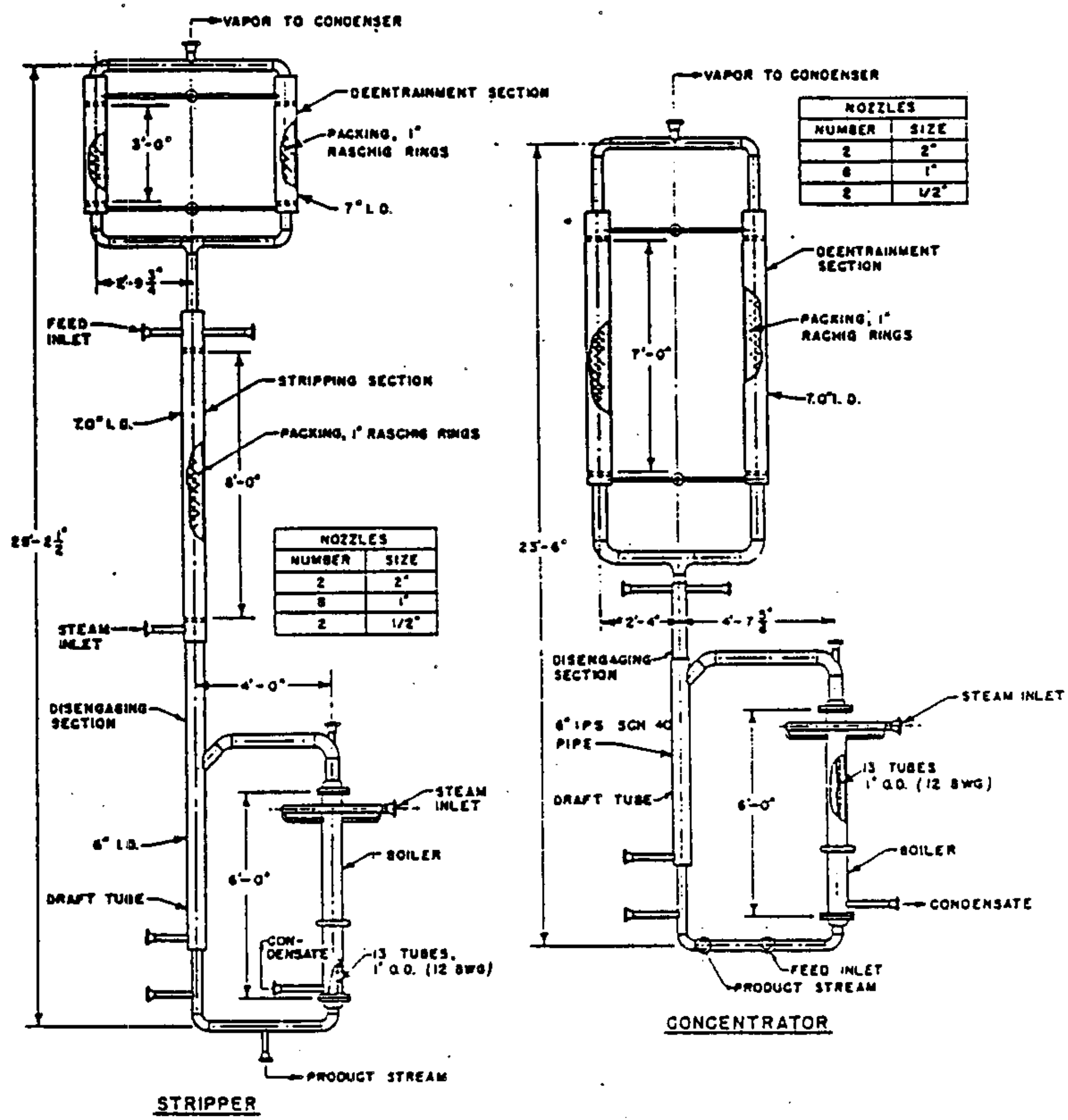
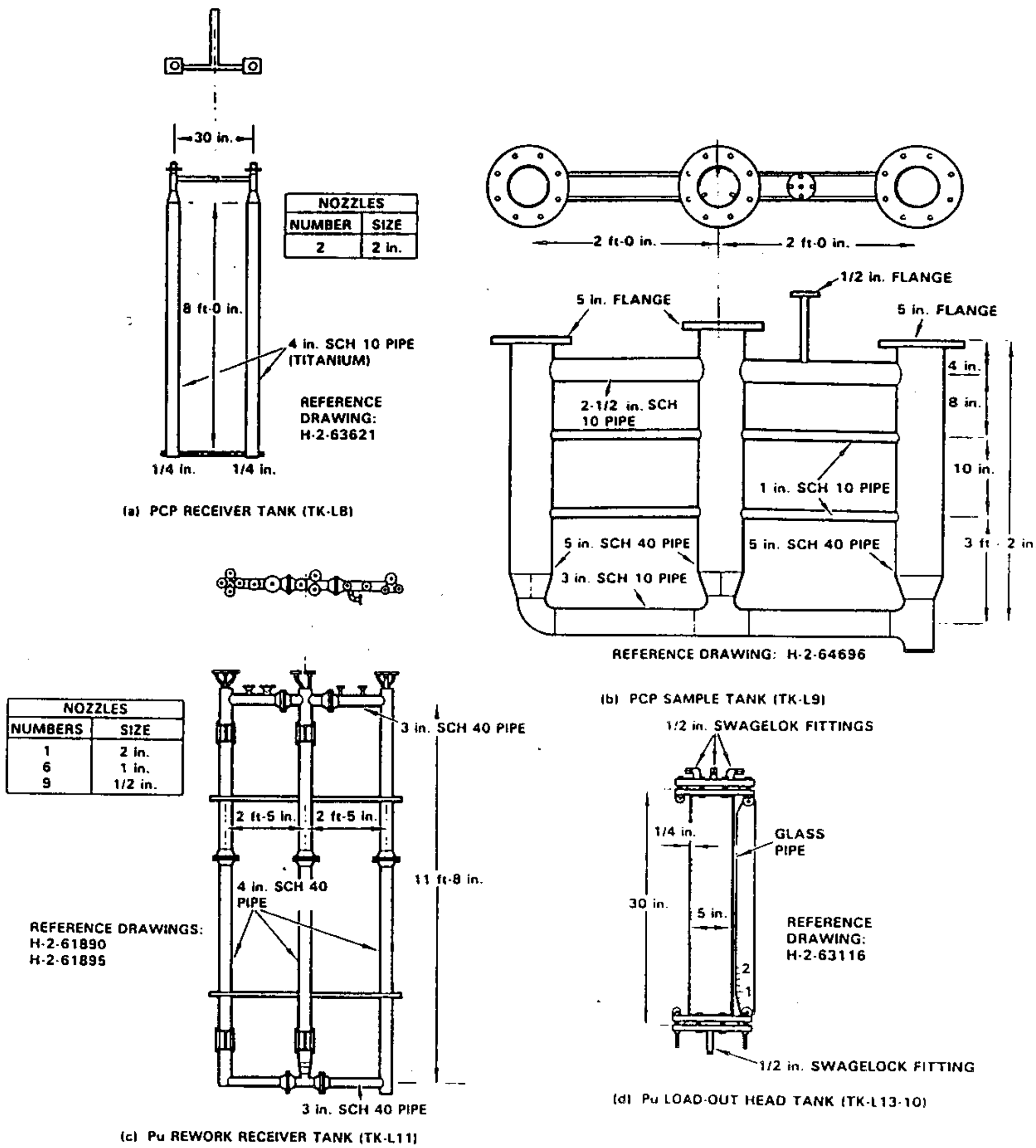


Figure 3-19. L Cell Package Equipment. (2 sheets)



Condensers E-L5 and E-L8 condensed the overhead vapors from the concentrators. Condenser E-L12 condensed the steam from the vacuum jet from the plutonium tank, TK-L11. Each condenser had ten 1-in.-OD by 5-ft-long tubes arranged in three passes in the 6-in.-IPS shell.

Concentrated plutonium solution from the concentrator was collected in the plutonium receiver TK-L6. This vessel consisted of two interconnected cylindrical, jacketed, 5.625 in. inner diameter by 4.5-ft-long tanks. The tanks were connected to the bottom by a manifold that contained approximately 8 ft of 3-in. pipe. The top connecting manifold contained 5 ft of 1-in. pipe. The receiver and vacuum tank are shown in Figure 3-19.

3.2.3.5 Position 5: Disposed December 12, 1971 on Car 4610. F2 Silver Reactor. This silver reactor (T-A2-F2, Model J) was removed from service February 26, 1971. This vessel was installed originally in A Cell. It was removed from A Cell and installed in F Cell on August 1, 1965. Figure 3-15, in Section 3.2.2.1, showed a typical silver reactor.

Iodine was removed from the dissolver offgas by reaction with silver nitrate deposited on the packing in the silver reactors. The reactor vessel had an OD of 4.5 ft and was about 13.5 ft tall. The shell and both dished heads were 0.25-in.-thick. The vessel was packed to a height of 8 ft with 0.5-in. ceramic Beryl saddles packed with silver nitrate. The straight portion of the shell was heated by an external steam coil of 15 turns of 2-in. pipe, which was covered by an outer shell of 20 gauge stainless steel sheet. Ten-inch flanged nozzles in the top head and in the shell near the bottom served as gas inlet and outlet, respectively. Inside the head were three spray nozzles for wetting the packing with chemical regenerating solutions.

F6 Demister. Entrained droplets of the concentrated acid solution were removed from the overhead vapors during concentration operations in order to minimize contamination of the recovered acid by radioisotopes. The bubble-cap trays and packed section in the towers surmounting each concentrator performed this function. The E-F6 concentrator originally included a seven tray (bubble-cap) tower and a chevron packed section for deentrainment. This assembly is shown in Figure 3-20. It is assumed that the demister stored in Position 5 of Tunnel 2 is of this type. Subsequent designs for the E-F6 concentrator included two 10-in.-thick de-entrainment sections made from tantalum.

Vessel Vent Line. The location from which this vessel vent line was removed is unknown.

Steel Catwalk and Guard Rails. The location from which the catwalk and guard rails were removed is unknown.

3.2.3.6 Position 6: Disposed December 12, 1971 on Car 4611. Figure 3-21 provides a schematic diagram of the equipment that was found in a typical dissolver cell. This diagram provides the typical dimensions for the equipment in Tunnel 2, Position 6 (described below), and the dissolver equipment stored in Tunnel 2 Positions 7, 9, and 11.

Figure 3-20. Large Concentrator Assembly.

NOZZLES	
NUMBER	SIZE
1	16"
12	4"
5	3"
12	2"
1	2" 3-WAY

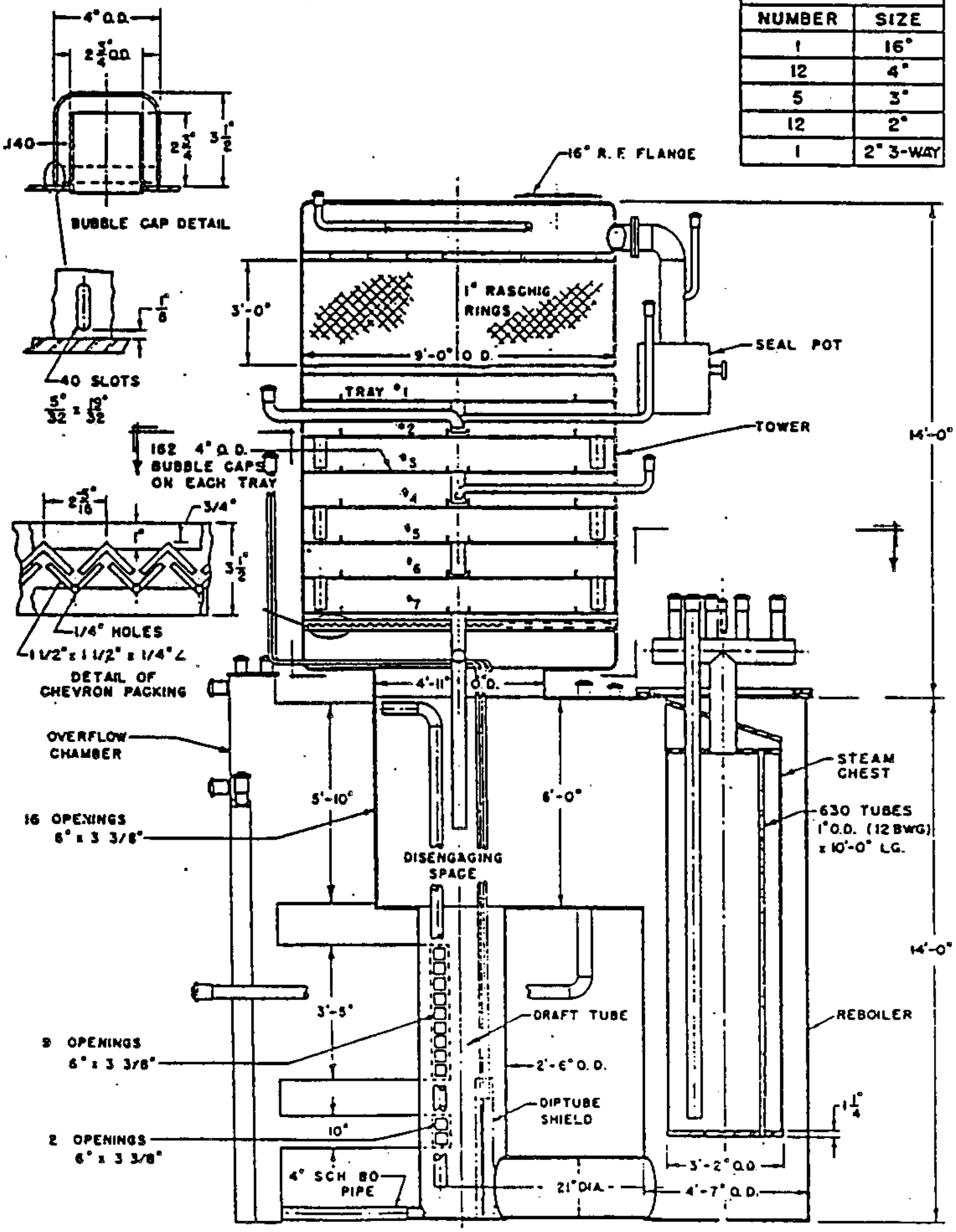
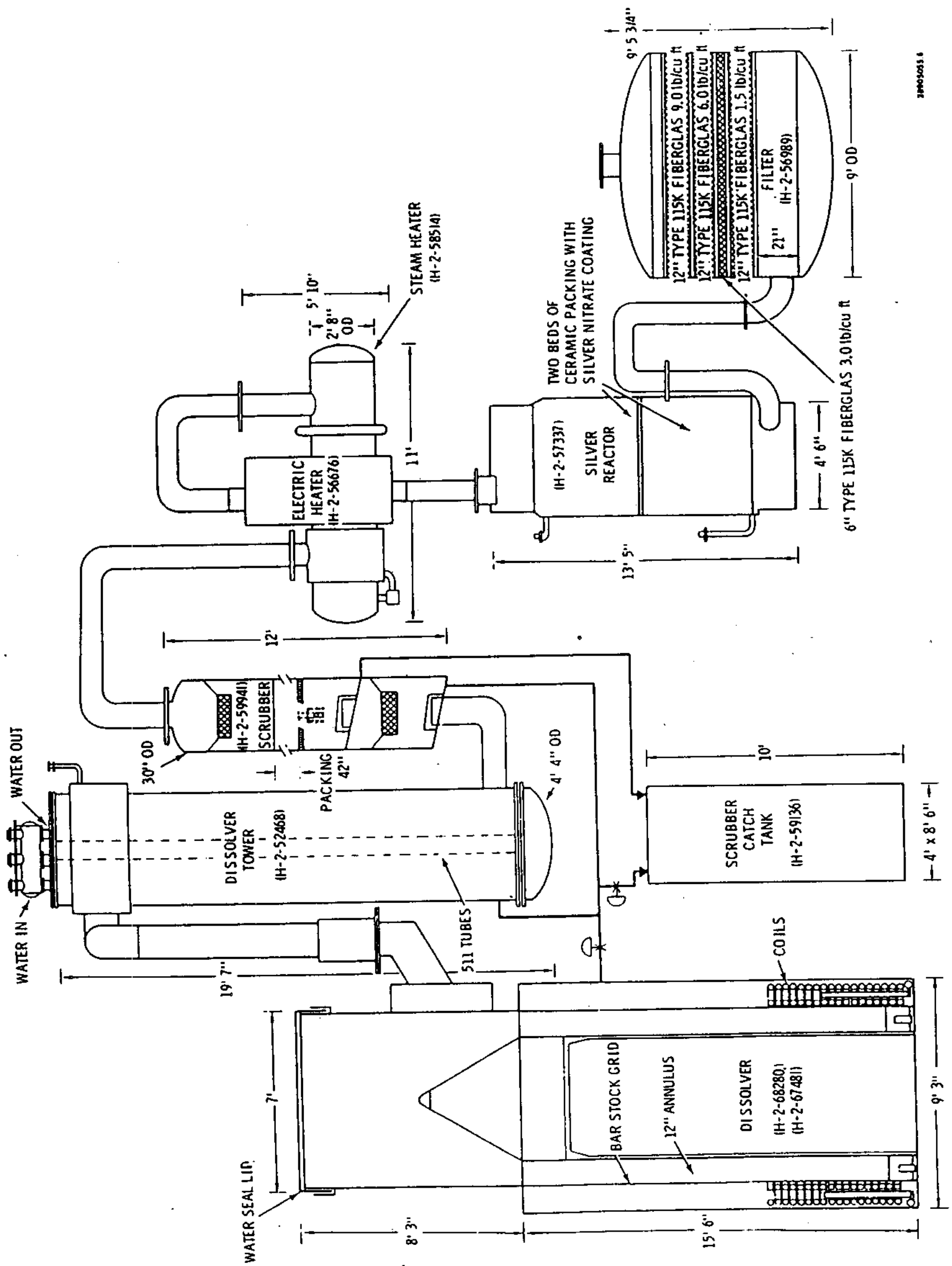


Figure 3-21. Dissolver Cell Equipment.



Modified A3 Tower. The dissolver tower was a vertical, counter-current condenser that served two main functions. First, during fuel decladding, i.e., the dissolver tower acted as an ammonia absorber as the condensing water vapor in the offgas absorbed some of the ammonia and cooled the offgas to a temperature favorable for ammonia absorption downstream in the ammonia scrubber. Second, during fuel dissolution, the tower acted as a nitric acid absorber via the same condensation-absorption mechanism, with the condensing water vapor absorbing some of the oxides of nitrogen.

The tower itself was a cylindrical vessel, 4.33 ft in diameter and about 19 ft 7 in. long. The shell and the lower dished head were 0.25-in.-thick stainless steel; the top head was a flat stainless steel plate 1.5-in.-thick. Around the shell, about 9 ft from the bottom, was a single corrugation expansion joint.

The offgas entered near the top of the tower via a 16-in. pipe attached to a distributor ring, 6.5 ft in diameter and 20 in. wide, on the outside of the tower.

The tower and the ammonia scrubber (described below) were fastened to dunnage constructed out of 8-in. carbon steel I beams. The tower sat inside the dunnage, which measured approximately 5.5 ft by 5.5 ft by 22 ft tall. The scrubber was fastened to the outside of the dunnage assembly. This dunnage may have been removed and placed in the tunnel with the tower.

Scrubber. The ammonia scrubber was installed downstream of the dissolver tower to remove ammonia from the offgas not removed by absorption. The ammonia-bearing solution was then collected in a catch tank and transferred with a steam jet to the ammonia scrubber waste concentrator feed tank.

The ammonia scrubber was about 30 in. in diameter and 12 ft tall. The top of the scrubber was a dished head, and the bottom was a flat plate at a 10 degree angle with the horizontal. The entire shell was constructed of stainless steel. The dissolver offgas entered the scrubber via a 10-in. line through the bottom plate and exited via a 10-in. flanged pipe on the top. As the offgas entered the scrubber, it impinged against an 8-in. baffle plate. It was then funneled through a 17-in.-diameter, 6-in. thick de-entrainment pad, made of 5-mil Tophet M wire with a density of 10 to 12 lb/ft^3. Directly above the pad, was a 0.5-in. spray head was used to rinse the pad.

From the de-entrainment pad the offgas was sent through a chimney-baffle arrangement and into the packed section of the scrubber. The packed section of the scrubber was about 42 in. long and consisted of 18 ft^3 of 1-in. diameter stainless steel Pall rings. The packing was supported by a metal grid covered with 0.75-in. mesh stainless steel wire cloth. Directly above the packing was a distributor plate that distributed the scrub water over the top of the packing. The plate consisted of 41 weir pipes, each about 2.5 in. diameter and 3.5 in. tall and fastened to a 0.25-in stainless steel plate in 3 concentric circles. Above the distributor plate, the offgas was funneled through a 17-in. diameter, 4-in.-thick deentrainment pad made of 5-mil tantalum wire with a mesh density of 12 to 19 lb/ft^3.

Lid. The 85-in.-diameter dissolver lid was water sealed and capable of holding about 8 in. of water vacuum. Figure 3-21 shows the lid.

Vapor Line. Vapors generated during dissolver operations exited to the downdraft condenser described above through a 16-in.-diameter offgas line that extended from the upper side of the dissolver. The vapor line associated with the dissolver is indicated in Figure 3-21.

3.2.3.7 Position 7: Disposed December 12, 1971 on Nine Foot Shortened Car B58. A3 Dissolver. The A3 annular tank dissolver stored in position 7 was removed from service in 1971 as a result of a leak in the coil. This leak was attributed to the high levels of fluoride experienced during dissolution of thoria fuels in 1970.

The PUREX Plant used three parallel vessels for the dissolution of irradiated reactor fuel. The original three dissolvers were pot-type vessels. Because of the design geometry, this type of dissolver could only be used for dissolving natural uranium. Starting in 1965, the pot dissolvers were replaced by annular dissolvers. Since that time the dissolvers have evolved through four designs. The discussion below assumes the subject dissolver was similar to the design described in the *PUREX Technical Manual*, dated 1989. The typical dissolver and the associated dissolver offgas equipment was shown previously in Figure 3-21.

The A3 dissolver, which consisted basically of two annuli separated by a slotted wall, was about 285 in. tall by 111 in. in OD at the bottom. All surfaces that came into contact with process vapors or liquids were made of stainless steel. The 11-in.-wide inner annulus in the bottom section of the dissolver was formed between a central, cylindrical, cadmium-jacketed concrete neutron moderator and a slotted wall made of vertical stainless steel walls. Fuel elements were dumped onto a stainless steel distributor cone that surmounted the concrete moderator and were distributed around the inner annulus. A raised grid of bars on the bottom of the inner (fuel) annulus supported the weight of the dumped fuel elements to protect the air and steam sparger from the weight of the fuel.

The fuel annulus was surrounded by a 14-in.-wide solution annulus containing heating and cooling coils made up of 915 ft of 2-in. Schedule-80 pipe, a sparge ring, and several dip tubes for solution transfers and instrumentation. The jet for transferring the dissolved metal solution was attached to an external nozzle on a suction leg in the solution annulus. The position of the jet was below the normal liquid level in the dissolver, because the dissolver jet could not overcome the hydraulic head of the liquid if the jet had been installed on top of the dissolver.

3.2.3.8 Position 8: Disposed August 29, 1972 on Car 19808. A1W1 Fuel Ends (in steel liner box). **New Production Reactor (NPR or N Reactor) Fuel Handling Equipment used with Suspected Canisters.** Irradiated fuel elements were delivered from the reactor storage basins to the 202-A building in shielded railroad cars. The cars entered the east end of the building through a railroad tunnel where canisters containing the fuel elements were remotely removed from fuel casks and emptied into the dissolvers with an overhead crane. Several types of equipment were used for transporting and unloading the spent fuel, and it is not clear which of these types are referred to here. A discussion of the fuel casks and canister handling baskets follows.

The fuel casks are large, heavily shielded containers used to transport canisters between the reactor basins and PUREX. The NPR cask is shown in Figure 3-22. The sides and bottom of the cask were constructed of 10-in.-thick lead, clad on the inside with 0.5-in.-thick stainless steel and on the outside with 0.75-in. carbon steel. Penetrations in the side of the cask allowed cooling water circulation around the fuel. The cask lid was 10-in.-thick lead clad with 0.5-in. carbon steel. The lid was held in place with locking cogs operated with an impact wrench. The overall dimensions of the cask were about 57 in. by 78 in. by 128 in. tall. The lid weighed about 8,250 lb and the cask 94,450 lb for a total weight of around 103,700 lb. The cask cavity, which was divided into four sections by a stainless steel insert containing 1% boron for neutron absorption, will hold 4 tall or 12 short canisters (described below).

Special baskets, called N-Fuel canister carriers, were used when using an NPR Basin cask and short canisters to transport fuel. The use of the baskets decreased the dissolver charging time by allowing the crane operator to remove three canisters at a time, instead of having to grapple for each individual canister. A basket, rectangular in shape, was about 14 in. by 20 in. by 83 in. tall and was constructed of 0.188-in. carbon steel. The bottom of the basket was perforated with 1-in. holes to allow water circulation. A basket held three short canisters and an NPR Basin cask held four baskets.

Suspected Canisters. The N Reactor fuel was stored and transported in six different types of canisters (Figure 3-23), of which there were two main types--short and tall. Both types consisted of two nominally 8-in. diameter tubes, each flared at the top, connected together side-by-side at three points by short cylindrical bars, one at the top and two at the bottom of the canister. The top bar served as the lifting trunnion and the lower bars as tipping trunnions. The bottom of the canister was perforated with 1-in. holes to allow water circulation around the fuel elements, and was covered with a screen.

The short canisters were made of 0.09-in.-thick aluminum and were 28 in. in length. The bottom of each tube was constructed of 0.375-in.-thick aluminum. There were two types of short canisters; one type had a round flare on the top of each tube, while the other had an octagonal flare. The round type was used for handling 0.95 fuel and the octagonal flare type is used for "spike" fuel. The capacity of a short canister was 14 fuel elements (about 700 lb of uranium), or one tier of 7 fuel elements, positioned vertically, per tube.

The tall canisters were made of 16-gauge, 300-series stainless steel and were 71 in. long. The bottom of each tube was constructed of 0.25-in.-thick stainless steel. Each tube had a round flare on top. The tall canisters were used for handling "spike" fuel and had a capacity of 42 fuel elements (about 1,500 lb of uranium), or 3 tiers of 7 fuel elements per tier.

Figure 3-22. NPR Basin Fuel Cask.

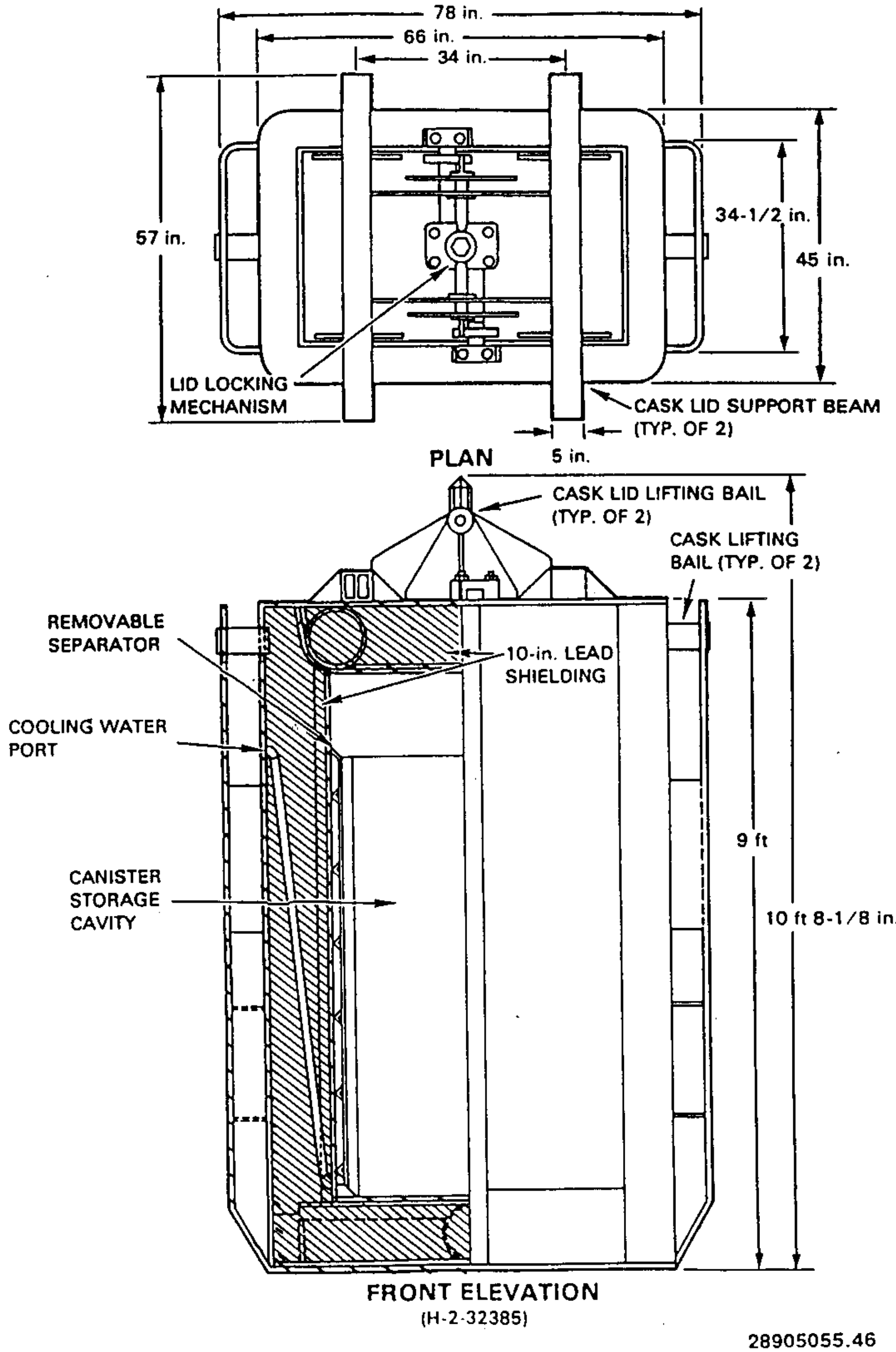
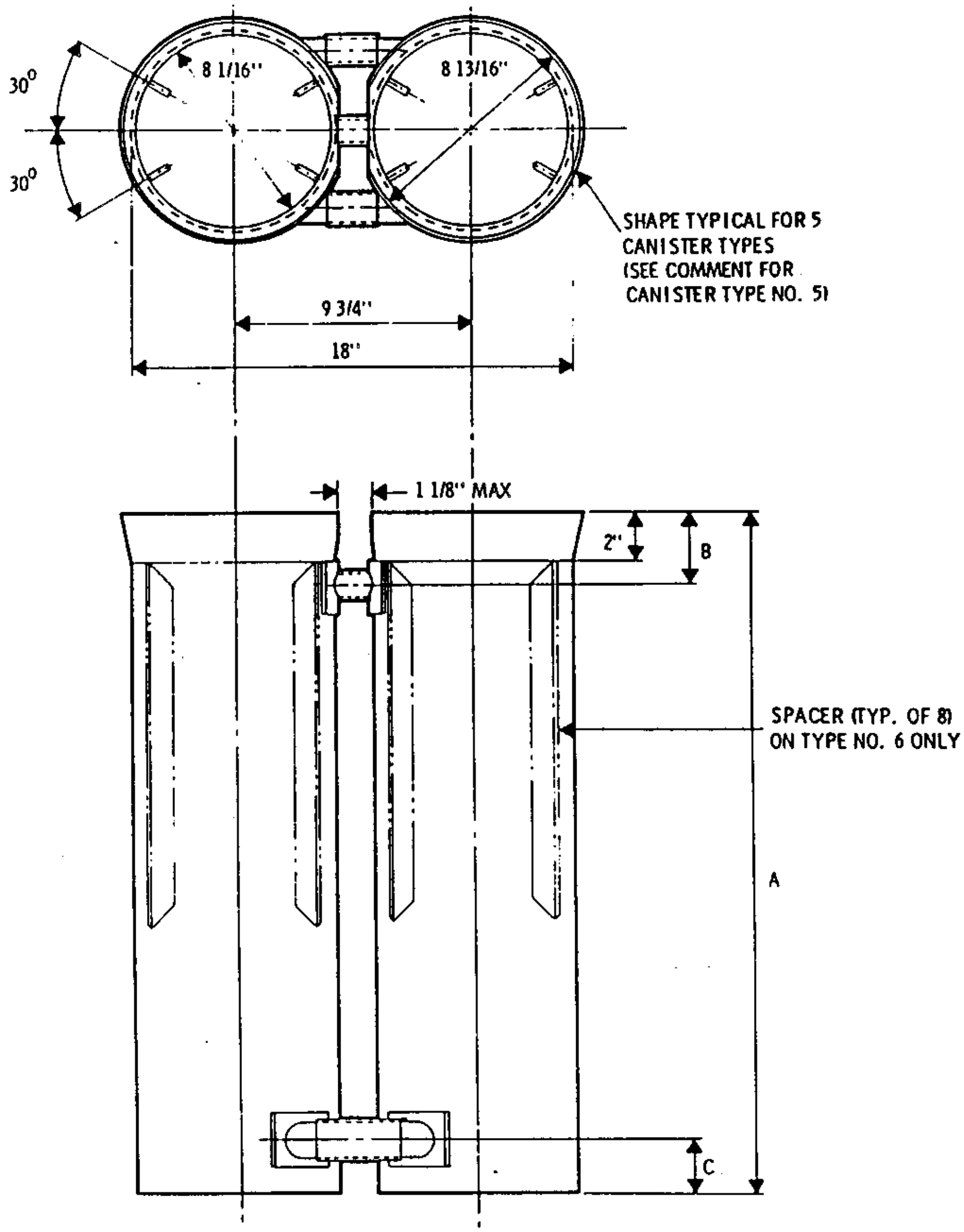


Figure 3-23. Fuel Element Canisters.



TYPE NO.	CANISTER MATERIAL	DIMENSIONS INCHES A	B	C	COMMENTS	DRAWING NUMBER
1	SST, ANY 300 SERIES, 16 ga	79	7.13	7.0	FEW IN EXISTENCE	H-1-37916
2	SST, ANY 300 SERIES, 16 ga	71	3.13	7.0	STD FOR SPIKE	H-1-37916
3	SST, ANY 300 SERIES, 16 ga	28	2.87	2.25		H-1-42594 SHT.'S 1,2
4	Al ALLOY 5086, 0.090 in.	28	2.87	2.25	MAJOR K BASIN LOAD	H-1-36935, SHT. 1
5	Al ALLOY 5086, 0.090 in.	28	2.87	2.25	OCTAGONAL TOP	H-1-36935, SHT.'S 1,2
					FOR SPIKE FUEL	
6	Al ALLOY 6061-T6, 0.090 in.	28.25	2.87	2.25	SALVAGED CO-	H-1-37916
					PRODUCT CANISTERS	

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3.2.3.9 Position 9: Disposed September 30, 1972 on Car 19811. C3 Dissolver. This annular tank dissolver was installed in Cell "C" where it was modified and, subsequently, failed on January 10, 1972. It is essentially the same as the A3 dissolver discussed previously in Section 3.2.3.7.

3.2.3.10 Position 10: Disposed August 30, 1983 on Car CDX-1. E-H4 [3-WB] Concentrator Reboiler. This reboiler was installed in position in June 1970 and was removed from service after it failed on August 23, 1983. The flat bottomed design of this reboiler was developed for improved criticality prevention during the thorium run.

Aqueous waste streams from the Final Uranium Cycle, Final Plutonium Cycles, Final Neptunium Cycles, and condensate from the Acid Recovery System are concentrated for recycle in Vessel E-H4-1.

Figure 3-24 shows the E-H4 concentrator. Liquid feed solution entered the E-H4-1 concentrator through the removable stripping tower, which contained six trays, each holding 88 bubble-caps for organic stripping and vapor deentrainment. Above the top tray, a tantalum wire mesh pad was mounted for deentrainment of the vapors as they passed to the condenser mounted on top of the tower.

The tower, which had a seal pot attached for pressure relief, was made of 304-L stainless steel, and was 102 in. in diameter and about 11.5 ft high. The tower was bolted with an 18-in. flange to the top of the concentrator central section. Except for the bottom, which was flat for criticality prevention, the central section was the same as described previously for E-F6.

The two reboilers were each 54 in. in diameter and had flat bottoms. The reboilers extended down slightly below the bottom of the central draft tube and discharge section of the concentrator. Each reboiler contained a steam chest with 687 tubes 1.25 in. in diameter by 10 ft long.

#61 Tube Bundle. The concentrator from which this tube bundle was removed in unknown. Tube bundles were discussed earlier in Section 3.2.3.1.

Prototype Cooling Coil

F-F1 Filter Tank. The vessel vent condensate tank, TK-F1, was constructed from a 10-ft length of 12-in. schedule-10 stainless steel pipe. This tank, which had a nominal 65-gal capacity, is shown in Figure 3-25. Condensate from the process vent condenser (E-F1) is routed to TK-F12 through TK-F1.

3.2.3.11 Position 11: Disposed January 18, 1986 on Car 3613. A3 Dissolver (Vessel #10). This annular dissolver was installed in A Cell in July 1981, where it failed on Thursday, March 17, 1985 at 7:00 p.m. This dissolver is essentially the same as the A3 dissolver described previously in Section 3.2.3.7.

Heater (Vessel #6). This offgas steam heater, E-A2, failed due to leaks in the tubes.

Figure 3-24. Backcycle Waste Concentrator E-H4-1 and Uranium Concentrator E-J8-1.

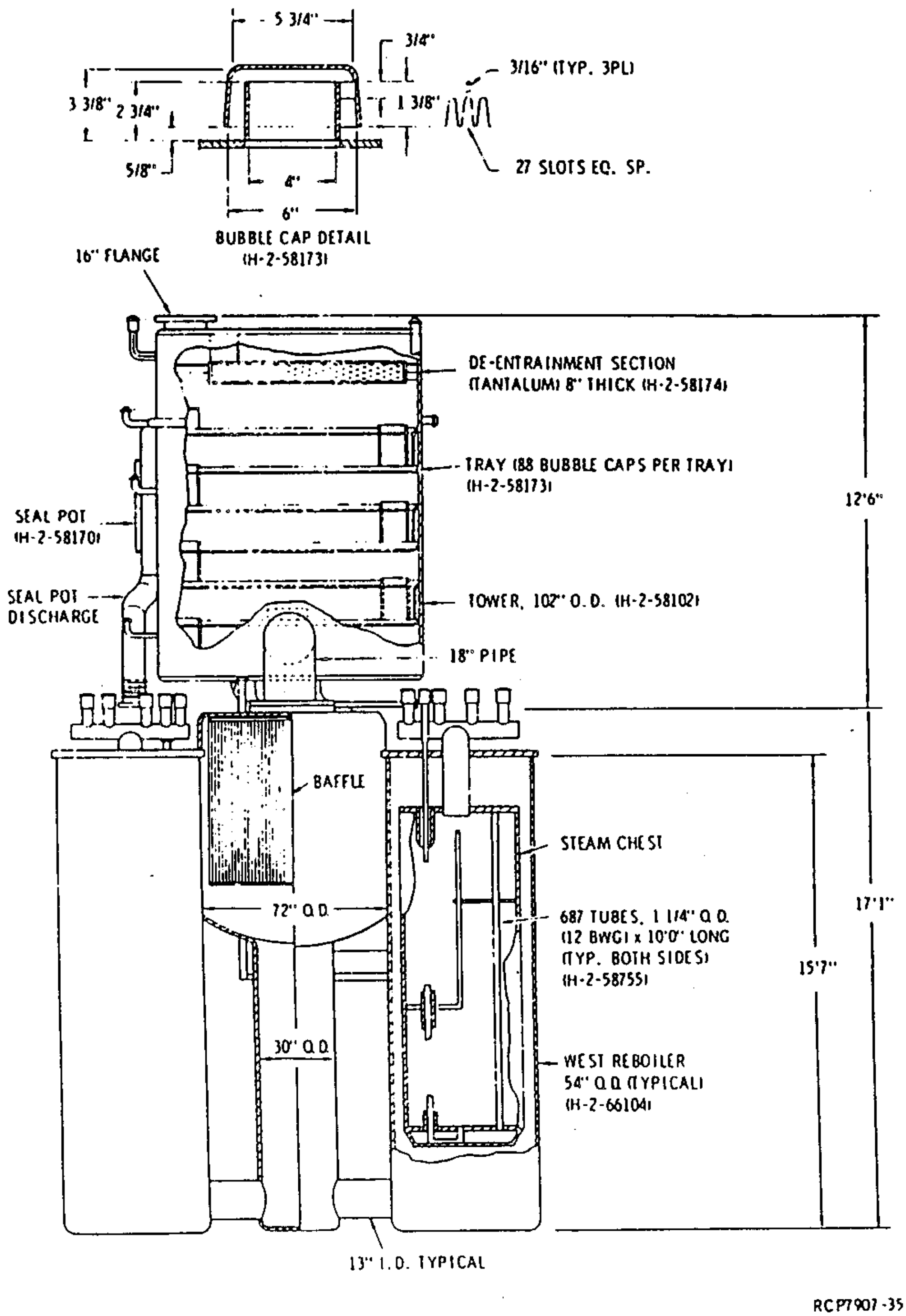
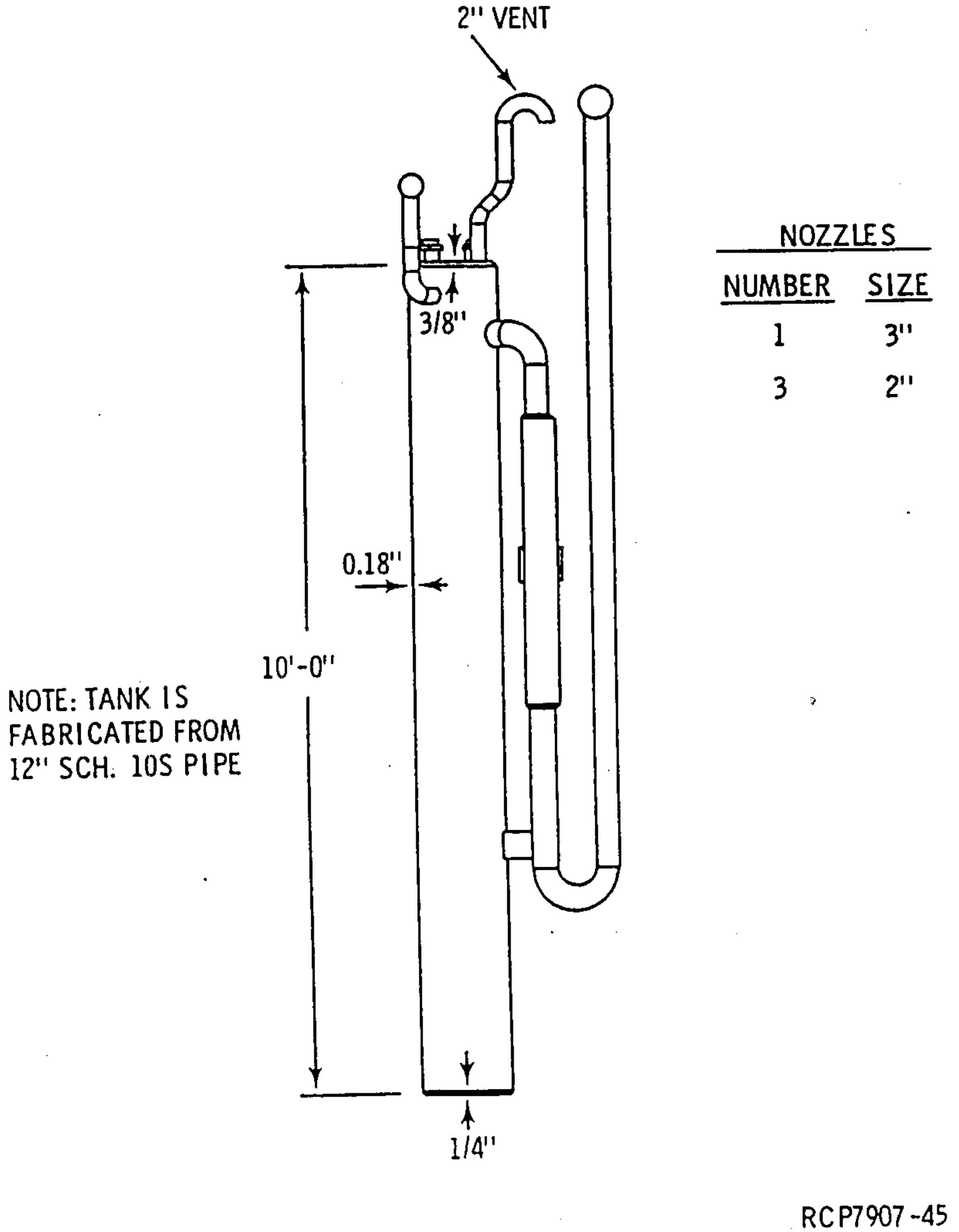


Figure 3-25. Vessel Vent Condensate Tank (TK-F1).



The dissolver offgas leaving the ammonia scrubber was heated to 380 °Fahrenheit (F) by a steam heater and an electric heater in series before entering the silver reactor for the removal of iodine from the gas stream. The steam heaters, such as E-A2, operated with 185 lb/in^2 (gage) steam, served as a preheater. The steam heater was a 2-ft, 8-in.-OD by 11-ft-long horizontal, finned tube, stainless steel, insulated heat exchange. The heater contained 171 steam-bearing tubes, 1-in. OD and 8-ft long. Each tube was finned to 2-in. OD over its central 6 ft with 20 longitudinal fins. The 0.25-in.-thick heater wall had an expansion joint near the gas inlet. The heater had 0.375-in.-thick dished heads and 10-in. flanged nozzles for gas inlet and outlet. A diagram of the steam heater can be found in Figure 3-21, Dissolver Cell Equipment.

3.2.3.12 Position 12: Disposed January 20, 1986 on Car 3611. White Box with 8 Tube Bundles, (57, 60, 62, 64, 67, 68, 74, and 76). The concentrators from which these tube bundles were removed in unknown. Tube bundles were discussed earlier in Section 3.2.3.1.

Pulser #5 (PG-J6). Pulsers were rugged mechanical pieces attached to the side of all but two of the solvent extraction columns at PUREX. Most of the pulse generators at PUREX, including PG-J8, were reciprocating piston mechanisms. Mechanical drive components reciprocated the piston at a fixed amplitude with variable frequency to suit process requirements. The pulse was transmitted to a column through a "pulse leg," or pipeline, filled with essentially stagnant liquid connecting the pulse generator to the bottom of the column.

The pulse generator was a piston reciprocated by a variable size electric motor acting through reduction gears and a conventional crank arrangement as shown in Figure 3-26. This particular pulser was one of the large pulsers designated a Number 2 pulser. The large pulsers had a cylinder bore of 21.2 in. and piston strokes of 1.375 in. or 2.75 in. The pulse generator consisted of three major sub-assemblies: the piston and cylinder, the motion box, and the power supply system.

Old Heater. This steam heater was installed in the E-A2 position in November of 1977. It failed on November 22, 1984. Steam heaters were discussed previously in Section 3.2.3.11.

Dissolver Lid. See discussion in Section 3.2.3.1.

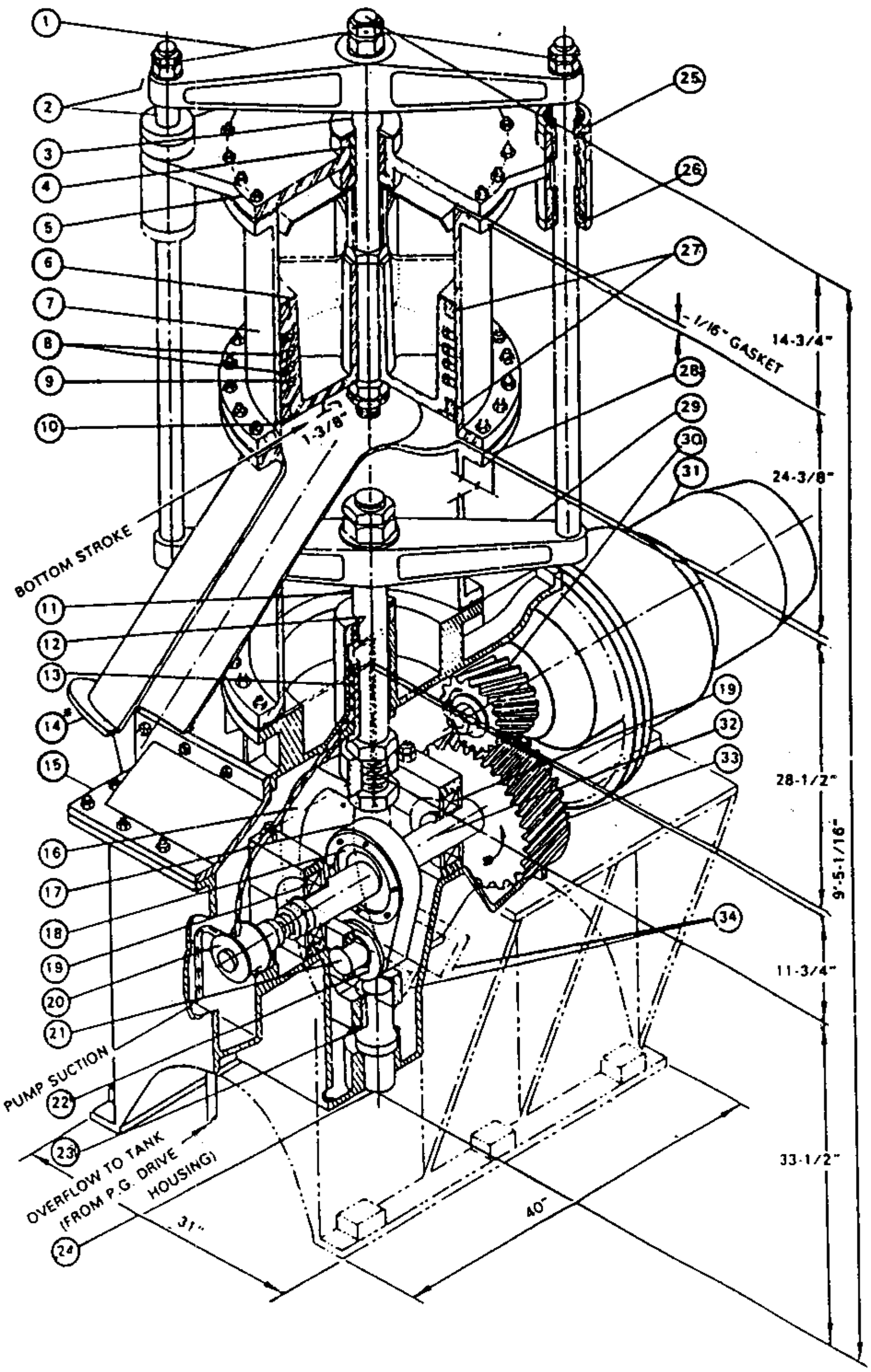
Nine 'Old Style' Dumping Trunnions

3.2.3.13 Position 13: Disposed January 21, 1986 on Car 19806. J5 Tank (Vessel #30). Tank J5, the 2A feed tank, was removed from service due to a coil that failed in 1983. This tank, which nominally held 370 gal, is shown in Figure 3-27.

F1 Condenser (Old Vessel #13). This condenser was installed in the E-F11-2 position on May 15, 1970.

Condensers of various sizes and configurations were used at PUREX in nearly all phases of the process. All of the condensers at PUREX were of a tube-and-shell design, and all surfaces that came into contact with process

Figure 3-26. Mechanical Pulse Generator.



1 UPPER HORIZONTAL PISTON YOKE
2 PISTON YOKE SPACER RODS
3 PISTON ROD
4 CYLINDER COVER VAPOR SEAL BUSH
5 CYLINDER COVER
6 PISTON
7 CYLINDER
8 PISTON RINGS
9 PISTON RING EXPANDERS
10 RIDER RING CLAMP RING
11 UPPER XHEAD YOKE ROD
12 UPPER XHEAD SHAFT SEAL
13 UPPER XHEAD SHAFT BUSHING
14 PULSE LEG TRANSITION PIPE
15 DRIVE HOUSING
16 XHEAD YOKE
17 CONECTING ROD
18 ECCENTRIC BRG.
19 CRANK SHAFT BKG. (INBD-OUTBD)
20 OIL PUMP
21 ECCENTRIC PIN
22 ECCENTRIC BUSHING
23 XHEAD YOKE GUIDE BUSHING
24 XHEAD YOKE GUIDE PIN
25 PISTON YOKE SPACER ROD GUIDE BUSHING
26 HOUSING SEAL
27 PISTON RIDER RINGS
28 CYLINDER SUPPORT
29 LOWER HORIZONTAL PISTON YOKE
30 DRIVE PINION
31 ELEC DRIVE MOTOR
32 CRANKSHAFT
33 DRIVE GEAR
34 XHEAD YOKE BARS

• (14) SHOWN ROTATED 45° (HORIZONTAL PLANE) CW FROM TRUE POSITION

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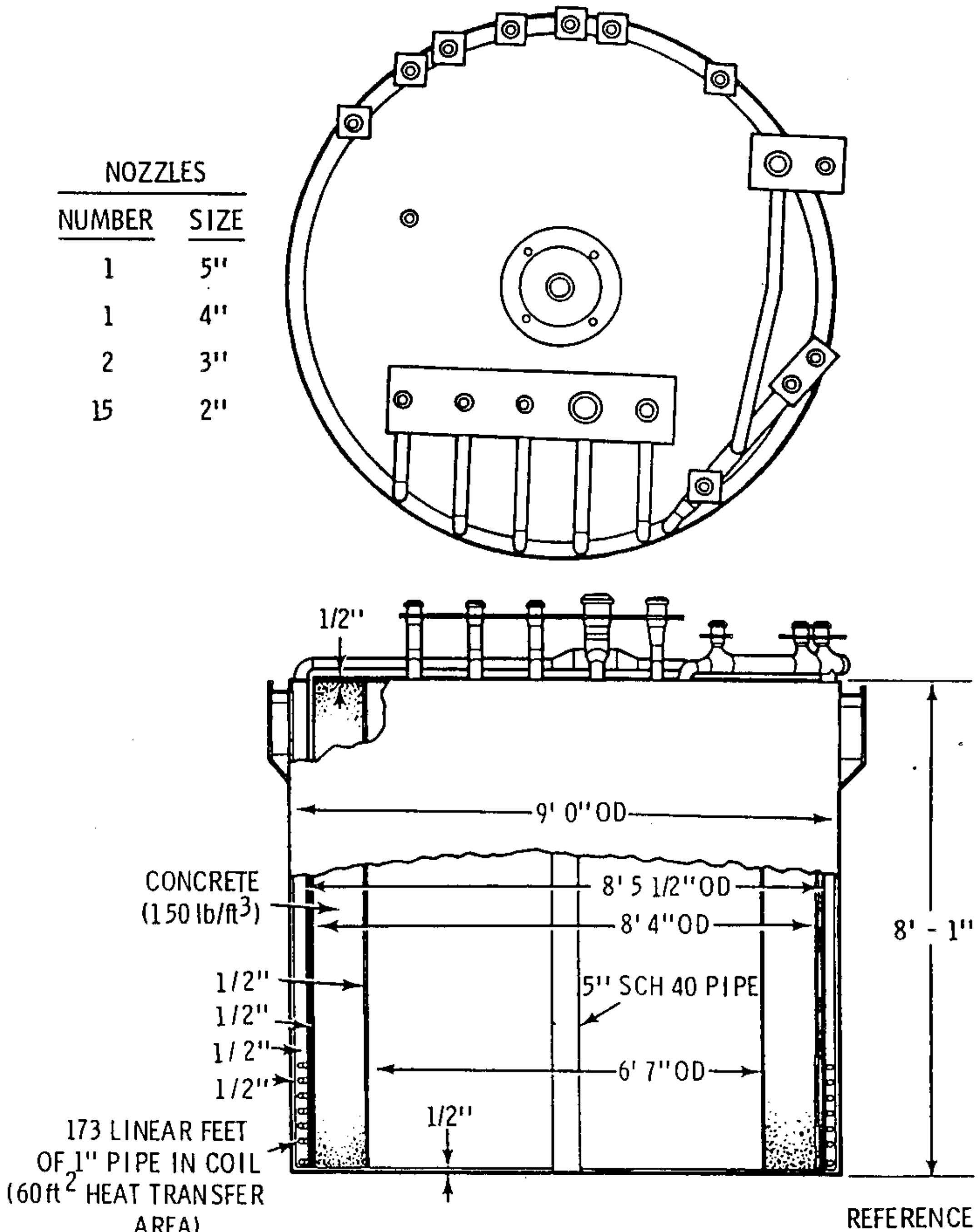
Figure 3-27. 2A Feed Tank (TK-J5).

NOZZLES	
NUMBER	SIZE
1	5"
1	4"
2	3"
15	2"



REFERENCE
DRAWINGS:
H-2-59968
H-2-59969
H-2-59970

28905055.231

fluids were made of 300-series stainless steel. Condenser E-F1 is shown in Figure 3-28.

Condenser E-F1 served to condense steam from the three process vent jets and some vapors from the process vent system. Jet steam and vapors from canyon cell the Vessel Vent System, the condenser vent system (from E-J8-2, E-K4-2, E-H4-2, E-L7-2 and E-L6), and condenser E-F5 entered E-F1 through an 8-in., 3-nozzle manifold in the side of the condenser. Noncondensible vapors and particulates not removed in E-F1 left the condenser through a 10-in. nozzle and were routed to the process vent steam heater, E-F2.

F12-B Cell Block

Old 4-Way Dumper

Dissolver Yoke. See discussion of the dissolvers in Section 3.2.3.7.

Dissolver Flange Plate. See discussion of the dissolvers in Section 3.2.3.7.

3.2.3.14 Position 14: Disposed November 18, 1987 on Car PX-10. L-1 Pulser. This #1 small pulser was installed in the L1 position in January 1955. It was removed from service on April 17, 1987 due to damaged piston rod, guide bars and yoke. The motor was removed prior to storage in Tunnel 2.

The larger (#2) pulsers were described earlier in Section 3.2.3.12. The smaller pulsers were scaled down models of the #2 pulsers and had a cylinder bore of 7.5 in. and a piston stroke of 1 in. (with the exception of the 2P pulse generator). A diagram of a mechanical pulse generator can be found in Figure 3-26.

Two Column Cartridges. All of the columns in the PUREX Plant, with exception of the 10 Column, were modified to permit the remote removal of the cartridge from the column. The column that these cartridges were removed from is not known.

The louver, nozzle, and sieve plates that made up the column cartridges were supported in a horizontal position by 0.313-in.- to 1-in.-diameter rods connected at the top and bottom of the cartridge to support "spiders." The plates were held apart by sections of 0.25-in. to 1-in. schedule-40 or -80 pipe slipped over the rods. The material of construction for the sieve plates could be either stainless steel of Fluorothene,[1] depending on the column.

Jumper Cutter. The jumper cutter was a 50-ton alligator shear and is pictured in Figure 3-29. The primary function of the jumper cutter was to cut up contaminated jumpers prior to scrapping them. Costly items, such as remote connectors, valves, and instruments could be severed from the bulky jumpers and reused. The jumper cutter was also used in the cells to sever tangled jumpers and other equipment.

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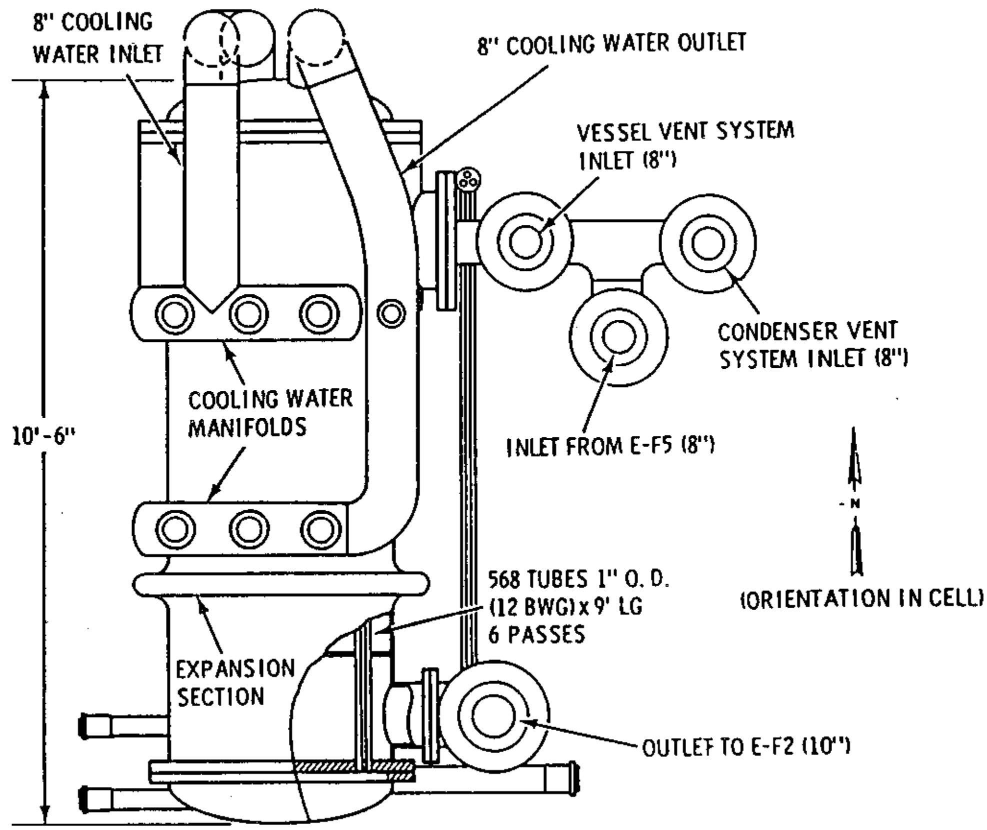
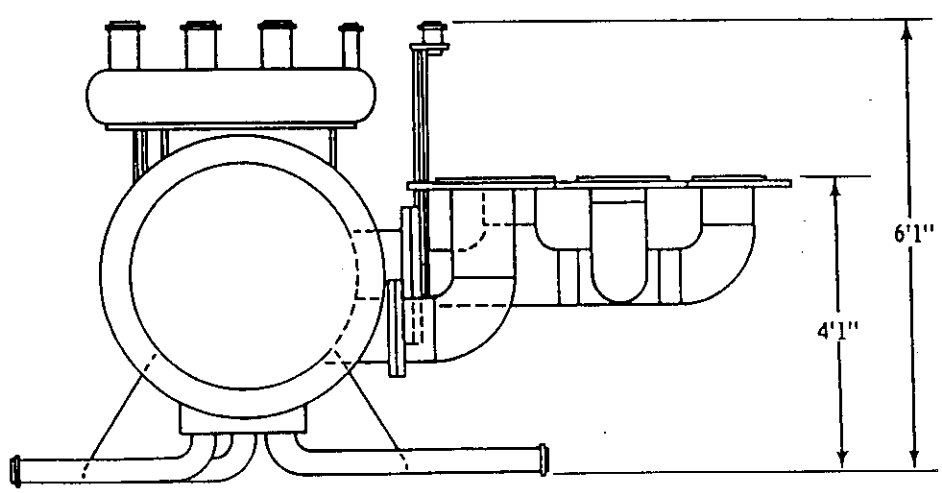
[1]Fluorothene is a trademark of the Union Carbide Corporation.

Figure 3-28. Condenser E-F1.



PLAN
(REF. H-2-52480, H-2-63152)



ELEVATION

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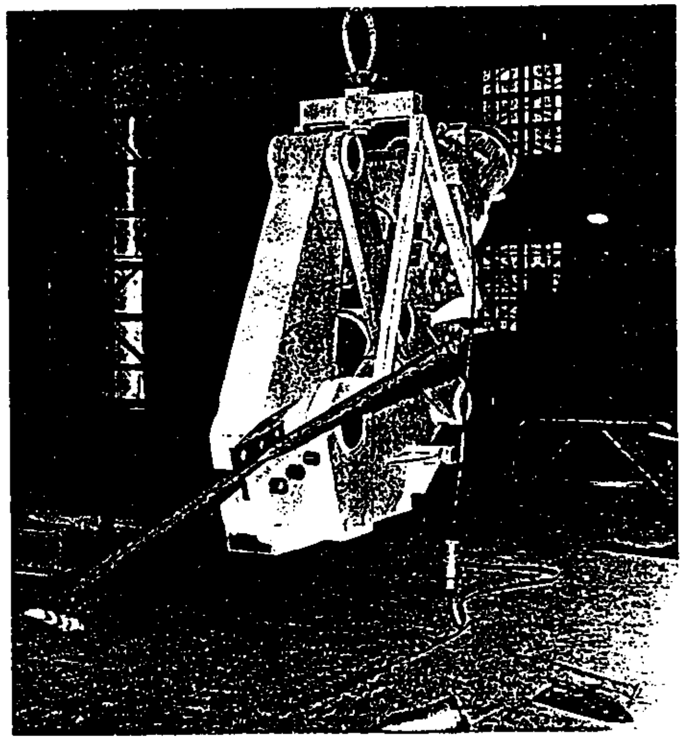
Figure 3-29. Jumper Cutter.



The jumper cutter was capable of cutting a 4-in. Schedule 40S pipe and a structural 4 in., 9.2 lb/ft tee simultaneously. The jaws, which opened to 12 in., were actuated by a four bar toggle linkage which was powered by a ball screw driven by a 7.5 horsepower electric motor. The knives were 14 in. long with edges serrated to retain victim material during cutting. The knives were fastened by 2-in. remote nuts.

Three Jumper Alignment Tools. Jumper alignment tools were discussed above in Section 3.1.2.1 and shown in Figure 3-6.

Nine Exterior Dumping Trunnions

Ten Pumps. The transfer of liquids in the PUREX Plant was accomplished through the use of pumps and jets. Twenty-four deep-well turbine-type pumps were used in the PUREX Canyon for handling radioactive process streams. Although the type (or types) of pumps located in position 14 is not known, it is assumed they are stored in Tunnel 2 because they were removed from canyon service.

An assembly drawing of a typical canyon pump is shown in Figure 3-30. Each pump was supported on the vessel nozzle flange with a mounting flange. A vertical torque tube extended downward from the flange and contained the pump stages as integral parts of the column assembly. The torque tube length was determined by the depth of the vessel from which the liquid was pumped, and the number of stages was established by the required head capacity characteristics of the pump.

Three Agitators. Section 3.2.3.1 discusses this section.

Four Tube Bundles. The concentrators from which these tube bundles were removed in unknown. Tube bundles were discussed earlier in Section 3.2.3.1.

Two Vent Jumpers. Jumpers are piping or electrical connectors used to connect process equipment to cell walls or to other pieces of equipment. Jumpers fail periodically due to problems such as broken or corroded head parts, shorted wiring, corroded or deformed piping, or failure of a diaphragm operated valve or flowmeter contained within the jumper. A typical jumper was shown previously in Figure 3-5.

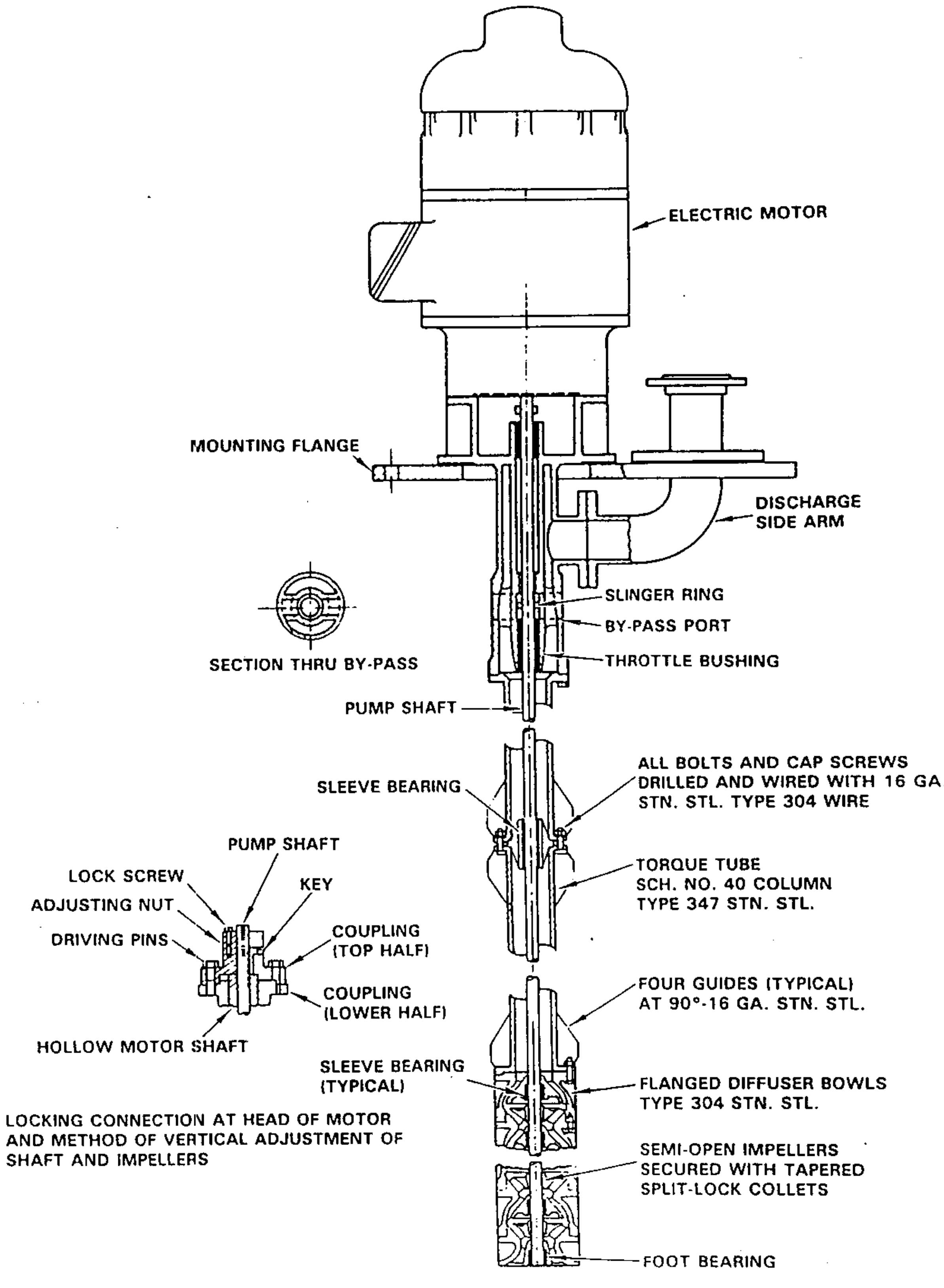
Seven Yokes

3.2.3.15 Position 15: Disposed May 13, 1988 on Car PX-9. Silver Reactor (5T-A2). This silver reactor was installed in February 1971 and was removed from service on November 21, 1987. See discussion in Section 3.2.3.5.

E-F2 Steam Heater. This heater was installed in the E-F2 position on November 23, 1984. It failed on December 17, 1986 and was removed on November 4, 1987.

Box of Cut-up Jumpers. Section 3.2.3.14 discusses this section.

Figure 3-30. Typical Canyon Pump.



S/R Cradle SK-GLR-11-2-87

3.2.3.16 Position 16, Disposed April 6, 1989 on Car PX-6. E-J8-1 Unitized Concentrator Vessel #1. This vessel was installed in the E-J8-1 position in January 1956. It failed on March 11, 1989 and was scrapped due to a corroded opening above the liquid level.

The uranium solution concentrator, E-J8-1, was identical, both in design and function, to the backcycle waste concentrator E-H4-1, which was described earlier in Section 3.2.3.10.

3.2.3.17 Position 17, Disposed August 5, 1989 on Car PX-19.

North Liner contains:

- 6 Pumps - See Section 3.2.3.14 for a discussion of the canyon pumps
- 1 Agitator - See discussion in Section 3.2.3.1
- 14 Tons Cut-Up Jumpers - See the description in Section 3.2.3.14.

South Liner contains:

- 1 Pump - See the discussion of canyon pumps in Section 3.2.3.14
- #15 Yoke
- 11.5 Tons Cut-Up Jumpers - See the description in Section 3.2.3.15.

4.0 PUREX FACILITY EQUIPMENT

4.1 PUREX PHYSICAL PLANT DESCRIPTION

The following discussion of the Plutonium-Uranium Extraction (PUREX) Physical Plant is provided so that the subsequent characterization of facility equipment can be correlated with locations and functions within the Plant.

4.1.1 202-A Building

Fuels reprocessing was conducted in the 202-A Building. Built of reinforced concrete, its approximate dimensions are: 306.3 meters (m) (1,005 feet [ft]) long, 36.3 m (119-ft) wide (at its maximum), and 30.5 m (100-ft) high, with approximately 12.2 m (40-ft) of this height below the grade elevation of 222.8 m (731-ft). It consists of three main structural components: (1) canyon, (2) galleries, and (3) service annex.

4.1.1.1 Canyon. The canyon is a thick-walled, heavily shielded concrete structure that houses the equipment used for radioactive processing. The canyon area proper is 306.3 m (1,005-ft) long, 9.3 m (30.5-ft) wide, and 31.7 (104-ft) high. A single row of 12 process cells is contained within the canyon. The functions of these 12 cells, as well as the equipment they contain, are described in Table 4-1. At the east end of the canyon is a basin where irradiated fuel would have been stored. A railroad tunnel, running north and south on the west side of the storage basin, brought casks containing fuel into the canyon.

The east crane maintenance platform (ECMP) is located in an extension that was added to the existing 202-A building in 1957. The extension is 71 ft 3 inches (in.) high, 36 ft wide, and 6 ft 6 in. deep, and is a reinforced concrete and steel-beamed structure. Three interior, 3-in.-thick, steel plate shielding doors separate the canyon from the ECMP. Below the 731 ft elevation, 10 in. of concrete of the original building separate the ECMP from the canyon. The roof is made up of coal-tar pitch, roofing felt, mineral-surfaced roofing, plastic roofing, cement, and roofing gravel. This addition served as the containment vessel when the canyon shielding doors were opened.

4.1.1.2 Gallery Levels. A 1.8-m- (6-ft-) thick concrete wall separates the cells from the galleries. The storage, sample, pipe and operations, and crane cab galleries parallel the north wall of the canyon and are located at different levels, one above the other. The wall above the cells is 1.2 m (4 ft). thick and forms a shielded cabway (Crane Cab Gallery) for the two 40-ton master gantry cranes. Located on rails above the master crane level is a 40-ton slave crane. Platforms for crane maintenance are located at the east and west ends of the crane cab level.

The Pipe and Operations Gallery, located below the Crane Cab Gallery, contains instrument transmitter racks, electrical motor controls, steam and cooling water supply lines, and the piping and associated valves used for transferring nonradioactive solutions. Since most of the valves were

Table 4-1. PUREX Canyon Cell Functions and Equipment.

Cell	Function	Equipment
A, B, C	Metal dissolution	Dissolvers, dissolver towers, scrubbers, heaters, silver reactors, process tanks, jets, filters
D	Metal solution storage	Metal solution storage tanks, metathesis solution storage, coating, waste receiver, pumps, jets, samples, agitators
E	Feed preparation and cladding waste treatment	Centrifuges, catch tank, coating waste tank, rework tank, feed makeup tank, recovered product tank, scrubber, pump, jets, agitators, samplers
F	Waste treatment and process ventilation	Nitric acid absorber, condensers, pumps, tanks, samplers, concentrators, jets, agitators
G	Solvent treatment system	Pulse column and generator, tanks, decanter, turbo-mixer, pumps, jet, agitators, samplers
H	First decontamination system	Tanks, concentrator, condenser, pumps, samplers, jets, pulse columns and pulse generators
J	Partition system/No recovery	Tanks, concentrator, condenser, pumps, samplers, jets, pulse columns and pulse generators
K	Uranium decontamination and concentration system	Pulse columns, tanks, pulse generators, concentrators, condensers, pumps, jets, agitators
L	Plutonium decontamination and concentration system	Pulse columns, tanks, pulse generators, concentrators, condensers, pumps, jets, agitators, stripper/condenser
M	Equipment decontamination and storage. Plutonium nitrate storage.	Tanks, pumps, hood, samplers

controlled from the control panels, only a few operations were required in the gallery. There are also several batch chemical addition tanks located on this level.

The next level down is the Sample Gallery, which contains the remote samplers used for obtaining process solution sampled from the cell equipment. A shielded pipe chase behind the remote sampler boxes contains headers for recovered nitric acid, organic solvent, sampler drains, and sampler lines to and from cell equipment.

The Storage Gallery area, the level beneath the Sample Gallery, was used primarily for storage of dry chemicals and spare equipment. A 5-ton-capacity elevator serves the Storage and Pipe and Operations Galleries, as well as the four floors of the aqueous makeup unit (AMU) area.

At the west end of the Storage Gallery is a separate area containing the deactivated neptunium purification and loadout facility (in Q Cell), the plutonium product handling and removal room, and the plutonium oxide production facility (in N Cell).

4.1.1.3 Service Annex. The Service Annex is adjacent to and north of the gallery section and consists of two separate areas. The larger, main area (the west annex), houses the maintenance shops, offices, lunchroom, locker room, radiation zone entry lobby, ventilation air and supply room, a switchgear room, compressor room, central control room, and the AMU facility. The smaller laboratory area (the west annex) contains the Analytical Laboratory, the Headend Control Room, and a switchgear room.

4.1.2 U and R Cells

External to building 202-A are the U and R cells, located adjacent to the north side of the structure. The U cell is located just east of the Hanford Control Room and contains recovered nitric acid storage tanks and laboratory waste tanks. The R cell is located at the northwest corner of 202-A Building and contains process equipment for cleanup of process solvent. The R Cell facility, also designated as the "cold" solvent building (276-A), houses equipment that was used to wash the organic waste stream from the Final Uranium Cycle and prepare it for reuse.

4.1.3 Auxiliary Facilities

A number of ancillary buildings that provided a variety of support services are located within the PUREX complex. These include the following:

- **203-A Tank Farm**--A pump house and concrete pad, enclosed and sectionalized with concrete dikes containing four 100,000-gallon tanks used for receipt, storage, and tank trailer loading of uranyl nitrate hexahydrate. A small uranyl nitrate hexahydrate concentration tank and a waste receiver tank are also included.

- **205-A Facility**--A transite (a composite of asbestos imbedded in a concretous matrix) building housing the (deactivated) silica gel beds (formerly used for uranium product treatment) and a concrete tank pad enclosed by a concrete dike. Contained within the building are storage tanks that were used to receive and store recovered nitric acid shipped from the Uranium-Trioxide Plant in the 200 West Area.

- **206-A Facility**--A concrete structure adjacent to U cell containing a vacuum fractionator and associated equipment that were used for concentrating PUREX and Uranium-Trioxide Plant recovered nitric acid.

- **211-A Facility**--A steel and transite pump house and associated tank farm for receipt, storage, and transfer of bulk process chemicals. The process water demineralizer units are also located in the pump house.

- **2714-A Building**--A steel warehouse for receipt, storage, and transfer of process chemicals that were received in less than bulk quantities.

- **212-A Building**--A steel building for load-in and load-out of liquid wastes (inactive).

- **213-A Building**--A steel building now used for temporary storage of contaminated dry waste.

- **218-E-14 and -15 Tunnels**--Two earth-covered tunnels extending southward from the east end of building 202-A for storage of large, contaminated equipment on rail cars.

- **291-A Facilities**--The canyon exhaust air filtration and discharge facilities. These facilities include two below-grade concrete filter cells and an unused, third filter cell, four parallel exhaust fans, and a 200-ft-high concrete stack.

- **292-A Building**--A wood structure adjacent to the east side of the 200-ft stack, housing stack monitoring, sampling, and flush equipment.

- **293-A Building**--A two level concrete structure containing absorption towers used to remove oxides of nitrogen and residual radioiodine from dissolver offgas.

- **294-A Facility**--A small steel building above grade and three filter cells below grade. It is located north of building 293-A and provided secondary filtration of dissolver gas.

4.2 DESCRIPTION OF EQUIPMENT FOR POTENTIAL REMOVAL AND WASTE PROCESSING DURING DECONTAMINATION AND DECOMMISSIONING

The PUREX Plant contains many process vessels, chemical storage tanks and other types of equipment that are candidates for removal and decontamination. Information about size, weight, material of construction, internal equipment and contents/contamination is important to estimating the potential extent of decontamination and decommissioning (D&D) work. The sections below contain descriptions of process vessels, chemical tanks, gloveboxes, pumps, and piping located at PUREX.

Table 4-2 lists PUREX process vessels for which an inventory estimate has been prepared for the end of deactivation. Since completing operations, most of the PUREX vessels have been flushed one or more times. The number of flushes is listed in Table 4-2. A goal for deactivating the plant is to achieve a pH between 2 and 12 in all vessels.

The composition data in Table 4-2 are derived from an estimate prepared to show inventory at the end of deactivation (Washenfelder, 1993). The deactivation estimate is based on flowsheet data and the number of flushes of each vessel following process operations. One flush was assumed to reduce the concentration by a factor of 100, two flushes by a factor of 1,000, etc. The deactivation estimate will likely be superseded by data from the current effort to sample most of the PUREX process vessels. Amounts of materials shown in Table 4-2 are based on estimated current volumes, as shown. The activities of radionuclides shown in the table are based on 180-day-old fuel, and so do not reflect the deactivation status. For D&D, these figures would have to be decayed to reflect the actual age of the fuel (5 to 10 or more years). The composition data shows the types of chemicals and isotopes that were present during processing, with an upper limit on radioactivity. The dissolvers also contain zirconium hulls, covered with water. Contents for some vessels are not shown. In many of these cases, the vessels have either been bypassed or were not included in the PUREX Flowsheet figures. Table 4-2 identifies the total number of process vessels, which is 143. The information in Table 4-2 was used as the basis for estimating waste classifications for this report.

Table 4-3 lists all PUREX Equipment except for piping, gloveboxes, and the railroad storage tunnels. The list is organized by location, beginning with the canyon cells and including the Pipe and Operating Gallery, Sample Gallery, 203-A Tank Farm, 211-A Chemical Tank Farm, 293-A Building, and AMU area. This table shows the current volume in many vessels, capacities, dimensions, key drawings and/or certified vendor information (CVI) file numbers, estimated volumes and weights, materials of construction, and estimated waste types.

The large number of items involved in this study precluded a survey of dimensions and weights for each piece of equipment based on inspection of individual as-built drawings. The as-built drawings represent the most up-to-date information, but would involve a fairly slow process of review and reproduction. For this study, approximately 5 percent (%) of dimension and weight data were obtained from drawings, and 37% from CVI files. The column

Table 4-2a. Physical Description of PUREX Process Vessels (4 sheets)

Vessel	Function					Diameter					
	gm/mol	Volume	Sample	Number	Capacity	or Width	Length	Height	Drawing	Volume	Volume
		(gal)	Number	of Flushes	(gal)	(ft)	(ft)	(ft)	Number	(ft3)	(m3)
	PUREX Estimated Inventory at Deactivation										
	Processing 180 day cooled Mark IA Fuel (12% Pu-240)										
CA-N10	second stage calciner	-			-						
CA-N9	first stage calciner	-			-						
E-F11-1	ASW concentrator	15		1	2,500	14.5	7.8	29.6	H-2-58100	3.32E+03	9.41E+01
E-F6-1	1WW concentrator	113		2	2,200	14.5	7.8	36.5	H-2-58100	4.10E+03	1.16E+02
E-H4-1	3WB concentrator	113		2	2,700	15	8.5	29.6	H-2-68104	3.77E+03	1.07E+02
E-J8-1	1CU concentrator	113		0	3,700	14	-	28	H-2-52478	4.31E+03	1.22E+02
E-K4-1	2EU concentrator	9		1	3,700	14	-	28	H-2-52478	4.31E+03	1.22E+02
E-L7-1	product concentrator	0		1	10	0.3	2.5	25.7	H-2-63616	1.60E+01	4.54E-01
E-N13	filtrate concentrator	0		1	7.1						
E-Q2	stripper concentrator				10	0.5	4.2	27.6	H-2-59506	5.74E+01	1.63E+00
E-Q8	vent jet condenser				12						
F-N8	vacuum drum filter	0		0	0.3						
G-E2	coating waste centrifuge	12.2		2	180	5	-	3.2		6.28E+01	1.78E+00
G-E4	coating waste centrifuge	12.2		2	125	4.6	-	3.2		5.32E+01	1.51E+00
T-A2	silver reactor (250 lb AgNO3)					4.5	-	13.5	H-2-57337	2.15E+02	6.08E+00
T-A3-1	dissolver tower					4.3	-	19.6	H-2-52468	2.89E+02	8.18E+00
T-A3-3	ammonia scrubber					2.5	-	12	H-2-59941	5.89E+01	1.67E+00
T-B2	silver reactor (250 lb AgNO3)					4.5	-	13.5	H-2-57337	2.15E+02	6.08E+00
T-B3-1	dissolver tower					4.3	-	19.6	H-2-52468	2.89E+02	8.18E+00
T-B3-3	ammonia scrubber					2.5	-	12	H-2-59941	5.89E+01	1.67E+00
T-C2	silver reactor (250 lb AgNO3)					4.5	-	13.5	H-2-57337	2.15E+02	6.08E+00
T-C3-1	dissolver tower					4.3	-	19.6	H-2-52468	2.89E+02	8.18E+00
T-C3-3	ammonia scrubber					2.5	-	12	H-2-59941	5.89E+01	1.67E+00
T-F6	acid absorber	299		0	300						
T-G2	1O column	5	P 1052	2	2,000	2.8	-	35	H-2-52489	2.27E+02	6.43E+00
T-H2	HA column	4		1	1,850	2.2	-	40.9	H-2-58367	1.51E+02	4.27E+00
T-H3	HS column (bypassed)				1,770	3.2	-	26.8	H-2-57486	2.11E+02	5.97E+00
T-J22	2N column	0		1	150	0.6	-	33.6	H-2-59355	8.98E+00	2.54E-01
T-J23	2P column	0		1	100	0.6	-	22.1	H-2-59357	5.91E+00	1.67E-01
T-J4	1BS column	1		1	130	1.9	-	16.1	H-2-58934	4.53E+01	1.28E+00
T-J6	1BX column	5		1	1,600	3	-	32.9	H-2-62609	2.33E+02	6.59E+00
T-J7	1C column	5		1	1,770	4	-	27	H-2-58966	3.39E+02	9.61E+00
T-K2	2D column	2		1	1,370	2.7	-	33.9	H-2-56837	1.95E+02	5.53E+00
T-K3	2E column	5		1	1,770	4	-	27	H-2-52501	3.39E+02	9.61E+00
T-L1	2A column	0		1	130	0.6	-	37.2	H-2-52507	1.14E+01	3.23E-01
T-L2	2B column	0		1	90	0.6	-	26.8	H-2-62624	8.21E+00	2.33E-01
T-L4	3A column	0		1	40	0.3	-	37.3	H-2-63609	3.26E+00	9.22E-02
T-L6	3B column	0		1	30	0.3	-	26.4	H-2-63612	2.30E+00	6.53E-02
T-L8	product stripper	0		1	10						

Table 4-2a. Physical Description of PUREX Process Vessels. (4 sheets)

Vessel	Function gm/mol	Volume (gal)	Sample Number	Number of Flushes	Capacity (gal)	Diameter or Width (ft)	Length (ft)	Height (ft)	Drawing Number	Volume (ft3)	Volume (m3)
T-Q2	NP stripper column					0.6	6	12.6	H-2-59507	3.15E+01	8.92E-01
T-Q4	3X resin column				16						
T-R2	2O column	1		2	2,000	2.9	-	35.5	H-2-52494	2.31E+02	6.53E+00
T-U6	fractionator	1,750		0	1,750						
T-U6	fractionator				1,750						
T-XA	acid absorber	0		0	460						
T-XB	acid absorber	0		0	260						
TK-A3	dissolver- (Zr heels)	1,830		3	5,000	9.3	-	23.9	H-2-68280	1.60E+03	4.52E+01
TK-A3-4	NH3 scrub waste	17		1	2,100	3.8	8.8	10	H-2-59136	3.28E+02	9.29E+00
TK-B3	dissolver- (Zr heels)	1,398		3	5,000	9.3	-	23.9	H-2-67481	1.60E+03	4.52E+01
TK-B3-4	NH3 scrub waste	17		1	2,100	3.8	8.8	10	H-2-59937	3.28E+02	9.29E+00
TK-C3	dissolver- (Zr heels)	1,226		3	5,000	9.3	-	23.9	H-2-68280	1.60E+03	4.52E+01
TK-C3-4	NH3 scrub waste	17		1	2,100	3.8	8.8	10	H-2-59136	3.28E+02	9.29E+00
TK-D1	metathesis storage	11		1	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-D2	decladding waste	22		2	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-D3/D4	metal solution	148		2	15,400	25.3	10.5	9.2	H-2-59668	2.44E+03	6.90E+01
TK-D6	metal solution-recycle, no FP	44		0	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-E1	centrifuge product	11		1	1,700	7	-	6.8	H-2-52522/CVI 8024	2.60E+02	7.36E+00
TK-E3	centrifuge feed	45		1	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-E3-2	NH3 scrub waste	6.3		1	250	3.2	-	6.2	H-2-63810	4.86E+01	1.38E+00
TK-E5	coating waste	297		1	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-E6	metal solution-recycle, no FP	21		0	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-F1	vessel vent condensate				65	1	-	10	-	7.85E+00	2.22E-01
TK-F10	3WF decanter	45		2	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-F12	E-F11 feed	46		4	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-F13	rework storage				5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-F14	decanter (not useable)				400	4	-	5.8	H-2-52528	7.33E+01	2.08E+00
TK-F15	1WW denitration/ZAW	2		2	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-F16	1WW denitration/NZAW	57		2	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-F17	tube bundle flush				1,200	4.2	-	11.8	H-2-58647	1.63E+02	4.62E+00
TK-F18	utility (sump) waste	56		0	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-F26	1WW receiver	16		2	3,600	6.8	10.5	9.9	H-2-59976	7.07E+02	2.00E+01
TK-F3	acid receiver	46		1	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-F4	vessel vent condensate				5,000						0.00E+00
TK-F7	1WF	15		2	3,800	6.8	10.5	9.9	H-2-59976	7.07E+02	2.00E+01
TK-F8	waste rework				5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-G1	1OF Solvent Washer	43	P 1051	2	5,000	10	-	9.3	H-2-52456	7.26E+02	2.06E+01
TK-G2	1OS	22		2	1,900	7	-	6.8	H-2-52522/CVI 8024	2.60E+02	7.36E+00
TK-G5	1OO - organic	55		0	15,000	16	10.5	14	H-2-52524	2.35E+03	6.66E+01
TK-G6	1OD decanter				450	4	-	5.8	H-2-52528	7.33E+01	2.08E+00
TK-G7	1OO pump tank				15,000	16	10.5	14	H-2-52524	2.35E+03	6.66E+01

Table 4-2a. Physical Description of PUREX Process Vessels. (4 sheets)

Vessel	Function gm/mol	Volume (gal)	Sample Number	Number of Flushes	Capacity (gal)	Diameter or Width (ft)	Length (ft)	Height (ft)	Drawing Number	Volume (ft3)	Volume (m3)
TK-G8	10W	434		0	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-H1	HAF	45		1	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-J1	3WB	45		2	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-J2	miscellaneous storage				1,340	4.2	-	14	H-2-59354	1.91E+02	5.41E+00
TK-J21	2NF	1		1	320	4.6	-	14.2	H-2-64600	2.34E+02	6.62E+00
TK-J3	1BXF	19	P 1054	2	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-J5	2AF	1		1	370	8	-	6.1	H-2-59968	5.14E+02	1.46E+01
TK-K1	2DF	45	P 1055	1	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-K5	2UC receiver				5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-K6	UNH product	122	P 1056	1	5,000	10	-	9.3	H-2-52521/CVI 8024	7.26E+02	2.06E+01
TK-L10	alternate PCP sampler				14	0.5	15.2	1.7	H-2-52475	1.26E+01	3.58E-01
TK-L11	Pu recycle	0		0	25	0.3	3.2	11.7	H-2-61890	1.23E+01	3.49E-01
TK-L13-10	Pu loadout				2.4	0.5	-	2.5	H-2-63116	4.12E-01	1.17E-02
TK-L3	3AF	11	P 1057	1	120	2.7	-	11.9	H-2-63608	6.99E+01	1.98E+00
TK-L8	product receiver	0		1	10	0.3	2.5	8	H-2-63621	6.67E+00	1.89E-01
TK-L8	product receiver				10						
TK-L9	Pu product sampler	0.05		1	11	0.4	4.4	3.2	H-2-64698	5.83E+00	1.65E-01
TK-M1	equipment decon.				4,100	7	-	14	H-2-52511	5.39E+02	1.53E+01
TK-M2	equipment decon.				1,800	5	-	12.5	H-2-52512	2.46E+02	6.96E+00
TK-M3	Pu nitrate sol'n storage	1		1	55	0.5	3.5	14	-	2.45E+01	6.94E-01
TK-M4	Pu nitrate sol'n storage	1		1	55	0.5	3.5	14	-	2.45E+01	6.94E-01
TK-M5	Pu nitrate sol'n storage	1		1	55	0.5	3.5	14	-	2.45E+01	6.94E-01
TK-M6	Pu nitrate sol'n storage	1		1	55	0.5	3.5	14	-	2.45E+01	6.94E-01
TK-N3	Pu nitrate feed	0		1	3	0.5	-	3.1	-	6.00E-01	1.70E-02
TK-N4	H2O2 feed tank	1		0	1	0.3	-	1.8	-	1.54E-01	4.36E-03
TK-N6	prereduction tank	0		1	8	0.5	-	2.9	-	5.62E-01	1.59E-02
TK-N8	pump tank	0		1	4	0.5	-	3.3	-	6.38E-01	1.81E-02
TK-N7	precipitator	0		1	0.8	0.5	-	-	-	-	
TK-N11	filtrate receiver	0		1	6.3	0.5	-	5.2	-	1.02E+00	2.90E-02
TK-N12	vent seal pot				0.5	-	-	1	-	-	
TK-N13	filtrate concentrator					0.5	1.2	11.8	-	6.89E+00	1.95E-01
TK-N15	filtrate holding tank	0		1	26	0.5	2.8	6.3	-	8.59E+00	2.43E-01
TK-N16	filtrate holding tank	0		1	26	0.5	2.8	6.3	-	8.59E+00	2.43E-01
TK-N19	offgas scrubber tank	0		0	2.6	0.5	-	7.5	-	1.47E+00	4.17E-02
TK-N20	liquid seal tank				2.4	0.5	-	1.6	-	3.19E-01	9.03E-03
TK-N21	condensate receiver tank	0		1	24	0.5	2.8	6.8	-	9.28E+00	2.63E-01
TK-N22	condensate receiver tank	0		1	24	0.5	2.8	6.8	-	9.28E+00	2.63E-01
TK-N24	seal liquid separator					0.5	-	1.6	-	3.19E-01	9.03E-03
TK-N30	vacuum tank				6	0.5	-	-	-	-	
TK-N33	closed lp cooling exp tk				2.1	0.5	-	-	H-2-65550	-	
TK-N34	H2O2 holding tank				66	-	-	3.2	-	-	
TK-N36	Oxalic Acid Feed Tank	16		0	161	3	-	-	-	-	

Table 4-2a. Physical Description of PUREX Process Vessels. (4 sheets)

Vessel	Function	Volume	Sample	Number	Capacity	Diameter or Width	Length	Height	Drawing	Volume	Volume
	gm/mol	(gal)	Number	of Flushes	(gal)	(ft)	(ft)	(ft)	Number	(ft3)	(m3)
TK-N36	Oxalic Acid Feed Tank	16		0	161	3	-	-	-	-	
TK-N38	1.2 M nitric acid head tank				13	1	-	4	-	3.14E+00	8.90E-02
TK-N39	vacuum drop-out			-	12.25	0.5	-	9.3	-	1.82E+00	5.14E-02
TK-N40	vacuum drop-out				12.25	0.5	-	9.3	-	1.82E+00	5.14E-02
TK-N43	vacuum drop-out				3.3						
TK-P1	UNH product	100	1 gm/l U	0	100,000	25	-	30	H-2-54805	1.47E+04	4.17E+02
TK-P2	UNH product/now recovered	100	P 1059	HNO3	100,000	25	-	30	H-2-54805	1.47E+04	4.17E+02
TK-P3	UNH product	100	P 1050	0	100,000	25	-	30	H-2-54805	1.47E+04	4.17E+02
TK-P4	UNH product	100	300 gm/l U	0	100,000	25	-	30	H-2-54805	1.47E+04	4.17E+02
TK-P5	waste pump tank	4,000	H20		4,000	9	-	9	-	5.73E+02	1.62E+01
TK-P6	steam rework tank	50	300 gm/l U	0	14,000	10	18	14	H-2-58430	2.24E+03	6.34E+01
TK-P13	recovered acid receiver	50		0	8,000	10	-	14	H-2-54895	1.10E+03	3.11E+01
TK-P14	recovered acid receiver	50	10 gm/l U	0	8,000	10	-	14	H-2-54895	1.10E+03	3.11E+01
TK-P15	recovered acid receiver	50		0	15,000	10.5	18	14	H-2-52524	2.35E+03	6.66E+01
TK-Q1	2PN concentrator feed				12	0.8	-	6	H-2-59509	1.78E+00	5.04E-02
TK-Q11	cooling water pump tank				315	3	-	6	H-2-59566	4.24E+01	1.20E+00
TK-Q13	chemical addition				9	0.5	-	6.3	H-2-59726	1.23E+00	3.49E-02
TK-Q3	3X feed				110	4	-	5.5	H-2-59511	7.06E+01	2.00E+00
TK-Q5	3XW waste				500	4	-	7	H-2-59512	8.80E+01	2.49E+00
TK-Q6	3XN receiver				25	1.5	-	2	H-2-59513	3.53E+00	1.00E-01
TK-Q7	Np product loadout				1.5	0.6	-	1	H-2-59514	2.42E-01	6.84E-03
TK-Q8	sump tank				46	2	-	2.2	H-2-59516	6.81E+00	1.93E-01
TK-R1	20F Solvent Washer	40	P 1058	2	5,000	10	-	9.3	H-2-52623	7.26E+02	2.06E+01
TK-R2	20X	5		2	1,800	7	-	6.8	H-2-52622	2.60E+02	7.36E+00
TK-R5	utility				8,000	10	-	14	H-2-54171	1.10E+03	3.11E+01
TK-R6	utility decanter				430	4	-	5.8	H-2-52528	7.33E+01	2.08E+00
TK-R7	20O - organic	0		0	8,000	10	-	14	H-2-54172	1.10E+03	3.11E+01
TK-R8	20W Batch Waste	1,673		0	5,100	10	-	9.3	H-2-54172	7.26E+02	2.06E+01
TK-U1	60% HNO3 storage	56		0	15,000	10.5	18	14	H-2-52524	2.35E+03	6.66E+01
TK-U2	60% HNO3 storage	67		0	15,000	10.5	18	14	H-2-52524	2.35E+03	6.66E+01
TK-U3	U Cell Sump Waste	5,368		0	8,000	10	-	14	BPF 8690	1.10E+03	3.11E+01
TK-U4	U Cell Sump Waste	2,374		0	8,000	10	-	14	BPF 8690	1.10E+03	3.11E+01
TK-U5	fractionator feed	0		0	8,000	10	-	14	CVI 10170	1.10E+03	3.11E+01
TK-XC	acid receiver	45		1	5,000	10	-	9.3	H-2-57003	7.26E+02	2.06E+01
TK-XD	acid receiver	45		1	2,300	8	-	8	H-2-57004	4.02E+02	1.14E+01
		Number			143				Total	1.37E+05	3.87E+03

Table 4-2b. Estimated Radionuclide in PUREX Process Vessels. (4 sheets)

Vessel	Function	U	Pu	Np	Zr	Sn	RuRh-106	I-129	Zr-Nb	Actinides	FP	Activ. Pr.
	gm/mol	238.03	244.06	237.05	91.22							
		kg	kg	kg	kg	kg	Ci	Ci	Ci	Ci	Ci	Ci
	PUREX Estimated Inventory at Deactivation											
	Processing 180 day cooled Mark IA Fuel (12% Pu-240)											
CA-N10	second stage calciner											
CA-N9	first stage calciner											
E-F11-1	ASW concentrator	0	0	0	0	0	3.07E-04	0	0	0	0	0
E-F6-1	1WW concentrator	1.37E-05	1.88E-07	5.13E-06	0	0	0	0	0	4.23E+00	4.66E+01	0
E-H4-1	3WB concentrator	5.95E-03	2.99E-06	0	0	0	0	0	0	0	5.13E-03	0
E-J8-1	1CU concentrator	2.13E+02	3.21E-05	0	0	0	0	0	0	0	1.45E-01	0
E-K4-1	2EU concentrator	1.73E-01	1.74E-09	3.41E-09	0	0	0	0	0	0	1.23E-06	0
E-L7-1	product concentrator	0	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
E-N13	filtrate concentrator	0	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
E-Q2	stripper concentrator	Bypassed										
E-Q9	vent jet condenser											
F-N8	vacuum drum filter	0	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
G-E2	coating waste centrifuge	5.18E-05	7.18E-08	0	1.77E-03	trace	0	0	0	3.86E-04	4.32E-03	6.50E-02
G-E4	coating waste centrifuge	5.18E-05	7.18E-08	0	1.77E-03	trace	0	0	0	3.86E-04	4.32E-03	6.50E-02
T-A2	silver reactor (250 lb AgNO3)											
T-A3-1	dissolver tower											
T-A3-3	ammonia scrubber											
T-B2	silver reactor (250 lb AgNO3)											
T-B3-1	dissolver tower											
T-B3-3	ammonia scrubber											
T-C2	silver reactor (250 lb AgNO3)											
T-C3-1	dissolver tower											
T-C3-3	ammonia scrubber											
T-F5	acid absorber	0	0	0	0	0	0	0	0	0	0	0
T-G2	1O column	1.20E+00	5.68E-10	0	0	0	1.65E-02	0	3.50E-07	6.38E-04	1.75E-01	0
T-H2	HA column	6.53E-03	1.29E-05	7.87E-08	0	0	0	0	0	4.86E-02	5.44E-01	0
T-H3	HS column (bypassed)											
T-J22	2N column	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
T-J23	2P column	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
T-J4	1BS column	2.26E-04	1.15E-05	0	0	0	0	0	0	0	4.92E-04	0
T-J6	1BX column	8.37E-03	1.51E-05	3.03E-08	0	0	0	0	0	0	7.00E-04	0
T-J7	1C column	5.05E-03	8.52E-10	0	0	0	0	0	0	0	4.35E-06	0
T-K2	2D column	4.52E-03	6.74E-10	0	0	0	0	0	0	0	3.18E-06	0
T-K3	2E column	6.40E-03	0	0	0	0	0	0	0	0	4.73E-08	0
T-L1	2A column	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
T-L2	2B column	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
T-L4	3A column	0	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
T-L5	3B column	0	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
T-L6	product stripper	0	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
T-Q2	NP stripper column											
T-Q4	3X resin column	Bypassed										
T-R2	2O column	0	5.68E-08	0	0	0	7.57E-07	0	3.03E-07	0	0	0

Table 4-2b. Estimated Radionuclide in PUREX Process Vessels. (4 sheets)

Vessel	Function	U	Pu	Np	Zr	Sn	RuRh-106	I-129	Zr-Nb	Actinides	FP	Activ. Pr.
	gm/mol	238.03	244.06	237.05	91.22							
		kg	kg	kg	kg	kg	Ci	Ci	Ci	Ci	Ci	Ci
T-U6	fractionator	0	0	0	0	0	0	0	0	0	0	0
T-U6	fractionator											
T-XA	acid absorber	0	0	0	0	0	0	0	0	0	0	0
T-XB	acid absorber	0	0	0	0	0	0	0	0	0	0	0
TK-A3	dissolver- (Zr heels)	3.02E-01	6.34E-04	0	2.55E-02	1.06E+01	1.05E+00	8.34E-07	0	2.25E+00	2.52E+01	9.36E-01
TK-A3-4	NH3 scrub waste	0	0	0	0	0	6.44E-04	0	0	0	0	0
TK-B3	dissolver- (Zr heels)	2.30E-01	4.84E-04	0	1.94E-02	1.06E+01	8.02E-01	6.36E-07	0	1.72E+00	1.92E+01	7.14E-01
TK-B3-4	NH3 scrub waste	0	0	0	0	0	6.44E-04	0	0	0	0	0
TK-C3	dissolver- (Zr heels)	2.02E-01	4.25E-04	0	1.71E-02	1.06E+01	7.04E-01	5.59E-07	0	1.51E+00	1.69E+01	6.27E-01
TK-C3-4	NH3 scrub waste	0	0	0	0	0	6.44E-04	0	0	0	0	0
TK-D1	metathesis storage	0	0	0	0	0	0	0	0	0	0	0
TK-D2	decladding waste	1.14E-04	1.67E-07	0	3.27E-03	1.13E-01	0	0	0	8.50E-04	9.52E-03	1.20E-01
TK-D3/D4	metal solution	2.71E-01	5.71E-04	0	0	0	0	0	0	2.02E+00	2.28E+01	0
TK-D5	metal solution-recycle, no	8.06E+01	1.70E-01	0	0	0	0	0	0	6.00E+02	0	0
TK-E1	centrifuge product	9.12E-03	1.88E-05	0	0	0	0	0	0	6.79E-02	7.60E-01	0
TK-E3	centrifuge feed	1.91E-03	2.65E-06	0	6.53E-02	trace	0	0	0	1.42E-02	1.59E-01	2.40E+00
TK-E3-2	NH3 scrub waste	0	0	0	0	0	0	0	0	0	0	0
TK-E5	coating waste	4.95E-03	3.34E-06	0	3.28E-01	trace	0	0	0	3.68E-02	4.13E-01	1.21E+01
TK-E6	metal solution-recycle, no	3.82E+01	7.87E-02	0	0	0	0	0	0	2.84E+02	0	0
TK-F1	vessel vent condensate											
TK-F10	3WF decanter	3.41E-04	1.70E-07	0	0	0	0	0	0	0	2.90E-04	0
TK-F12	E-F11 feed	0	0	0	0	0	9.40E-07	0	0	0	0	0
TK-F13	rework storage											
TK-F14	decanter (not useable)											
TK-F15	1WW denitration/ZAW	2.26E-07	3.31E-09	9.58E-08	0	0	0	0	0	8.04E-02	8.88E-01	0
TK-F16	1WW denitration/NZAW	4.53E-06	6.69E-08	1.94E-06	0	0	0	0	0	1.64E+00	1.81E+01	0
TK-F17	tube bundle flush											
TK-F18	utility (sump) waste	4.45E-01	6.36E-04	0	0	0	0	0	0	0	0	0
TK-F26	1WW receiver	1.82E-06	2.50E-08	6.81E-07	0	0	0	0	0	5.61E-01	6.19E+00	0
TK-F3	acid receiver	0	0	0	0	0	0	0	0	0	0	0
TK-F4	vessel vent condensate											
TK-F7	1WF	6.81E-08	1.02E-09	3.12E-08	0	0	0	0	0	1.87E-02	2.07E-01	0
TK-F8	waste rework											
TK-G1	1OF Solvent Washer	2.47E-01	0	0	0	0	0	0	0	3.08E-01	8.61E-01	0
TK-G2	1OS	0	0	0	0	0	0	0	0	0	0	0
TK-G5	1OO - organic	0	6.25E-06	0	0	0	1.04E-02	0	3.85E-03	0	0	0
TK-G6	1OD decanter											
TK-G7	1OO pump tank											
TK-G8	1OW	1.81E-01	0	0	0	0	0	0	0	0	9.04E+01	0
TK-H1	HAF	4.99E-01	1.01E-03	0	0	0	0	0	0	3.71E+00	4.16E+01	0
TK-J1	3WB	1.99E-03	1.11E-06	0	0	0	0	0	0	0	1.70E-03	0
TK-J2	miscellaneous storage											
TK-J21	2NF	3.34E-04	1.89E-07	0	0	0	0	0	0	0	2.84E-04	0
TK-J3	1BXF	5.13E-02	0	0	0	0	0	0	0	7.70E-04	4.55E-02	0

Table 4-2b. Estimated Radionuclide in PUREX Process Vessels. (4 sheets)

Vessel	Function	U	Pu	Np	Zr	Sn	RuRh-106	I-129	Zr-Nb	Actinides	FP	Activ. Pr.
	gm/mol	238.03	244.06	237.05	91.22							
		kg	kg	kg	kg	kg	Ci	Ci	Ci	Ci	Ci	Ci
TK-J5	2AF	2.65E-07	1.82E-05	0	0	0	0	0	0	0	4.16E-04	0
TK-K1	2DF	5.93E-01	0	0	0	0	0	0	0	7.00E-04	3.42E-01	0
TK-K5	2UC receiver											
TK-K6	UNH product	1.24E+01	2.48E-06	4.62E-08	0	0	0	0	0	1.01E-02	1.55E-02	0
TK-L10	alternate PCP sampler											
TK-L11	Pu recycle	0	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
TK-L13-10	Pu loadout	Not in Service										
TK-L3	3AF	3.67E-02	2.05E-03	0	0	0	0	0	0	1.28E-02	1.41E-03	0
TK-L8	product receiver	0	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
TK-L8	product receiver											
TK-L9	Pu product sampler	0	6.34E-04	0	0	0	0	0	0	0	2.72E-09	0
TK-M1	equipment decon.											
TK-M2	equipment decon.											
TK-M3	Pu nitrate sol'n storage	0	1.32E-02	0	0	0	0	0	0	0	5.68E-08	0
TK-M4	Pu nitrate sol'n storage	0	1.32E-02	0	0	0	0	0	0	0	5.68E-08	0
TK-M5	Pu nitrate sol'n storage	0	1.32E-02	0	0	0	0	0	0	0	5.68E-08	0
TK-M6	Pu nitrate sol'n storage	0	1.32E-02	0	0	0	0	0	0	0	5.68E-08	0
TK-N3	Pu nitrate feed	0	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
TK-N4	H2O2 feed tank	0	0	0	0	0	0	0	0	0	0	0
TK-N5	prereduction tank	0	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
TK-N6	pump tank	0	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
TK-N7	precipitator	0	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
TK-N11	filtrate receiver	0	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
TK-N12	vent seal pot											
TK-N13	filtrate concentrator											
TK-N15	filtrate holding tank	0	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
TK-N16	filtrate holding tank	0	0.00E+00	0	0	0	0	0	0	0	0.00E+00	0
TK-N19	offgas scrubber tank	0	0	0	0	0	0	0	0	0	0	0
TK-N20	liquid seal tank											
TK-N21	condensate receiver tank	0	0	0	0	0	0	0	0	0	0	0
TK-N22	condensate receiver tank	0	0	0	0	0	0	0	0	0	0	0
TK-N24	seal liquid separator											
TK-N30	vacuum tank											
TK-N33	closed lp cooling exp tk											
TK-N34	H2O2 holding tank											
TK-N35	Oxalic Acid Feed Tank	0	0	0	0	0	0	0	0	0	0	0
TK-N36	Oxalic Acid Feed Tank	0	0	0	0	0	0	0	0	0	0	0
TK-N38	1.2 M nitric acid head tank											
TK-N39	vacuum drop-out											
TK-N40	vacuum drop-out											
TK-N43	vacuum drop-out											
TK-P1	UNH product	3.79E-01	1.93E-06	3.79E-06	0	0	0	0	0	0	1.36E-03	0
TK-P2	UNH product/now recovere	3.41E+00	3.41E-08	6.81E-08	0	0	1.36E-04	0	6.81E-05	3.06E-04	4.13E-03	0
TK-P3	UNH product	4.01E-04	1.04E-07	3.79E-06	0	0	0	0	0	1.15E-05	3.48E-03	0
TK-P4	UNH product	1.14E+02	1.93E-06	3.79E-06	0	0	0	0	0	0	1.36E-03	0

Table 4-2b. Estimated Radionuclide in PUREX Process Vessels. (4 sheets)

Vessel	Function	U	Pu	Np	Zr	Sn	RuRh-106	I-129	Zr-Nb	Actinides	FP	Activ. Pr.
	gm/mol	238.03	244.06	237.05	91.22							
		kg	kg	kg	kg	kg	Ci	Ci	Ci	Ci	Ci	Ci
TK-P5	waste pump tank											
TK-P6	steam rework tank	5.68E+01	9.65E-07	1.89E-06	0	0	0	0	0	0	6.81E-04	0
TK-P13	recovered acid receiver	1.70E+00	1.70E-08	3.41E-08	0	0	0	0	0	0	1.02E-04	0
TK-P14	recovered acid receiver	1.89E+00	1.70E-08	3.41E-08	0	0	0	0	0	0	1.02E-04	0
TK-P15	recovered acid receiver	1.70E+00	1.70E-08	3.41E-08	0	0	0	0	0	0	1.02E-04	0
TK-Q1	2PN concentrator feed	Bypassed										
TK-Q11	cooling water pump tank											
TK-Q13	chemical addition											
TK-Q3	3X feed	Bypassed										
TK-Q5	3XW waste	Bypassed										
TK-Q6	3XN receiver	Bypassed										
TK-Q7	Np product loadout	Bypassed										
TK-Q8	sump tank	Bypassed										
TK-R1	2OF Solvent Washer	1.34E-01	1.48E-04	0	0	0	0	0	0	4.83E-04	1.20E-02	0
TK-R2	2OX	0	0	0	0	0	0	0	0	0	0	0
TK-R5	utility											
TK-R6	utility decanter											
TK-R7	2OO - organic	0	0.00E+00	0	0	0	0.00E+00	0	0.00E+00	0	0	0
TK-R8	2OW Batch Waste	0	0	0	0	0	0	0	0	0	0	0
TK-U1	50% HNO3 storage	0	0	0	0	0	0	0	0	0	0	0
TK-U2	50% HNO3 storage	0	0	0	0	0	0	0	0	0	0	0
TK-U3	U Cell Sump Waste	7.72E-02	9.75E-05	0	0	0	0	0	0	0	0	0
TK-U4	U Cell Sump Waste	3.41E-02	4.31E-05	0	0	0	0	0	0	0	0	0
TK-U5	fractionator feed	0	0	0	0	0	0	0	0	0	0	0
TK-XC	acid receiver	0	0	0	0	0	0	0	0	0	0	0
TK-XD	acid receiver	0	0	0	0	0	0	0	0	0	0	0

Table 4-2c. Estimated Hazardous Constituents of PUREX Process Vessels. (3 sheets)

Vessel	Function	NH4F	NH4NO3	NH4OH	KOH	KF	HNO3	HF	NaF	NaNO3	NaNO2	NH3	NaOH	ANN	N2H4	NH3OH-NO3	TBP	NPH	H2O2	Oxalic Ac.
	gm/mol	37.04	80.05	35.05	56.1	58.1	63.02	20.01	42	85.01	69	17.03	40.01	375.14	32.05	96.04			34.02	90.04
		kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg
	PUREX Estimated Inventory at Deactivation																			
	Processing 180 day cooled Mark IA Fuel (12% Pu-240)																			
CA-N10	second stage calciner																			
CA-N9	first stage calciner																			
E-F11-1	ASW concentrator	0	0	6.97E-03	0	0	0	0	0	0	0	1.84E-04	0	0	0	0	0	0	0	0
E-F6-1	1WW concentrator	0	0	0	0	0	5.83E-02	5.14E-04	0	0	0	0	0	0	0	0	0	0	0	0
E-H4-1	3WB concentrator	0	0	0	0	0	2.18E-01	0	0	0	0	0	0	0	0	0	0	0	0	0
E-J6-1	1CU concentrator	0	0	0	0	0	2.10E+01	0	0	0	0	0	0	0	0	0	0	0	0	0
E-K4-1	2EU concentrator	0	0	0	0	0	2.15E-03	0	0	0	0	0	0	0	0	0	0	0	0	0
E-L7-1	product concentrator	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
E-N13	filtrate concentrator	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
E-O2	stripper concentrator																			
E-O9	vent jet condenser																			
F-NB	vacuum drum filter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G-E2	coating waste centrifuge	5.47E-04	2.22E-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G-E4	coating waste centrifuge	5.47E-04	2.22E-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-A2	silver reactor (250 lb AgNO3)																			
T-A3-1	dissolver tower																			
T-A3-3	ammonia scrubber																			
T-B2	silver reactor (250 lb AgNO3)																			
T-B3-1	dissolver tower																			
T-B3-3	ammonia scrubber																			
T-C2	silver reactor (250 lb AgNO3)																			
T-C3-1	dissolver tower																			
T-C3-3	ammonia scrubber																			
T-F5	acid absorber	0	0	0	0	0	3.00E+02	0	0	0	0	0	0	0	0	0	0	0	0	0
T-G2	1O column	0	0	0	0	0	1.19E-05	0	0	0	0	0	0	0	0	0	4.60E-03	1.08E-02	0	0
T-H2	HA column	0	0	0	0	0	1.12E-02	7.88E-06	0	0	0	0	0	0	0	0	0	0	0	0
T-H3	HS column (bypassed)																			
T-J22	2N column	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
T-J23	2P column	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
T-J4	1BS column	0	0	0	0	0	8.61E-03	0	0	0	0	0	0	0	0	0	0	0	0	0
T-J6	1BX column	0	0	0	0	0	2.27E-03	0	0	0	0	0	0	0	0	0	0	0	0	0
T-J7	1C column	0	0	0	0	0	3.22E-04	0	0	0	0	0	0	0	0	0	0	0	0	0
T-K2	2D column	0	0	0	0	0	9.84E-04	0	0	0	0	0	0	0	1.41E-08	6.47E-06	0	0	0	0
T-K3	2E column	0	0	0	0	0	8.96E-05	0	0	0	0	0	0	0	0	0	0	0	0	0
T-L1	2A column	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
T-L2	2B column	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
T-L4	3A column	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
T-L5	3B column	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
T-L6	product stripper	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
T-O2	NP stripper column																			
T-O4	3X resin column																			
T-R2	2O column	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.21E-01	2.16E+00	0	0
T-U6	fractionator	0	0	0	0	0	1.34E+03	0	0	0	0	0	0	0	0	0	0	0	0	0
T-U8	fractionator																			
T-XA	acid absorber	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
T-XB	acid absorber	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-A3	dissolver- (Zr heels)	7.94E-02	1.52E-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-A3-4	NH3 scrub waste	0	0	1.60E-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-B3	dissolver- (Zr heels)	6.05E-02	1.16E-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-B3-4	NH3 scrub waste	0	0	1.60E-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-C3	dissolver- (Zr heels)	5.32E-02	1.02E-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-C3-4	NH3 scrub waste	0	0	1.60E-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-D1	metathesis storage	0	0	0	9.97E-02	2.84E-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-D2	decladding waste	1.02E-03	4.00E-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-D3/D4	metal solution	0	trace	0	0	0	1.48E-02	3.36E-04	0	0	0	0	0	0	0	0	0	0	0	0
TK-D5	metal solution-recycle, n	0	trace	0	0	0	4.41E+00	1.00E-01	0	0	0	0	0	0	0	0	0	0	0	0
TK-E1	centrifuge product	0	0	0	0	0	7.24E-02	0	0	0	0	0	0	8.15E-02	0	0	0	0	0	0
TK-E3	centrifuge feed	2.02E-02	8.18E-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-E3-2	NH3 scrub waste	0	0	4.18E-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-F5	coating waste	0	0	0	0	0	0	0	1.04E+00	4.78E-02	1.09E-02	1.53E-01	3.98E-01	0	0	0	0	0	0	0

Table 4-2c. Estimated Hazardous Constituents of PUREX Process Vessels. (3 sheets)

Vessel	Function	NH4F	NH4NO3	NH4OH	KOH	KF	HNO3	HF	NaF	NaNO3	NaNO2	NH3	NaOH	ANN	N2H4	NH3OH-NO3	TBP	NPH	H2O2	Oxalid Ac.
	gm/mol	37.04	80.05	35.05	56.1	58.1	63.02	20.01	42	85.01	69	17.03	40.01	376.14	32.05	96.04			34.02	90.04
		kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg
TK-E6	metal solution-recycle, n	0	trace	0	0	0	2.05E+00	3.18E-02	0	0	0	0	0	0	0	0	0	0	0	0
TK-F1	vessel vent condensate																			
TK-F10	3WF decanter	0	0	0	0	0	1.26E-02	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-F12	E-F11 feed	0	0	2.14E-05	0	0	0	0	0	0	0	5.63E-07	0	0	0	0	0	0	0	0
TK-F13	rework storage																			
TK-F14	decanter (not useable)																			
TK-F15	1WW denitration/ZAW	0	0	0	0	0	3.91E-04	9.93E-06	0	0	0	0	0	0	0	0	0	0	0	0
TK-F16	1WW denitration/NZAW	0	0	0	0	0	0	0	4.26E-04	1.07E-02	1.64E-04	0	8.63E-03	0	0	0	0	0	0	0
TK-F17	tube bundle flush																			
TK-F18	utility (sump) waste	0	0	0	0	0	0	0	0	0	1.61E-01	0	2.48E-02	0	0	0	0	0	0	0
TK-F26	1WW receiver	0	0	0	0	0	7.87E-03	6.82E-05	0	0	0	0	0	0	0	0	0	0	0	0
TK-F3	acid receiver	0	0	0	0	0	2.68E-01	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-F4	vessel vent condensate																			
TK-F7	1WF	0	0	0	0	0	4.15E-03	3.07E-06	0	0	0	0	0	0	0	0	0	0	0	0
TK-F8	waste rework																			
TK-G1	10F Solvent Washer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.96E-02	9.28E-02	0	0
TK-G2	10S	0	0	0	0	0	2.10E-04	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-G5	10O - organic	0	0	0	0	0	1.31E-01	0	0	0	0	0	0	0	0	0	5.06E+01	1.19E+02	0	0
TK-G6	10D decanter																			
TK-G7	10O pump tank																			
TK-G8	10W	0	0	0	0	0	0	0	0	2.79E+00	0	0	0	0	0	0	0	0	0	0
TK-H1	HAF	0	0	0	0	0	6.98E-02	6.82E-04	0	0	0	0	0	0	0	0	0	0	0	0
TK-J1	3WB	0	0	0	0	0	7.84E-02	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-J2	miscellaneous storage																			
TK-J21	2NF	0	0	0	0	0	1.43E-02	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-J3	18XF	0	0	0	0	0	8.16E-04	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-J5	2AF	0	0	0	0	0	7.63E-03	0	0	0	5.22E-06	0	0	0	0	0	0	0	0	0
TK-K1	2DF	0	0	0	0	0	1.61E+01	0	0	0	0	0	0	0	2.49E-04	0	0	0	0	0
TK-K5	2UC receiver																			
TK-K6	UNH product	0	0	0	0	0	2.91E-02	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-L10	alternate PCP sampler																			
TK-L11	Pu recycle	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-L13-10	Pu loadout																			
TK-L3	3AF	0	0	0	0	0	8.66E-02	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-L8	product receiver	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-L8	product receiver																			
TK-L9	Pu product sampler	0	0	0	0	0	8.21E-04	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-M1	equipment decon.																			
TK-M2	equipment decon.																			
TK-M3	Pu nitrate sol'n storage	0	0	0	0	0	2.08E-02	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-M4	Pu nitrate sol'n storage	0	0	0	0	0	2.08E-02	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-M5	Pu nitrate sol'n storage	0	0	0	0	0	2.08E-02	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-M6	Pu nitrate sol'n storage	0	0	0	0	0	2.08E-02	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-N3	Pu nitrate feed	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-N4	H2O2 feed tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.88E-01	0
TK-N5	prereduction tank	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-N6	pump tank	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-N7	precipitator	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-N11	filtrate receiver	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-N12	vent seal pot																			
TK-N13	filtrate concentrator																			
TK-N15	filtrate holding tank	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-N16	filtrate holding tank	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-N19	offgas scrubber tank	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-N20	liquid seal tank																			
TK-N21	condensate receiver tank	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-N22	condensate receiver tank	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-N24	seal liquid separator																			
TK-N30	vacuum tank																			
TK-N33	closed lp cooling exp tk																			
TK-N34	H2O2 holding tank																			
TK-N35	Oxalic Acid Feed Tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.91E+00
TK-N38	Oxalic Acid Feed Tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.91E+00
TK-N38	1.2 M nitric acid head tank																			

Table 4-2c. Estimated Hazardous Constituents of PUREX Process Vessels. (3 sheets)

Vessel	Function	NH_4F	NH_4NO_3	NH_4OH	KOH	KF	HNO_3	HF	NaF	$NaNO_3$	$NaNO_2$	NH_3	NaOH	ANN	N_2H_4	$NH_3OH\text{-}NO_3$	TBP	NPH	H_2O_2	Oxalic Ac.
	gm/mol	37.04	80.05	35.05	56.1	58.1	63.02	20.01	42	85.01	69	17.03	40.01	376.14	32.05	96.04			34.02	90.04
		kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg
TK-N39	vacuum drop-out																			
TK-N40	vacuum drop-out																			
TK-N43	vacuum drop-out																			
TK-P1	UNH product	0	0	0	0	0	2.39E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-P2	UNH product/now receve	0	0	0	0	0	2.48E+02	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-P3	UNH product	0	0	0	0	0	2.67E-01	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-P4	UNH product	0	0	0	0	0	2.39E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-P5	waste pump tank																			
TK-P6	steam rework tank	0	0	0	0	0	1.19E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-P13	recovered acid receiver	0	0	0	0	0	1.24E+02	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-P14	recovered acid receiver	0	0	0	0	0	1.24E+02	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-P15	recovered acid receiver	0	0	0	0	0	1.24E+02	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-O1	2PN concentrator feed																			
TK-O11	cooling water pump tank																			
TK-O13	chemical addition																			
TK-O3	3X feed																			
TK-O5	3XW waste																			
TK-O6	3XN receiver																			
TK-O7	Np product loadout																			
TK-O8	sump tank																			
TK-R1	2OF Solvent Washer	0	0	0	0	0	9.54E-07	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-R2	2OX	0	0	0	0	0	4.77E-06	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-R5	utility																			
TK-R6	utility decanter																			
TK-R7	2OO - organic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00E+00	0.00E+00	0	0
TK-R8	2OW Batch Waste	0	0	0	0	0	1.60E+01	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-U1	50% HNO3 storage	0	0	0	0	0	1.36E+02	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-U2	50% HNO3 storage	0	0	0	0	0	1.66E+02	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-U3	U Cell Sump Waste	0	0	0	0	0	0	0	0	0	1.54E+01	0	8.13E+00	0	0	0	0	0	0	0
TK-U4	U Cell Sump Waste	0	0	0	0	0	0	0	0	0	6.82E+00	0	3.00E+00	0	0	0	0	0	0	0
TK-U5	fractionator feed	0	0	0	0	0	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-XC	acid receiver	0	0	0	0	0	2.15E-01	0	0	0	0	0	0	0	0	0	0	0	0	0
TK-XD	acid receiver	0	0	0	0	0	2.15E-01	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
	PUREX Est. Inventory at Deactivation													
	Basis 180 day Mark IA Fuel (12% Pu-240)													
	A-CELL	H-2-53500												
E	E-A2	off gas heater (steam)						H-2-52530	H-2-56678	1.00E+03	12,000	SS	A-Cell	LLW-1
E	F-A1	filter						H-2-52526	H-2-56989 CVI 8488	1.00E+03	12,000		A-Cell	LLW-1
E	H-A2	off gas heater (electric)							H-2-56676	1.00E+03	12,000	SS	A-Cell	LLW-1
P	T-A2	silver reactor (250 lb AgNO3)			11.8	8.5	16.6	H-2-63161	H-2-57337 CVI 7988	1.67E+03	15,500	SS	A-Cell	LLMW >3
P	T-A3-1 and T-A3-3	dissolver tower and ammonia scrubber unit			8.0	12.0	23.6	H-2-59135 H-2-59141	H-2-52468 H-2-59941 CVI 8286	2.27E+03	33,000	SS	A-Cell	LLW-1
P	TK-A3	dissolver- (Zr heels)	1,830	5,000	10.8	10.8	23.8	H-2-75760	H-2-75760	2.76E+03	42,000	SS	A-Cell	TRUMW-3
P	TK-A3-4	NH3 scrub waste	17	2,100	6.6	11.8	15.7	H-2-59135	H-2-59136	1.22E+03	13,000	SS	A-Cell	LLW-1
	B-CELL	H-2-53501												
E	E-B2	off gas heater (steam)						H-2-52530	H-2-56678	1.00E+03	12,000	SS	B-Cell	LLW-1
E	F-B1	filter (CVI 8488)						H-2-52526	H-2-52463 CVI 8488	1.00E+03	12,000		B-Cell	LLW-1
E	H-B2	off gas heater (electric)							H-2-56676	1.00E+03	12,000	SS	B-Cell	LLW-1
P	T-B2	silver reactor (250 lb AgNO3)			11.8	8.3	16.3	H-2-52555	H-2-52467 CVI 7988	1.59E+03	15,500	SS	B-Cell	LLMW >3
P	T-B3-1 and T-B3-3	dissolver tower and ammonia scrubber unit			8.0	12.0	23.6	H-2-59135 H-2-59141	H-2-52468 H-2-59941 CVI 8286	2.27E+03	33,000	SS	B-Cell	LLW-1

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
P	TK-B3	dissolver- (Zr heels)	1,396	5,000	10.8	10.8	23.8	H-2-59131	H-2-67481	2.76E+03	42,000	SS	B-Cell	LLMW-3
P	TK-B3-4	NH3 scrub waste	17	2,100	6.6	11.8	15.7	H-2-59135	H-2-59937	1.22E+03	13,000	SS	B-Cell	LLW-1
	C-CELL	H-2-53502												
E	E-C2	off gas heater (steam)						H-2-52530	H-2-58514	1.00E+03	12,000	SS	C-Cell	LLW-1
E	F-C1	filter (CVI 8488)						H-2-52526	H-2-56989	1.00E+03	12,000		C-Cell	LLW-1
E	H-C2	off gas heater (electric)							H-2-56676	1.00E+03	12,000	SS	C-Cell	LLW-1
P	T-C2	silver reactor (250 lb AgNO3)			11.8	8.5	16.6	H-2-63161	H-2-57337 CVI 7988	1.67E+03	15,500	SS	C-Cell	LLMW >3
P	T-C3-1 and T-C3-3	dissolver tower and ammonia scrubber unit			8.0	12.0	23.6	H-2-59135 H-2-59141	H-2-52468 H-2-59941 CVI 8286	2.27E+03	33,000	SS	C-Cell	LLW-1
P	TK-C3	dissolver- (Zr heels)	1,226	5,000	10.8	10.8	23.8	H-2-59926	H-2-67481	2.76E+03	42,000	SS	C-Cell	LLMW-3
P	TK-C3-4	NH3 scrub waste	17	2,100	6.6	11.8	15.7	H-2-59135	H-2-59136	1.22E+03	13,000	SS	C-Cell	LLW-1
	D-CELL	H-2-53503/4												
x	TK-D1	metathesis storage	11	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	D-Cell	LLW-1
E	D1	agitator		10 HP	3.0		12.5			8.84E+01	2,250	SS	D-Cell	LLW-1
x	TK-D2	decladding waste	22	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	D-Cell	LLW-1
x	D2	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	D-Cell	LLW-1
E	TK-D3/D4	metal solution	148	15,400	25.3	10.5	9.2	H-2-59668	H-2-59670	2.44E+03	33,000	SS	D-Cell	TRU-3
x	D3	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	D-Cell	TRU-3
x	D4	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	D-Cell	TRU-3

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
x	TK-D5	metal sol'n-recycle, no FP	44	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	D-Cell	TRU
x	D5	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	D-Cell	TRU
E	P-D5	pump		3 HP	3.0	-	13.4			9.47E+01	1,500	SS	D-Cell	TRU
	E-CELL	H-2-53505/06/07												
E	G-E2	coating waste centrifuge	12.2	180	5.0	-	3.2	H-2-53179	H-2-52995 CVI 8046	6.28E+01	1,000	SS	E-Cell	LLW-1
E	G-E4	coating waste centrifuge	12.2	125	4.6	-	3.2	H-2-53179	H-2-52995	5.32E+01	1,000	SS	E-Cell	LLW-1
E	T-E3-1	NH3 scrub tower						H-2-59942	H-2-59943	3.00E+02	18,000		E-Cell	LLW-1
x	TK-E1	centrifuge product	11	1,700	8.8	10.8	10.1	H-2-52522	H-2-52450 CVI 8024	9.58E+02	5,760	SS	E-Cell	LLW-3
x	E1	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	E-Cell	LLW-3
x	TK-E3	centrifuge feed	45	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	E-Cell	LLW-3
x	E3	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	E-Cell	LLW-3
E	TK-E3-2	NH3 scrub waste	6.3	250	3.2	-	6.2	H-2-59942	H-2-63810	4.86E+01	650		E-Cell	LLW-1
x	TK-E5	coating waste	297	5,000	10.8	-	10.2	H-2-94434	H-2-52521 CVI 8024	9.26E+02	11,125	SS	E-Cell	LLW-1
x	E5	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	E-Cell	LLW-1
x	TK-E6	metal sol'n-recycle, no FP	21	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	E-Cell	TRU
x	E6-1	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	E-Cell	TRU
x	E6-2	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	E-Cell	TRU
	F-CELL	H-2-53508 through 15												
E	E-F2	off gas heater (steam)							H-2-74408	1.00E+03	12,000		F-Cell	LLW-1
E	E-F1	condenser						H-2-63152	H-2-52480	1.00E+03	12,000		F-Cell	LLW-1
E	E-F5	condenser						H-2-52551	H-2-52480	1.00E+03	12,000		F-Cell	LLW-1
E	E-F9	condenser						H-2-52538	H-2-52481 CVI 8171	1.00E+03	12,000		F-Cell	LLW-1
E	E-F11-1	ASW concentrator	15	2,500	14.5	7.8	29.6	H-2-58101	H-2-58106	3.32E+03	30,000		F-Cell	LLW-1

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
		tube bundle (east)						H-2-52550	H-2-58755				F-Cell	
		concentrator tower						H-2-58101	H-2-66047				F-Cell	
		condenser						H-2-68231	H-2-62616				F-Cell	
		tube bundle (west)						H-2-52550	H-2-58755				F-Cell	
E	E-F6-1	1WW concentrator	113	2,200	14.5	7.8	36.5	H-2-58101	H-2-58106	4.10E+03	30,000		F-Cell	TRU-3
		tube bundle (east)						H-2-52550	H-2-72337				F-Cell	
		concentrator tower						H-2-58101	H-2-58104				F-Cell	
		concentrator deentrainer						H-2-57499	H-2-57499				F-Cell	
		tube bundle (west)						H-2-52550	H-2-58755				F-Cell	
E	F-F1	filter (CVI 8488)						H-2-52527	H-2-56989	1.00E+03	12,000		F-Cell	LLW-1
E	T-F2	silver reactor (no silver or raschig rings)						H-2-65092	H-2-90166	1.67E+03	15,500	SS	F-Cell	LLW-1
E	T-F5	acid absorber	299	300				H-2-52535	CVI 8158	1.80E+03	6,000		F-Cell	LLW-1
E	TK-F1	vessel vent condensate		65	1.0	-	10.0		-	7.85E+00	350		F-Cell	LLW-1
x	TK-F3	acid receiver	45	5,000	10.8	-	10.2	H-2-52521	H-2-65024 CVI 8024	9.26E+02	11,125	SS	F-Cell	LLW-1
x	F3	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	F-Cell	LLW-1
E	P-F3	pump		10 HP	3.0	-	13.4			9.47E+01	1,400		F-Cell	LLW-1
x	TK-F4	vessel vent condensate		5,000	10.8	- .	10.2	H-2-52521	H-2-52453 CVI 8024		11,125	SS	F-Cell	LLW-1
E	TK-F7/F26	1WF	30	7,600	6.8	10.5	9.9	H-2-59976	H-2-59997	7.07E+02	10,000		F-Cell	LLW-1
E	F26	agitator		15 HP	3.0		12.5			8.84E+01	2,250		F-Cell	LLW-1
E	P-F7	pump		10 HP	3.0	-	13.4			9.47E+01	1,400		F-Cell	LLW-1
x	TK-F8	waste rework		5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	F-Cell	LLW-1
E	F8	agitator		15 HP	3.0		12.5			8.84E+01	1,400		F-Cell	LLW-1
x	TK-F10	3WF decanter	45	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	F-Cell	LLW-1
x	F10	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	F-Cell	LLW-1
E	P-F10	pump		10 HP	3.0	-	13.4			9.47E+01	1,400		F-Cell	LLW-1
x	TK-F12	E-F11 feed	46	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	F-Cell	LLW-1
x	F12	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	F-Cell	LLW-1

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
E	P-F12	pump		10 HP	3.0	-	13.4			9.47E+01	1,400		F-Cell	LLW-1
x	TK-F13	rework storage		5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	F-Cell	LLW-1
x	F13	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	F-Cell	LLW-1
E	P-F13	pump		3 HP	3.0	-	13.4			9.47E+01	1,400		F-Cell	LLW-1
x	TK-F14	decanter (not useable)		400	5.3	5.5	6.6	H-2-52471	H-2-52528 CVI 7829	1.94E+02	1,900	SS	F-Cell	LLW-1
x	TK-F15	1WW denitration/ZAW	2	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	F-Cell	LLW-1
x	F15	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	F-Cell	LLW-1
x	TK-F16	1WW denitration/NZAW	57	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	F-Cell	TRU-3
x	F16	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	F-Cell	TRU-3
E	TK-F17	tube bundle flush		1,200	4.2	-	11.8		H-2-58647	1.63E+02			F-Cell	LLW-1
x	TK-F18	utility (sump) waste	56	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	F-Cell	TRU
x	F18	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	F-Cell	TRU
	G-CELL	H-2-53516 through 19												
x	T-G2	1O column	5	2,000	6.5	7.0	35.0	H-2-52542	H-2-52489 CVI 8405	1.59E+03	19,025	SS	G-Cell	LLW-1
x		pulse generator			3.5	2.7	7.0	H-2-53178	CVI 7335	6.53E+01		SS	G-Cell	LLW-1
x	TK-G1	1OF Solvent Washer	43	5,000	10.8	-	10.2	H-2-52523	H-2-52456 CVI 8024	9.26E+02	13,610	SS	G-Cell	LLW-3
E	P-G1-1	pump		10 HP	3.0		13.4			9.47E+01	1,400		G-Cell	LLW-3
E	P-G1-2	pump		10 HP	3.0		10.8			7.63E+01	1,400		G-Cell	LLW-3
x	TK-G2	1OS	22	1,900	8.8	10.8	10.1	H-2-52522	H-2-52450 CVI 8024	9.58E+02	5,760	SS	G-Cell	LLW-1
E	P-G2	pump		3 HP	3.0		13.4			9.47E+01	1,400		G-Cell	LLW-1
E	TK-G5	1OO - organic	55	15,000	16.0	10.5	14.0	H-2-52524	H-2-52457 CVI 8170	2.35E+03	33,000		G-Cell	LLW-1
x	G5-1	agitator		15 HP	3.9		17.4		CVI 8097	2.05E+02	2,400	SS	G-Cell	LLW-1
x	G5-2	agitator		15 HP	3.9		17.4		CVI 8097	2.05E+02	2,400	SS	G-Cell	LLW-1
E	P-G5-1	pump		5 HP	3.0		18.1			1.28E+02	1,400		G-Cell	LLW-1

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
E	P-G5-2	pump		5 HP	3.0		18.1			1.28E+02	1,400		G-Cell	LLW-1
E	P-G5-3	pump		5 HP	3.0		18.1			1.28E+02	1,400		G-Cell	LLW-1
x	TK-G6	1OD decanter		450	5.3	5.5	6.6	H-2-52471	H-2-52528 CVI 7829	1.94E+02	1,900	SS	G-Cell	LLW-1
x	TK-G7	1OO pump tank		15,000	16.0	10.8	15.0	H-2-52524	H-2-52457 CVI 8170	2.59E+03	33,000	SS	G-Cell	LLW-1
x	G7-1	agitator		15 HP	3.9		17.4		CVI 8097	2.05E+02	2,400	SS	G-Cell	LLW-1
x	G7-2	agitator		15 HP	3.9		17.4		CVI 8097	2.05E+02	2,400	SS	G-Cell	LLW-1
E	P-G7-1	pump		5 HP	3.0		9.4			6.64E+01	1,400		G-Cell	LLW-1
E	P-G7-2	pump		5 HP	3.0		9.4			6.64E+01	1,400		G-Cell	LLW-1
E	P-G7-3	pump		5 HP	3.0		18.1			1.28E+02	1,400		G-Cell	LLW-1
x	TK-G8	1OW	434	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	G-Cell	LLW-3
x	G8	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	G-Cell	LLW-3
E	E-F11 #4 spare concentrator (stored)							H-2-52532	H-2-56213 CVI 8158	3.32E+03	30,000		G-Cell	LLW-1
	H-CELL	H-2-53520 through 21												
E	E-H4-1	3WB concentrator	113	2,700	15.0	8.5	29.6	H-2-58101	H-2-66104 H-2-66046	3.77E+03	30,000		H-Cell	LLW-1
		tube bundle (east)						H-2-52550	H-2-94422				H-Cell	
		concentrator tower						H-2-58101	H-2-58102				H-Cell	
E	E-H4-2	condenser						H-2-52551	H-2-52480	1.00E+03	12,000		H-Cell	LLW-1
		tube bundle (west)						H-2-52550	H-2-94422				H-Cell	
	T-H2	HA column	4	1,850	2.2	-	40.9	H-2-58483	H-2-58367	1.51E+02	18,000		H-Cell	LLW-3
x		pulse generator PG-K2			3.5	2.7	7.0	H-2-53178	CVI 7335	6.53E+01	n/a	SS	H-Cell	LLW-3
		column cartridge							H-2-58377				H-Cell	LLW-3
x	T-H3	HS column (bypassed)		1,770	7.2	6.8	27.9	H-2-58183	H-2-57486 CVI 8405	1.37E+03	15,300	SS/CS	H-Cell	LLW-1
		column cartridge							H-2-57768				H-Cell	LLW-1
x	TK-H1	HAF (TK-D2 spare)	45	5,000	10.8	-	10.2		H-2-52521 CVI 8024	9.26E+02	11,125	SS	H-Cell	TRU-3
x	H1	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	H-Cell	TRU-3

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
E	P-H1	pump		3 HP	3.0		13.4			9.47E+01	1,400		H-Cell	TRU-3
		pulser PG-K3 (hot spare?)						H-2-53178	CVI 7335				H-Cell	LLW-1
	J-CELL	H-2-53522 through 5												
E	E-J8-1	1CU concentrator	113	3,700	14.0	-	29.8	H-2-58101	H-2-52478 H-2-66104	4.58E+03	35,000		J-Cell	LLW-3
		tube bundle (east)						H-2-52550	H-2-59114				J-Cell	LLW-3
		concentrator tower T-J8						H-2-58101	H-2-58102				J-Cell	LLW-3
E	E-J8-2	condenser						H-2-52551	H-2-52480	1.00E+03	12,000		J-Cell	LLW-1
		tube bundle (west)						H-2-52550	H-2-59114				J-Cell	LLW-1
x	T-J4	1BS column	1	130	11.5	7.3	21.9	H-2-64521	H-2-58934 CVI 8405	1.82E+03	6,600	SS	J-Cell	LLW-3
		column cartridge							H-2-58936				J-Cell	LLW-3
		pulser 2 PG-J4							H-2-56910				J-Cell	LLW-3
E	T-J6	1BX column	5	1,600	6.0	6.0	34.0	H-2-62609	H-2-62609 CVI 8111	1.22E+03	4,400	SS	J-Cell	LLW-3
		column cartridge	.						H-2-62614				J-Cell	LLW-3
x		pulser PG-J2			3.5	2.7	7.0	H-2-53178	CVI 7335	6.53E+01		SS	J-Cell	LLW-3
E	T-J7	1C column	5	1,770	4.0	-	27.0	H-2-58968	H-2-58966	3.39E+02	1,500	SS/CS	J-Cell	LLW-1
		column cartridge							H-2-58900				J-Cell	LLW-1
x		pulser 3 PG-G2			3.5	2.7	7.0		CVI 7335	6.53E+01		SS	J-Cell	LLW-1
E	T-J22	2N column (not removeable?	0	150	0.6	-	33.6	H-2-59373	H-2-59355	8.98E+00	1,500		J-Cell	LLW-1
		column cartridge							H-2-59356				J-Cell	LLW-1
		pulser 3 PG-J4						H-2-58402	H-2-56360				J-Cell	LLW-1
E	T-J23	2P column (not removeable?	0	100	0.6	-	22.1	H-2-59373	H-2-59357	5.91E+00	1,500		J-Cell	LLW-1
		column cartridge							H-2-59358				J-Cell	LLW-1
		pulser PG-J23						H-2-58402	H-2-59351				J-Cell	LLW-1
x	TK-J1	3WB	45	5,000	10.8	-	10.2		H-2-52521 CVI 8024	9.26E+02	11,125	SS	J-Cell	LLW-1
x	J1	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	J-Cell	LLW-1
E	P-J1	pump		3 HP	3.0		13.4			9.47E+01	1,400		J-Cell	LLW-1

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
E	TK-J2	miscellaneous storage		1,340	4.2	-	14.0	H-2-64600	H-2-59352	1.91E+02	4,000		J-Cell	LLW-1
E	P-J2	pump		7.5 HP	3.0		18.1			1.28E+02	1,400		J-Cell	LLW-1
x	TK-J3	1BXF	19	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	J-Cell	LLW-1
x	J3	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	J-Cell	LLW-1
E	P-J3	pump		10 HP	3.0		13.4			9.47E+01	1,400		J-Cell	LLW-1
x	TK-J5	2AF	1	370	4.3	8.9	7.3	H-2-59968	H-2-59969 CVI 7829	2.74E+02	3,200	SS	J-Cell	LLW-3
E	P-J5	pump		1.5 HP	3.0		12.8			9.05E+01	1,400		J-Cell	LLW-3
E	TK-J21	2NF	1	320	4.6	-	14.2		H-2-64600	2.34E+02	1,000		J-Cell	LLW-1
E	P-J21	pump		1.5 HP	3.0		18.5			1.31E+02	1,400		J-Cell	LLW-1
	K-CELL	H-2-53525 through H-2-53528												
E	E-K4-1	2EU concentrator	9	3,700	14.0	-	28.0	H-2-52532	H-2-52477 CVI 8158	4.31E+03	35,000		K-Cell	LLW-1
		tube bundle (east)						H-2-52550	H-2-59114				K-Cell	LLW-1
E	E-K4-2	condenser						H-2-52551	H-2-52480	1.00E+03	12,000		K-Cell	LLW-1
		tube bundle (west)						H-2-52550	H-2-52453				K-Cell	LLW-1
x	T-K2	2D column	2	1,370	7.0	4.5	35.6	H-2-52545	H-2-56837 CVI 8405	1.12E+03	12,000	SS	K-Cell	LLW-1
		column cartridge							H-2-58387				K-Cell	LLW-1
x		pulse generator 6 PG-G2			3.5	2.7	7.0	Atomics Int'l.	CVI 7335	6.53E+01		SS	K-Cell	LLW-1
E	T-K3	2E column	5	1,770	4.0	-	27.0	H-2-52547	H-2-52501 H-2-56480	3.39E+02	16,000	SS/CS	K-Cell	LLW-1
		column cartridge							H-2-58425				K-Cell	LLW-1
x		pulse generator PG-H2			3.6	2.7	7.0	H-2-53178	CVI 7335	6.72E+01		SS	K-Cell	LLW-1
x	TK-K1	2DF	45	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	K-Cell	LLW-3
x	K1	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	K-Cell	LLW-3
E	P-K1	pump		3 HP	3.0		13.4			9.47E+01	1,400		K-Cell	LLW-3

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Location	Est. Waste Type
x	TK-K5	2UC receiver		5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	K-Cell	LLW-1
x	K5	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	K-Cell	LLW-1
x	TK-K6	UNH product	122	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	K-Cell	LLW-1
x	K6	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	K-Cell	LLW-1
E	P-K6	pump		10 HP	3.0		13.4			9.47E+01	1,400		K-Cell	LLW-1
	L-CELL	H-2-53528 through 29												
E	E-L6	condenser						H-2-63615	H-2-63615	1.00E+03	12,000		L-Cell	TRU
P	E-L7-1	product concentrator	0	10	5.8	0.3	29.6	H-2-63618	H-2-63615	5.68E+01	600	SS/Ti	L-Cell	TRU
E	E-L7-2	condenser						H-2-63618	H-2-56742	1.00E+03	12,000		L-Cell	TRU
x	T-L1	2A column	0	130	11.6	7.7	42.6	H-2-52544	H-2-52507 CVI 8405	3.77E+03	13,000	SS	L-Cell	TRU
		pulser PG-J4						H-2-53177	H-2-56910 CVI 7335				L-Cell	TRU
x	T-L2	2B column	0	90	10.1	7.5	35.2	H-2-62624	H-2-52509 CVI 8405	2.66E+03	1,695	SS/CS	L-Cell	TRU
P		column cartridge			1.7	-	25.8		H-2-62627	5.64E+01	400	SS	L-Cell	TRU
		pulser PG-L2						H-2-53177	H-2-56910 CVI 7335				L-Cell	TRU
P	T-L4	3A column	0	40	3.0	-	37.3		H-2-63609 H-2-63619	2.64E+02	2,246	SS	L-Cell	TRU
P	T-L5	3B column	0	30	3.0	-	26.4		H-2-63612 H-2-63613	1.87E+02	2,000	SS	L-Cell	TRU
P		column cartridge			1.3	-	25.0		H-2-63614 H-2-63607	3.38E+01	135	SS	L-Cell	TRU
P	T-L6	product stripper	0	10	6.3	0.3	33.3		H-2-63607 H-2-63615	6.93E+01	650	Ti/Ta	L-Cell	TRU
P	TK-L3	3AF	11	120	2.8	-	14.1		H-2-63608 H-2-63622	8.81E+01	11,740	SS	L-Cell	TRU
E	P-G7-2	pump		3 HP	3.0		16.7			1.18E+02	1,400		L-Cell	TRU
P	TK-L8	product receiver	0	10	0.3	2.5	8.0	H-2-63621	H-2-64696	6.67E+00	65	SS/Ti	L-Cell	TRU

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
x	TK-L9	Pu product sampler	0.05	11	1.7	1.9	15.2		H-2-64696 CVI 8098	4.84E+01	300	SS	L-Cell	TRU
x	TK-L10	alternate PCP sampler		14	1.7	1.9	15.2		H-2-52475 CVI 8098	4.84E+01	300	SS	L-Cell	TRU
E	TK-L11	Pu recycle	0	25	0.3	3.2	11.7		H-2-61890	1.23E+01	500		L-Cell	TRU
E	TK-L13-10	Pu loadout		2.4	0.5	-	2.5		H-2-63116	4.12E-01	50		L-Cell	TRU
	M-CELL													
x	TK-M1	equipment decon.		4,100	10.8	10.8	14.9		H-2-52511 CVI 8332	1.73E+03	7,900	SS	M-Cell	LLW-1
x	TK-M2	equipment decon.		1,800	5.3	5.3	14.3		H-2-52512 CVI 7910	4.07E+02	3,800	SS	M-Cell	LLW-1
E	TK-M3	Pu nitrate sol'n storage	1	55	0.5	3.5	14.0		-	2.45E+01	1,000		M-Cell	TRU
E	TK-M4	Pu nitrate sol'n storage	1	55	0.5	3.5	14.0		-	2.45E+01	1,000		M-Cell	TRU
E	TK-M5	Pu nitrate sol'n storage	1	55	0.5	3.5	14.0		-	2.45E+01	1,000		M-Cell	TRU
E	TK-M6	Pu nitrate sol'n storage	1	55	0.5	3.5	14.0		-	2.45E+01	1,000		M-Cell	TRU
	N-CELL													
	CA-N10	second stage calciner	-	-									N-Cell	TRU
	CA-N9	first stage calciner	-	-									N-Cell	TRU
E	E-N13	filtrate concentrator	0	7.1						4.00E+01	450		N-Cell	TRU
E	F-N8	vacuum drum filter	0	0.3						3.00E+01	450		N-Cell	TRU
E	TK-N3	Pu nitrate feed	0	3	0.5	-	3.1		-	6.00E-01	400		N-Cell	TRU
E	TK-N4	H2O2 feed tank	1	1	0.3	-	1.8		-	1.54E-01	150		N-Cell	TRU
E	TK-N5	prereduction tank	0	8	0.5	-	2.9		-	5.62E-01	500		N-Cell	TRU
E	TK-N6	pump tank	0	4	0.5	-	3.3		-	6.38E-01	400		N-Cell	TRU
E	TK-N7	precipitator	0	0.8	0.5	-	-		-	-	150		N-Cell	TRU
x	TK-N11	filtrate receiver	0	6.3	0.7	1.7	5.8		CVI 20686	6.39E+00	92	G/SS	N-Cell	TRU

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
x	TK-N12	vent seal pot		0.5	0.5	1.7	1.7		CVI 20699	1.41E+00	55	G/SS	N-Cell	TRU
x	TK-N13	filtrate concentrator		6	1.1	2.5	12.3		CVI 20687	3.36E+01	463	SS/Ti	N-Cell	TRU
x	TK-N15	filtrate holding tank	0	26	0.7	4.0	7.4		CVI 20688	1.97E+01	591	SS	N-Cell	TRU
x	TK-N16	filtrate holding tank	0	26	0.7	4.0	7.4		CVI 20688	1.97E+01	591	SS	N-Cell	TRU
x	TK-N19	offgas scrubber tank	0	2.6	0.9	1.7	7.8		CVI 20689	1.20E+01	310	SS	N-Cell	TRU
x	TK-N20	liquid seal tank		2.4	0.6	1.2	1.8		CVI 20690	1.22E+00	58	SS	N-Cell	TRU
x	TK-N21	condensate receiver tank	0	24	0.6	4.0	7.6		CVI 20691	1.78E+01	642	SS	N-Cell	TRU
x	TK-N22	condensate receiver tank	0	24	0.6	4.0	7.6		CVI 20691	1.78E+01	642	SS	N-Cell	TRU
E	TK-N24	seal liquid separator			0.5	-	1.6		-	3.19E-01	150		N-Cell	TRU
E	TK-N30	vacuum tank		6	0.5	-	-		-	-	100		N-Cell	TRU
E	TK-N33	closed lp cooling exp tk		2.1	0.5	-	-		H-2-65550	-	100		N-Cell	TRU
x	TK-N34	H2O2 holding tank		66.0	2.3	-	4.5		CVI 20694	1.92E+01	353	SS	N-Cell	TRU
E	TK-N35	Oxalic Acid Feed Tank	16	161	3.0	-	-		-	8.00E+01	700		N-Cell	TRU
E	TK-N36	Oxalic Acid Feed Tank	16	161	3.0	-	-		-	8.00E+01	700		N-Cell	TRU
x	TK-N38	1.2 M nitric acid head tank		13	1.1	1.5	4.3		CVI 20696	6.84E+00	319	SS	N-Cell	TRU
x	TK-N39	vacuum drop-out		12.25	0.6	1.1	9.6		CVI 20736	5.95E+00	282	SS	N-Cell	TRU
x	TK-N40	vacuum drop-out		12.25	0.6	1.1	9.6		CVI 20736	5.95E+00	282	SS	N-Cell	TRU
E	TK-N43	vacuum drop-out		3.3						2.00E+00	150		N-Cell	TRU
	Q-CELL													
E	E-Q2	stripper concentrator		10	0.5	4.2	27.6		H-2-59506	5.74E+01	800		Q-Cell	TRU
E	E-Q9	vent jet condenser		12							800		Q-Cell	TRU
E	T-Q2	NP stripper column			0.5	5.0	12.6		H-2-59507	3.15E+01	450		Q-Cell	TRU
E	T-Q4	3X resin column		16							800		Q-Cell	TRU

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
E	TK-Q1	2PN concentrator feed		12	0.6	-	6.0		H-2-59509	1.78E+00	280		Q-Cell	TRU
E	TK-Q3	3X feed		110	4.0	-	5.5		H-2-59511	7.06E+01	550		Q-Cell	TRU
E	TK-Q5	3XW waste		500	4.0	-	7.0		H-2-59512	8.80E+01	2,400		Q-Cell	TRU
E	TK-Q6	3XN receiver		25	1.5	-	2.0		H-2-59513	3.53E+00	550		Q-Cell	TRU
E	TK-Q7	Np product loadout		1.5	0.6	-	1.0		H-2-59514	2.42E-01	100		Q-Cell	TRU
E	TK-Q8	sump tank		46	2.0	-	2.2		H-2-59515	6.81E+00	550		Q-Cell	TRU
E	TK-Q11	cooling water pump tank		315	3.0	-	6.0		H-2-59566	4.24E+01	1,500		Q-Cell	TRU
E	P-Q11-1	pump									150		Q-Cell	TRU
E	P-Q11-2	pump									150		Q-Cell	TRU
E	TK-Q13	chemical addition		9	0.5	-	6.3		H-2-59726	1.23E+00	200		Q-Cell	TRU
	Q Cell Aqueous Makeup Tanks*													
E	TK-Q21	wash tank		21	1.5		2		H-2-59516	3.53E+00	500		AMU	SW
x	Q21	agitator		0.25 HP	0.8		3.9		CVI 12490	2.14E+00	90	SS	AMU	SW
E	TK-Q22	wash tank		256	3.5		4			3.85E+01	1,000		AMU	SW
x	Q22	agitator		0.33 HP	0.8		6.2		CVI 12490	3.38E+00	100	SS	AMU	SW
E	TK-Q23	resin add tank		11.9	1		2.1		H-2-59518	1.64E+00	280		AMU	SW
E	TK-Q24	NaNO2 add tank		58.1	1		2.5		H-2-59519	1.96E+00	350		AMU	SW
E	TK-Q25	ANN add tank		11.6	1		2		H-2-59520	1.57E+00	280		AMU	SW
E	TK-Q26	Fe(NH2SO3)2 add tank		11.6	1		2		H-2-59521	1.57E+00	280		AMU	SW
E	TK-Q27	N2H4 add tank		4.9	1		1		H-2-59521	7.85E-01	150		AMU	SW
E	TK-Q31	HNO3 rinse tank		15.1	1.2		2		H-2-59547	2.14E+00	300		AMU	SW
	*Inactive													

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
	R-CELL													
x	T-R2	2O column	1	2,000	7.0	4.5	30.9		H-2-52494 CVI 8405	9.73E+02	18,825	SS	R-Cell	LLW-1
x		pulser PG-R2			3.6	2.7	7.0	H-2-53178	CVI 7335	6.72E+01		SS	R-Cell	LLW-1
E	TK-R1	2OF Solvent Washer	40	5,000	10.0	-	10.7		H-2-52523 CVI 8332	8.41E+02	11,125	SS	R-Cell	TRU
E	P-R1-1	pump		10 HP	3.0		13.2			9.33E+01	1,400		R-Cell	TRU
E	P-R1-2	pump		10 HP	3.0		13.2			9.33E+01	1,400		R-Cell	TRU
E	TK-R2	2OX	5	1,900	7.0	-	10.0		H-2-52522 CVI 8151	3.85E+02	4,000	SS	R-Cell	LLW-1
E	P-R2	pump		3 HP	3.0		10.7			7.56E+01	1,400		R-Cell	LLW-1
E	TK-R5	utility		9,000	10.0	-	14.0		H-2-54171	1.10E+03	20,000		R-Cell	LLW-1
E	R5	agitator		15 HP	3.0		18.0			1.27E+02	1,400		R-Cell	LLW-1
x	P-R5-1	pump			4.5	1.5	1.6		CVI 7931	1.11E+01	505	SS	R-Cell	LLW-1
E	P-R5-1-1	pump									505		R-Cell	LLW-1
x	TK-R6	utility decanter	.	430	4.0	5.0	7.1		H-2-52528 CVI 7847	1.43E+02	2,100	SS	R-Cell	LLW-1
E	TK-R7	2OO - organic	0	9,000	10.0	-	14.0		H-2-54172	1.10E+03	20,000		R-Cell	LLW-1
E	R7	agitator		15 HP	3.0		18.0			1.27E+02	2,250		R-Cell	LLW-1
E	P-R5-2	pump									505		R-Cell	LLW-1
x	P-R5-3	pump			3.8	1.0	1.6		CVI 7931	6.31E+00	505	SS	R-Cell	LLW-1
x	P-R5-4	pump			3.8	1.0	1.6		CVI 7931	6.31E+00	505	SS	R-Cell	LLW-1
E	TK-R8	20W Batch Waste	1,673	5,100	10.0	-	10.7		H-2-54172 CVI 8151	8.41E+02	11,125	SS	R-Cell	LLW-1
x	R8	agitator		7.5 HP	3.9		12.4		CVI 7515	1.49E+02	1,050	SS	R-Cell	LLW-1
	G-R3	stored centrifuge						H-2-53180	H-2-52995 CVI 8406		32,000		R-Cell	LLW-1
	G-R4	stored centrifuge						H-2-53180	H-2-52995 CVI 8406		32,000		R-Cell	LLW-1

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Location	Est. Waste Type
	U-CELL													
x	T-U6	fractionator	1,750	1,750	8.0	-	39.5		CVI 10170	1.99E+03	54,000	SS	U-Cell	LLW-1
x	E-U6-1	condenser			7.2	7.0	7.0		CVI 10170	3.51E+02	2,500	SS	U-Cell	LLW-1
x	E-U6-2	reboiler			5.3	11.2	5.6		CVI 10170	3.27E+02	13,500	SS	U-Cell	LLW-1
E	TK-U1	50% HNO3 storage	55	15,000	11.3	16.8	15.5		H-2-52524 CVI 8151	2.95E+03	33,000	SS	U-Cell	LLW-1
E	U1	agitator		15 HP	3.0		17.5			1.24E+02	2,250		U-Cell	LLW-1
E	P-U1-1	pump		10 HP	3.0	14.0	18.0			1.27E+02	1,400		U-Cell	LLW-1
E	P-U1-2	pump		10 HP	3.0	14.0	18.0			1.27E+02	1,400		U-Cell	LLW-1
E	TK-U2	50% HNO3 storage	67	15,000	11.3	16.8	15.5		H-2-52524 CVI 8151	2.95E+03	33,000	SS	U-Cell	LLW-1
E	U2	agitator		15 HP	3.0		17.5			1.24E+02	2,250		U-Cell	LLW-1
E	P-U2-1	pump		10 HP	3.0		18.0			1.27E+02	1,400		U-Cell	LLW-1
E	P-U2-2	pump		10 HP	3.0		18.0			1.27E+02	1,400		U-Cell	LLW-1
x	TK-U3	U Cell Sump Waste	5,368	8,000	10.0	-	20.0		CVI 8690	1.57E+03	10,500	SS	U-Cell	LLW-3
E	U3	agitator		15 HP	3.0		18.0			1.27E+02	2,250		U-Cell	LLW-3
x	TK-U4	U Cell Sump Waste	2,374	8,000	10.0	-	20.0		CVI 8690	1.57E+03	10,500	SS	U-Cell	LLW-3
E	U4	agitator		15 HP	3.0		18.0			1.27E+02	2,250		U-Cell	LLW-3
x	TK-U5	fractionator feed	0	9,000	10.0	-	20.0		CVI 10170	1.57E+03	12,700	SS/CS	U-Cell	LLW-1
E	P-U5-1	pump			3.0						1,400		U-Cell	LLW-1
E	P-U5-2	pump			3.0						1,400		U-Cell	LLW-1
E	TK-U7	chlorine purge		90	2.0		4.0		H-2-56264	1.26E+01	500		U-Cell	LLW-1
E	U7	agitator		0.33 HP	0.3		4.9			4.28E-01	150		U-Cell	LLW-1
E	P-U8-1	pump									500		U-Cell	LLW-1
E	P-U8-2	pump									500		U-Cell	LLW-1

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca- tion	Est. Waste Type
	PUREX PIPE AND OPERATING GALLERY													
E	TK-A3-A	dissolver drown (H2O)		3000	7.5		9		CVI 7704	3.98E+02	2,000	A	P&O	SW
E	TK-B3-A	dissolver drown (H2O)		3000	7.5		9		CVI 7704	3.98E+02	2,000	A	P&O	SW
E	TK-C3-A	dissolver drown (H2O)		3000	7.5		9		CVI 7704	3.98E+02	2,000	A	P&O	SW
E	TK-B1-A	25% caustic addition*		250	3		5		H-2-56226	3.53E+01	1,000	SS	P&O	SW
E	TK-C2-A	AgNO3 Addition*		40	1.5		3		NA	5.30E+00	250	SS	P&O	SW
x	TK-E2-A	centrifuge spray*		90	2.5	2.5	7.2		CVI 7703	4.48E+01	400	SS	P&O	SW
x	E2A	agitator		0.5 HP	1.45		6.5		CVI 7515	1.07E+01	169	SS	P&O	SW
E	P-E2-A	pump									150		P&O	SW
E	TK-E3-A	not used		160	3.3		2.7		NA	2.31E+01	700	SS	P&O	SW
E	TK-F15-XA-	antifoam addition*		60	2.1		2.2		NA	7.62E+00	300	SS	P&O	SW
E	TK-F15-XA-	not used		10	0.54		6		NA	1.37E+00	50	SS	P&O	SW
x	TK-G3-A	not used		90	2.5	2.5	7.2		CVI 7703	4.48E+01	400	SS	P&O	SW
x	G3A	agitator		0.5 HP	1.45		6.5		CVI 7515	1.07E+01	169	SS	P&O	SW
E	P-G3-A	pump									150		P&O	SW
x	TK-G5-A	caustic/nitrite		3000	8	8.5	13.5		CVI 8690	9.18E+02	4,000	SS	P&O	SW
E	G5A	agitator		7.5 HP	0.33		10.5			9.16E-01	1,500		P&O	SW
E	TK-J6-A	not used		250	3		5.4		NA	3.82E+01	1,000	SS	P&O	SW
E	TK-J6-B	not used		250	3		5.4		NA	3.82E+01	1,000	SS	P&O	SW
E	TK-L3-A	3AF addition*		15	1.375		1.375		H-2-56603	2.04E+00	100	SS	P&O	SW
x	TK-L9-A	plutonium cell addition		20	2	12.1	6.5		CVI 7703	1.57E+02	200	SS	P&O	SW
x	TK-M1-A	M1 solution addition		725	5.5	5.0	9.75		CVI 8661	2.68E+02	1,400	SS	P&O	SW
E	M1A	agitator		1 HP	0.50		6.3			1.24E+00	300		P&O	SW
x	TK-R1-A	organic blend addition		3000	8	8.5	13.5		CVI 7703	9.18E+02	4,000	SS	P&O	SW
E	R1A	agitator		7.5 HP	2.17		10			3.69E+01	1,500		P&O	SW
x	TK-R3-A	not used		90	2.5	2.5	7.2		CVI 7703	4.48E+01	400	SS	P&O	SW
x	R3A	agitator		0.5 HP	1.45		6.5		CVI 7515	1.07E+01	169	SS	P&O	SW
	P-R3-A	pump											P&O	SW

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
x	TK-R5-A	organic treatment add.		3000	8	8.5	13.5		CVI 7703	9.18E+02	4,000	SS	P&O	SW
E	R5A	agitator		7.5 HP	2.17		10			3.69E+01	1,500		P&O	SW
	*not in service													
	PUREX SAMPLE GALLERY													
E	TK-N34-1	H2O2									100		SG	SW
E	TK-N35-1	(COOH)2-2H2O									100		SG	SW
E	TK-N36-1	(COOH)2-2H2O									100		SG	SW
	203-A TANK FARM													
x	TK-P1	UNH product	100	100,000	26.0	25.0	32.4		H-2-54805 CVI 8422	2.11E+04	37,923	SS	203-A	LLW-1
x	P-P1	pump			4.2	1.3	1.5		CVI 8368	7.65E+00	600	SS	203-A	LLW-1
x	TK-P2	UNH product/now recovered	100	100,000	26.0	25.0	32.4		H-2-54805 CVI 8422	2.11E+04	37,923	SS	203-A	LLW-1
x	TK-P3	UNH product	100	100,000	26.0	25.0	32.4		H-2-54805 CVI 8422	2.11E+04	37,923	SS	203-A	LLW-1
E	P-P3	pump									600		203-A	LLW-1
x	TK-P4	UNH product	100	100,000	26.0	25.0	32.4		H-2-54805 CVI 8422	2.11E+04	37,923	SS	203-A	LLW-1
E	TK-P5	waste pump tank	4,000	4,000	9.0	-	9.0		-	5.73E+02	5,500		203-A	LLW-1
E	TK-P6	steam rework tank	50	14,000	10.0	16.0	14.0		H-2-58430	2.24E+03	20,000		203-A	LLW-1
E	TK-P13	recovered acid receiver	50	8,000	10.0	-	14.0		H-2-54895	1.10E+03	10,500		203-A	LLW-1
E	TK-P14	recovered acid receiver	50	8,000	10.0	-	14.0		H-2-54895	1.10E+03	10,500		203-A	LLW-1
E	TK-P15	recovered acid receiver	50	15,000	10.5	16.0	14.0		H-2-52524	2.35E+03	20,000		203-A	LLW-1
E	P-13-1	pump									600		203-A	LLW-1
E	P-13-2	pump									600		203-A	LLW-1
E	P-13-3	pump									600		203-A	LLW-1
E	P-15	pump									600		203-A	LLW-1

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
	211-A CHEMICAL TANK FARM													
E	TK-10	50% Cd(NO3)2		4600	9.5		9.8		H-2-54803	6.95E+02	5,500	SS	211-A	SW
	P-10	pump									600		211-A	SW
x	TK-11	AFAN		100000	25		33		H-2-60105 CVI 8422	1.62E+04	37,745	SS	211-A	SW
x	P-11-1	pump			5.6	2.0	3.2		CVI 8388	3.55E+01	1,010	SS	211-A	SW
x	P-11-2	pump			5.6	2.0	3.2		CVI 8388	3.55E+01	1,010	SS	211-A	SW
E	P-11-3	pump									1,010		211-A	SW
E	P-11-4	pump									1,010		211-A	SW
x	TK-12	57% HNO3		100000	25		33		H-2-54803 CVI 8422	1.62E+04	37,745	SS	211-A	SW
x	P-12-1	pump			4.5	1.5	1.6		CVI 7931	1.11E+01	505	SS	211-A	SW
x	P-12-2	pump			4.5	1.5	1.6		CVI 7931	1.11E+01	505	SS	211-A	SW
x	TK-20	50% NaOH		30000	15		26.7		H-2-54804 CVI 8422	4.71E+03	16,700	CS	211-A	SW
x	P-20	pump			4.6	1.5	3.2		CVI 8388	2.26E+01	700	SS	211-A	SW
x	P-21-1	pump			3.8	1.0	1.4		CVI 8368	5.27E+00	465	SS	211-A	SW
x	P-21-2	pump			3.8	1.0	1.4		CVI 8368	5.27E+00	465	SS	211-A	SW
x	TK-21	45% KOH		30000	15		26.7		H-2-54804 CVI 8422	4.71E+03	16,700	CS	211-A	SW
E	P-21	pump									465		211-A	SW
x	TK-30	demin. H2O		50000	25		35.0		H-2-54804 CVI 8422	1.72E+04	10,000	A	211-A	SW
x	P-30-1	pump			4.0	1.6	2.5		CVI 8517	1.57E+01	1,295	SS	211-A	SW
x	P-30-2	pump			4.0	1.6	2.5		CVI 8517	1.57E+01	1,295	SS	211-A	SW
x	TK-40	NPH		65000	22		27		H-2-54803 CVI 8422	1.03E+04	25,000	CS	211-A	SW
x	P-40-1	pump			5.6	2.0	3.2		CVI 8388	3.55E+01	1,010	SS	211-A	SW
x	P-40-2	pump			4.0	1.3	1.4		CVI 8368	7.03E+00	530	SS	211-A	SW
x	TK-41	TBP		30000	15		26.7		H-2-54803 CVI 8422	4.71E+03	16,000	CS	211-A	SW
x	P-41-1	pump			4.6	1.5	3.0		CVI 8388	2.12E+01	610	SS	211-A	SW
E	TK-42	ANN		7850	10		14		H-2-60105	1.10E+03	10,500	SS	211-A	SW

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
E	P-41-1	pump									600		211-A	SW
E	TK-50	93% H2SO4		8400	8		24		H-2-58870	1.21E+03	10,500	CS	211-A	SW
x	P-50	pump			4.6	1.5	3.0		CVI 8388	2.12E+01	610	SS	211-A	SW
E	P-51	pump									610		211-A	SW
	293-A BUILDING (BACK-UP FACILITY)													
E	T-XA	acid absorber	0	450	7.0	7.0	25.8		CVI 10702	1.27E+03	2,000	SS	293-A	LLW-1
E	T-XB	acid absorber	0	250							1,500		293-A	LLW-1
E	TK-XC	acid receiver	45	5,000	11.0	-	11.2		H-2-57003 CVI 10649	1.07E+03	7,000	SS	293-A	LLW-1
E	TK-XD	acid receiver	45	2,300	9.0	10.0	10.2		H-2-57004 CVI 10648	9.21E+02	3,500	SS	293-A	LLW-1
x	TK-X10	50% H2O2 Tank		10,000	11.8	11.8	16.7		SK-2-52799 CVI 21070	2.33E+03	3,500	A	293-A	SW
x	TK-X11	50% H2O2 Tank		10,000	11.8	11.8	16.7		SK-2-52799 CVI 21070	2.33E+03	3,500	A	293-A	SW
x	TK-X12	50% H2O2 Tank		10,000	11.8	11.8	16.7		SK-2-52799 CVI 21070	2.33E+03	3,500	A	293-A	SW
	AQUEOUS MAKEUP													
x	TK-51	resin wash (inactive)		75	3.0	2.5	6.7		CVI 8285	5.00E+01	450	CS	AMU	SW
x	TK-101	ferrous sulfamate		750	6.0	6.0	7.6		H-2-59450 CVI 7703	2.73E+02	1,400	SS	AMU	SW
E	101	agitator		1 HP	0.50		6.3			1.24E+00	200		AMU	SW
x	P-101	pump			4.25	1.3	1.6		CVI 7931	8.74E+00	513	SS	AMU	SW
E	TK-101A	HNO3 to TK-101		55	1.9		2.8		NA	7.94E+00	350	SS	AMU	SW
x	TK-103	hydroxylamine nitrate		750	6.0	6.0	7.5		H-2-59450 CVI 7703	2.70E+02	1,900	SS	AMU	SW
E	103	agitator		1 HP	0.50		6.3			1.24E+00	200		AMU	SW
x	P-103	pump			4.25	1.3	1.6		CVI 7931	8.74E+00	513	SS	AMU	SW
x	TK-104	sodium nitrate		3000	8.5	8.5	14.3		CVI 7429	1.03E+03	4,300	CS	AMU	SW

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
	104	agitator		7.5 HP	2.17		10.1			3.72E+01	600		AMU	SW
x	P-104	pump			4.0	1.3	1.4		CVI 8368	7.03E+00	530	SS	AMU	SW
E	TK-105	utility		3000	8.0		8.0		CVI 7703	4.02E+02	4,300	SS	AMU	SW
E	105	agitator		7.5 HP	2.17		10.1			3.72E+01	600		AMU	SW
x	P-105	pump			4.4	1.5	1.6		CVI 8368	1.06E+01	775	SS	AMU	SW
x	TK-106	sodium nitrite		750	7.0	7.0	7.8		CVI 7429	3.80E+02	2,000	CS	AMU	SW
	106	agitator		1 HP	0.50		6.3			1.24E+00	300		AMU	SW
x	P-106	pump			4.0	1.3	1.4		CVI 8368	7.03E+00	525	SS	AMU	SW
x	TK-107	Na2CO3/KMnO4		3000	8.5	8.5	14.3		CVI 7703	1.03E+03	4,000	CS	AMU	SW
	107	agitator		7.5 HP	2.17		10.1			3.72E+01	600		AMU	SW
x	P-107	pump			4.4	1.5	1.6		CVI 8368	1.06E+01	775	SS	AMU	SW
E	TK-108	utility		2700	6.5		11		H-2-59661	3.65E+02	4,000	SS	AMU	SW
E	108	agitator		5 HP	2.17		12			4.42E+01	500		AMU	SW
E	P-108	pump									775		AMU	SW
E	TK-150	3BX/HNO3		700	5.5		4		H-2-59452	9.50E+01	2,000	SS	AMU	SW
E	150	agitator		3 HP	0.58		4.3			1.12E+00	300		AMU	SW
E	P-150	pump									500		AMU	SW
E	TK-151	Cd(NO3)2		700	5.5		4		H-2-59452	9.50E+01	2,000	SS	AMU	SW
E	151	agitator		3 HP	0.58		4.3			1.12E+00	300		AMU	SW
E	P-151	pump									500		AMU	SW
E	TK-152	NaNO2 feed		700	5.5		4		H-2-59452	9.50E+01	2,000	SS	AMU	SW
E	TK-153	NaOH		700	5.5		4		H-2-59452	9.50E+01	2,000	SS	AMU	SW
E	TK-155	3BX feed - HNO3		425	4		4.5		H-2-63469	5.65E+01	1,200	SS	AMU	SW
E	TK-156	3AS feed - HNO3		425	4		4.5		H-2-63469	5.65E+01	1,200	SS	AMU	SW
E	TK-201	NaOH (not in service)		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-202	NaOH (not in service)		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-203	NaOH (not in service)		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-204	sugar makeup/feed		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	204	agitator		1 HP	0.58		6.3			1.64E+00	300		AMU	SW

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
E	TK-205	Al(NO3)3-9H2O		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	205	agitator		1 HP	0.58		6.3			1.64E+00	300		AMU	SW
E	TK-206	KOH feed		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	206	agitator		1 HP	0.58		10			2.60E+00	300		AMU	SW
E	TK-207	NaNO3		3000	8		8		CVI 7703	4.02E+02	4,300	SS	AMU	SW
E	TK-208	Na2CO3/KMnO4		3000	8		8		CVI 7703	4.02E+02	4,300	SS	AMU	SW
E	TK-209	1BX-FeSA/SA		3000	8		8		CVI 7703	4.02E+02	4,300	SS	AMU	SW
E	209	agitator		7.5 HP	2.17		10			3.69E+01	500		AMU	SW
E	TK-210	1BX-FeSA/SA		3000	8		8		CVI 7703	4.02E+02	4,300	SS	AMU	SW
E	210	agitator		7.5 HP	2.17		6.3			2.32E+01	300		AMU	SW
E	TK-211	3AS - HNO3		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	211	agitator		1 HP	0.58		6.3			1.64E+00	300		AMU	SW
E	TK-212	AFAN		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	212	agitator		1 HP	0.58		6.3			1.64E+00	300		AMU	SW
E	TK-213	2BX - HN N2H4		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	213	agitator		1 HP	0.58		6.3			1.64E+00	300		AMU	SW
E	TK-214	2BX - HN N2H4		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	214	agitator		1 HP	0.58		6.3			1.64E+00	300		AMU	SW
E	TK-215	57% HNO3		50	2		2.6		NA	8.17E+00	300	SS	AMU	SW
E	TK-216	FeSA		100	2		4		CVI 7703	1.26E+01	450	SS	AMU	SW
E	TK-217	N2H4		100	2		4		CVI 7703	1.26E+01	450	SS	AMU	SW
E	217	agitator		unk.	unk.		6.3			unk.	150		AMU	SW

Table 4-3. List of PUREX Equipment Sorted by Location. (21 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
E	TK-218	HN		100	2		4		CVI 7703	1.26E+01	450	SS	AMU	SW
E	TK-219	HN		100	2		4		CVI 7703	1.26E+01	450	SS	AMU	SW
E	TK-220	2NS - HNO3/FeSA/N2H4		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	220	agitator		3 HP	0.58		5.8			1.51E+00	300		AMU	SW
E	TK-220/221	N2H4 head/metering		3	0.5		2		NA	3.93E-01	50	G	AMU	SW
E	TK-221	2NS - HNO3/FeSA/N2H4		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	221	agitator		3 HP	0.58		5.8			1.51E+00	300		AMU	SW
E	TK-222	57% HNO3		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-223	demineralized H2O		5000	8		12		CVI 7933	6.03E+02	2,500	A	AMU	SW
E	TK-224	2PX - HNO3		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	224	agitator		1 HP	0.58		5			1.30E+00	300		AMU	SW
E	TK-224/225	HNO3 metering		3	2		3		NA	9.42E+00	50	G	AMU	SW
E	TK-225	2PX - HNO3		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	225	agitator		3 HP	0.58		6.5			1.69E+00	300		AMU	SW
E	TK-324	utility		3000	8		8		CVI 7703	4.02E+02	4,300	SS	AMU	SW

Notes:

E volume and/or mass are estimates

x data from CVI files

P data from blueprints

*Materials are:

A Aluminum

CS Carbon Steel

G Glass

SS Stainless Steel

Ti Titanium

Ta Tantalum

Diameter for cell agitators and pumps is assumed to be 3 ft unless dimensions are known.

Diameter for other agitators is for the impeller unless dimensions are known.

Height for cell agitators and pumps is for the shaft plus 4 feet to include the motor unless dimensions are known.

Height for other agitators and pumps is for the shaft unless dimensions are known.

on the far left of Table 4-3 shows the method used to develop weight and volume data. An "x" means the CVI file equals the source, a "P" indicates a blueprint, and an "E" represents an estimate. The CVI files were used because they were readily accessible, and could be reviewed without making copies. The only disadvantage is that without the as-built drawings there is no positive verification that the items described in the files are the items actually installed in the plant. Many of the CVI files specifically call out vessel or assembly weights, and therefore they were very useful.

The items not identified using prints or CVI files contain estimates based, where available, on information located in the PUREX Technical Manual (RHO 1983), and on known values for similar pieces of equipment. Dimensions obtained from the technical manual do not include flanges or connectors or support structures. The technical manual also does not provide equipment weights. An item by item inspection and consultation of prints would be necessary to support actual D&D work.

Table 4-3 also includes a listing of estimated waste types. All of the equipment is assumed to be nonhazardous a known hazardous component is present. This assumption is based on the goal of the current deactivation effort to minimize dangerous wastes. Hazardous (mixed) wastes include the dissolvers, which contain zirconium hulls and mercury thermowells, and the silver reactors, which contain silver salts. Nonradioactive, nonhazardous wastes are identified as solid waste (SW). Radioactive wastes have been classified according to the activities shown in Table 4-2 and using the definitions given in the Westinghouse Manual WHC-EP-0063-3, Table 4-1.

The equipment was first examined for transuranic (TRU) content. In this case, the curies of actinides and then the uranium plus plutonium content were examined to estimate the maximum nanocuries of TRU per gram of equipment. The estimate is conservative for two reasons. First, the use of data for 180-day-old fuel causes the activities to be higher than they actually are. Second, many actinides are not TRU elements, so use of the data for actinides also causes the estimates of TRU activity to be higher than they actually are. The uranium and plutonium average activities at 180 days are assumed to be 1.1E-06 curie per gram uranium and 3.45 curies per gram plutonium (Washenfelder 1993).

The next step in assigning a waste category was a comparison of the fission product data with the radionuclide concentration limits of WHC-EP-063-3 (Willis and Triner 1991). Since individual nuclides are not all known, fission products were assumed to be the same as strontium-90 to complete the comparison. This sort identified low-level waste (LLW)-1, LLW-3, and LLW>3 equipment. In addition, if examination showed a TRU item to also be category 3 or greater due to fission products, this was also noted. Such items were labeled "TRU-3," etc.

After assigning radioactive waste categories, items with associated dangerous wastes were identified, and the mixed waste (MW) label was added. At this point, all items with associated inventory data were labeled with a waste type.

The next step was to assign waste categories to the remaining equipment. This was accomplished using the following assumptions: all N Cell and Q Cell equipment was assumed to be TRU, except for the Q Cell AMU tanks, which were identified as SW. Pumps, agitators, and pulsers were assumed to be in the same category as the associated vessel. All other radioactive service items were assumed to be LLW-1. All nonradioactive service items were assumed to be nondangerous SW.

4.2.1 Miscellaneous Equipment

Table 4-4 lists miscellaneous equipment. Items on this list include: filters, steam and electric offgas heaters, centrifuges, and calciners. The volume and weight data are almost all the result of estimates, so these data are more likely to change upon refinement, as compared to data for other equipment. Of the 17 pieces of miscellaneous equipment, 2 are expected to be TRU (calciners from N Cell), with the balance being LLW-1. The total estimated volume is 11,100 cubic feet (ft^3) and the total estimated weight is 199,000 pounds (lb). Most items are stainless steel, except for one calciner, which is titanium. Many of the tanks contain internal heating or cooling coils. Many are also equipped with carbon steel supports.

4.2.2 Towers

Table 4-5 lists PUREX towers, including solvent exchange columns, silver reactors, scrubbers and absorbers, etc. Most of the PUREX towers are stainless steel. One tower is made of titanium and tantalum. As in the case of tanks, columns are frequently supported with carbon steel structures. In the case of the columns, these make up a significant framework around the equipment. Of the 32 towers, 17 are LLW-1, 9 are TRU, 3 are LLW-3, and 3 are low-level mixed waste (LLMW)>3. The MW units are the silver reactors which contain silver salts and ^{129}I. The total volume is 34,800 ft^3 and the total weight is 379,000 lb.

4.2.3 Tanks

Table 4-6 lists 195 tanks, which are located in the PUREX canyon, chemical and makeup tank areas, and support areas. While all of the major tanks have been identified, there could be more. (Some chemical tanks identified in the CVI files were not listed in the technical manual, and are not listed in Table 4-6. These may be out of service, or they may have been removed.) The tanks range in capacity from about 1 to 100,000 gallons. Most are stainless steel, with a few made of carbon steel, aluminum, glass or titanium. Tank waste types include 86 that are SW, 49 that are LLW-1, and 46 that are TRU. The balance are LLW-3, LLMW3, TRU-3, and transuranic mixed waste (TRUMW)-3. The total estimated volume is 252,000 ft^3 and the total estimated weight is 1.31 million lb. Items considered MW are the dissolvers, which contain zirconium hulls and mercury thermowells.

Table 4-4. List of Miscellaneous PUREX Equipment. (2 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
	PUREX Est. Inventory at Deactivation			Miscellaneous Equipment										
	Basis 180 day Mark IA Fuel (12% Pu-240)													
E	E-A2	off gas heater (steam)						H-2-52530	H-2-56678	1.00E+03	12,000	SS	A-Cell	LLW-1
E	F-A1	filter						H-2-52526	H-2-56989 CVI 8488	1.00E+03	12,000		A-Cell	LLW-1
E	H-A2	off gas heater (electric)							H-2-56676	1.00E+03	12,000	SS	A-Cell	LLW-1
E	E-B2	off gas heater (steam)						H-2-52530	H-2-56678	1.00E+03	12,000	SS	B-Cell	LLW-1
E	F-B1	filter (CVI 8488)						H-2-52526	H-2-52463 CVI 8488	1.00E+03	12,000		B-Cell	LLW-1
E	H-B2	off gas heater (electric)							H-2-56676	1.00E+03	12,000	SS	B-Cell	LLW-1
E	E-C2	off gas heater (steam)						H-2-52530	H-2-58514	1.00E+03	12,000	SS	C-Cell	LLW-1
E	F-C1	filter (CVI 8488)						H-2-52526	H-2-56989	1.00E+03	12,000		C-Cell	LLW-1
E	H-C2	off gas heater (electric)							H-2-56676	1.00E+03	12,000	SS	C-Cell	LLW-1
E	G-E2	coating waste centrifuge	12.2	180	5.0	-	3.2	H-2-53179	H-2-52995 CVI 8046	6.28E+01	1,000	SS	E-Cell	LLW-1
E	G-E4	coating waste centrifuge	12.2	125	4.6	-	3.2	H-2-53179	H-2-52995	5.32E+01	1,000	SS	E-Cell	LLW-1
E	E-F2	off gas heater (steam)							H-2-74408	1.00E+03	12,000		F-Cell	LLW-1
E	F-F1	filter (CVI 8488)						H-2-52527	H-2-56989	1.00E+03	12,000		F-Cell	LLW-1
	G-R3	stored centrifuge						H-2-53180	H-2-52995 CVI 8406		32,000		R-Cell	LLW-1
	G-R4	stored centrifuge						H-2-53180	H-2-52995 CVI 8406		32,000		R-Cell	LLW-1
E	CA-N9	first stage calciner	-	-	6.0	1.0	1.0			6.00E+00	500	Ti	N-Cell	TRU
E	CA-N10	second stage calciner	-	-	6.0	1.0	1.0			6.00E+00	500	SS	N-Cell	TRU
		number of items	17						TOTAL	1.11E+04	1.99E+05			

Table 4-4. List of Miscellaneous PUREX Equipment. (2 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Location	Est. Waste Type
Notes:								Summary:	LLW-1	TRU				
E	volume and/or mass are estimates								11,100 ft3	12 ft3				
x	data from CVI files								134,000 lb	1000 lb				
P	data from blueprints								15 items	2 items				
*Materials are:														
A	Aluminum													
CS	Carbon Steel													
G	Glass													
SS	Stainless Steel													
Ti	Titanium													
Ta	Tantalum													

Table 4-5. List of PUREX Towers. (3 sheets)

	Tower	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
	PUREX Est. Inventory at Deactivation													
	Basis 180 day Mark IA Fuel (12% Pu-240)													
P	T-A2	silver reactor (250 lb AgNO3)			11.8	8.5	16.6	H-2-63161	H-2-57337 CVI 7988	1.67E+03	15,500	SS	A-Cell	LLMW >3
P	T-B2	silver reactor (250 lb AgNO3)			11.8	8.3	16.3	H-2-52555	H-2-52467 CVI 7988	1.59E+03	15,500	SS	B-Cell	LLMW >3
P	T-C2	silver reactor (250 lb AgNO3)			11.8	8.5	16.6	H-2-63161	H-2-57337 CVI 7988	1.67E+03	15,500	SS	C-Cell	LLMW >3
						No. Items		3.0	subtotal	4.92E+03	4.65E+04			
P	T-A3-1 and T-A3-3	dissolver tower and ammonia scrubber unit			8.0	12.0	23.6	H-2-59135 H-2-59141	H-2-52468 H-2-59941 CVI 8286	2.27E+03	33,000	SS	A-Cell	LLW-1
P	T-B3-1 and T-B3-3	dissolver tower and ammonia scrubber unit			8.0	12.0	23.6	H-2-59135 H-2-59141	H-2-52468 H-2-59941 CVI 8286	2.27E+03	33,000	SS	B-Cell	LLW-1
P	T-C3-1 and T-C3-3	dissolver tower and ammonia scrubber unit			8.0	12.0	23.6	H-2-59135 H-2-59141	H-2-52468 H-2-59941 CVI 8286	2.27E+03	33,000	SS	C-Cell	LLW-1
E	T-E3-1	NH3 scrub tower						H-2-59942	H-2-59943	3.00E+02	18,000		E-Cell	LLW-1
E	T-F2	raschig rings)						H-2-65092	H-2-90166	1.67E+03	15,500	SS	F-Cell	LLW-1
E	T-F5	acid absorber	299	300				H-2-52535	CVI 8158	1.80E+03	6,000		F-Cell	LLW-1
x	T-G2	1O column	5	2,000	6.5	7.0	35.0	H-2-52542	CVI 8405	1.59E+03	19,025	SS	G-Cell	LLW-1
x	T-H3	HS column (bypassed)		1,770	7.2	6.8	27.9	H-2-58183	H-2-57486 CVI 8405	1.37E+03	15,300	SS/CS	H-Cell	LLW-1
		column cartridge							H-2-57768				H-Cell	LLW-1
E	T-J7	1C column	5	1,770	4.0	-	27.0	H-2-58968	H-2-58966	3.39E+02	1,500	SS/CS	J-Cell	LLW-1
		column cartridge							H-2-58900				J-Cell	LLW-1
E	T-J22	removeable?	0	150	0.6	-	33.6	H-2-59373	H-2-59355	8.98E+00	1,500		J-Cell	LLW-1

Table 4-5. List of PUREX Towers. (3 sheets)

	Tower	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
		column cartridge							H-2-59356				J-Cell	LLW-1
E	T-J23	removeable?	0	100	0.6	-	22.1	H-2-59373	H-2-59357	5.91E+00	1,500		J-Cell	LLW-1
		column cartridge							H-2-59358				J-Cell	LLW-1
x	T-K2	2D column	2	1,370	7.0	4.5	35.6	H-2-52545	CVI 8405	1.12E+03	12,000	SS	K-Cell	LLW-1
		column cartridge							H-2-58387				K-Cell	LLW-1
E	T-K3	2E column	5	1,770	4.0	-	27.0	H-2-52547	H-2-56480	3.39E+02	16,000	SS/CS	K-Cell	LLW-1
		column cartridge							H-2-58425				K-Cell	LLW-1
x	T-R2	2O column	1	2,000	7.0	4.5	30.9		CVI 8405	9.73E+02	18,825	SS	R-Cell	LLW-1
x	T-U6	fractionator	1,750	1,750	8.0	-	39.5		CVI 10170	1.99E+03	54,000	SS	U-Cell	LLW-1
E	T-XA	acid absorber	0	450	7.0	7.0	25.8		CVI 10702	1.27E+03	2,000	SS	293-A	LLW-1
E	T-XB	acid absorber	0	250							1,500		293-A	LLW-1
						No. Items		17.0	subtotal	1.96E+04	2.82E+05			
	T-H2	HA column	4	1,850	2.2	-	40.9	H-2-58483	H-2-58367	1.51E+02	18,000		H-Cell	LLW-3
		column cartridge							H-2-58377				H-Cell	LLW-3
x	T-J4	1BS column	1	130	11.5	7.3	21.9	H-2-64521	CVI 8405	1.82E+03	6,600	SS	J-Cell	LLW-3
		column cartridge							H-2-58936				J-Cell	LLW-3
E	T-J6	1BX column	5	1,600	6.0	6.0	34.0	H-2-62609	H-2-62609 CVI 8111	1.22E+03	4,400	SS	J-Cell	LLW-3
		column cartridge							H-2-62614				J-Cell	LLW-3
						No. Items		3.0	subtotal	3.20E+03	2.90E+04			
x	T-L1	2A column	0	130	11.6	7.7	42.6	H-2-52544	CVI 8405	3.77E+03	13,000	SS	L-Cell	TRU
x	T-L2	2B column	0	90	10.1	7.5	35.2	H-2-62624	H-2-52509 CVI 8405	2.66E+03	1,695	SS/CS	L-Cell	TRU
P		column cartridge			1.7	-	25.8		H-2-62627	5.64E+01	400	SS	L-Cell	TRU

Table 4-5. List of PUREX Towers. (3 sheets)

	Tower	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
P	T-L4	3A column	0	40	3.0	-	37.3		H-2-63609 H-2-63619	2.64E+02	2,246	SS	L-Cell	TRU
P	T-L5	3B column	0	30	3.0	-	26.4		H-2-63612 H-2-63613	1.87E+02	2,000	SS	L-Cell	TRU
P		column cartridge			1.3	-	25.0		H-2-63607	3.38E+01	135	SS	L-Cell	TRU
P	T-L6	product stripper	0	10	6.3	0.3	33.3		H-2-63615	6.93E+01	650	Ti/Ta	L-Cell	TRU
E	T-Q2	NP stripper column			0.5	5.0	12.6		H-2-59507	3.15E+01	450		Q-Cell	TRU
E	T-Q4	3X resin column		16							800		Q-Cell	TRU
						No. Items		9.0	subtotal	7.08E+03	2.14E+04			
						Total Items		32	Total	3.48E+04	3.79E+05			
			*Materials are:											
			A Aluminum											
			CS Carbon Steel											
			G Glass											
			SS Stainless Steel											
			Ti Titanium											
			Ta Tantalum											

Table 4-6. List of PUREX Tanks. (10 sheets)

	Tank	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
	PUREX Est. Inventory at Deactivation													
	Basis 180 day Mark IA Fuel (12% Pu-240)													
P	TK-A3	dissolver- (Zr heels)	1,830	5,000	10.8	10.8	23.8	H-2-75760	H-2-75760	2.76E+03	42,000	SS	A-Cell	TRUMW-3
P	TK-A3-4	NH3 scrub waste	17	2,100	6.6	11.8	15.7	H-2-59135	H-2-59136	1.22E+03	13,000	SS	A-Cell	LLW-1
P	TK-B3	dissolver- (Zr heels)	1,396	5,000	10.8	10.8	23.8	H-2-59131	H-2-67481	2.76E+03	42,000	SS	B-Cell	LLMW-3
P	TK-B3-4	NH3 scrub waste	17	2,100	6.6	11.8	15.7	H-2-59135	H-2-59937	1.22E+03	13,000	SS	B-Cell	LLW-1
P	TK-C3	dissolver- (Zr heels)	1,226	5,000	10.8	10.8	23.8	H-2-59926	H-2-67481	2.76E+03	42,000	SS	C-Cell	LLMW-3
P	TK-C3-4	NH3 scrub waste	17	2,100	6.6	11.8	15.7	H-2-59135	H-2-59136	1.22E+03	13,000	SS	C-Cell	LLW-1
x	TK-D1	metathesis storage	11	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	D-Cell	LLW-1
x	TK-D2	decladding waste	22	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	D-Cell	LLW-1
E	TK-D3/D4	metal solution	148	15,400	25.3	10.5	9.2	H-2-59668	H-2-59670	2.44E+03	33,000	SS	D-Cell	TRU-3
x	TK-D5	metal sol'n-recycle, no FP	44	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	D-Cell	TRU
x	TK-E1	centrifuge product	11	1,700	8.8	10.8	10.1	H-2-52522	H-2-52450 CVI 8024	9.58E+02	5,760	SS	E-Cell	LLW-3
x	TK-E3	centrifuge feed	45	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	E-Cell	LLW-3
E	TK-E3-2	NH3 scrub waste	6.3	250	3.2	-	6.2	H-2-59942	H-2-63810	4.86E+01	650		E-Cell	LLW-1
x	TK-E5	coating waste	297	5,000	10.8	-	10.2	H-2-94434	H-2-52521 CVI 8024	9.26E+02	11,125	SS	E-Cell	LLW-1
x	TK-E6	metal sol'n-recycle, no FP	21	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	E-Cell	TRU

Table 4-6. List of PUREX Tanks. (10 sheets)

	Tank	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
E	TK-F1	vessel vent condensate		65	1.0	-	10.0		-	7.85E+00	350		F-Cell	LLW-1
x	TK-F3	acid receiver	45	5,000	10.8	-	10.2	H-2-52521	H-2-65024 CVI 8024	9.26E+02	11,125	SS	F-Cell	LLW-1
x	TK-F4	vessel vent condensate		5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024		11,125	SS	F-Cell	LLW-1
E	TK-F7/F26	1WF	30	7,600	6.8	10.5	9.9	H-2-59976	H-2-59997	7.07E+02	10,000		F-Cell	LLW-1
x	TK-F8	waste rework		5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	F-Cell	LLW-1
x	TK-F10	3WF decanter	45	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	F-Cell	LLW-1
x	TK-F12	E-F11 feed	46	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	F-Cell	LLW-1
x	TK-F13	rework storage		5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	F-Cell	LLW-1
x	TK-F14	decanter (not useable)		400	5.3	5.5	6.6	H-2-52471	H-2-52528 CVI 7829	1.94E+02	1,900	SS	F-Cell	LLW-1
x	TK-F15	1WW denitration/ZAW	2	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	F-Cell	LLW-1
x	TK-F16	1WW denitration/NZAW	57	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	F-Cell	TRU-3
E	TK-F17	tube bundle flush		1,200	4.2	-	11.8		H-2-58647	1.63E+02			F-Cell	LLW-1
x	TK-F18	utility (sump) waste	56	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	F-Cell	TRU
x	TK-G1	1OF Solvent Washer	43	5,000	10.8	-	10.2	H-2-52523	H-2-52456 CVI 8024	9.26E+02	13,610	SS	G-Cell	LLW-3
x	TK-G2	1OS	22	1,900	8.8	10.8	10.1	H-2-52522	H-2-52450 CVI 8024	9.58E+02	5,760	SS	G-Cell	LLW-1
E	TK-G5	1OO - organic	55	15,000	16.0	10.5	14.0	H-2-52524	H-2-52457 CVI 8170	2.35E+03	33,000		G-Cell	LLW-1
x	TK-G6	1OD decanter		450	5.3	5.5	6.6	H-2-52471	H-2-52528 CVI 7829	1.94E+02	1,900	SS	G-Cell	LLW-1

Table 4-6. List of PUREX Tanks. (10 sheets)

	Tank	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
x	TK-G7	1OO pump tank		15,000	16.0	10.8	15.0	H-2-52524	H-2-52457 CVI 8170	2.59E+03	33,000	SS	G-Cell	LLW-1
x	TK-G8	1OW	434	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	G-Cell	LLW-3
x	TK-H1	HAF (TK-D2 spare)	45	5,000	10.8	-	10.2		H-2-52521 CVI 8024	9.26E+02	11,125	SS	H-Cell	TRU-3
x	TK-J1	3WB	45	5,000	10.8	-	10.2		H-2-52521 CVI 8024	9.26E+02	11,125	SS	J-Cell	LLW-1
E	TK-J2	miscellaneous storage		1,340	4.2	-	14.0	H-2-64600	H-2-59352	1.91E+02	4,000		J-Cell	LLW-1
x	TK-J3	1BXF	19	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	J-Cell	LLW-1
x	TK-J5	2AF	1	370	4.3	8.9	7.3	H-2-59968	H-2-59969 CVI 7829	2.74E+02	3,200	SS	J-Cell	LLW-3
E	TK-J21	2NF	1	320	4.6	-	14.2		H-2-64600	2.34E+02	1,000		J-Cell	LLW-1
x	TK-K1	2DF	45	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	K-Cell	LLW-3
x	TK-K5	2UC receiver		5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	K-Cell	LLW-1
x	TK-K6	UNH product	122	5,000	10.8	-	10.2	H-2-52521	H-2-52453 CVI 8024	9.26E+02	11,125	SS	K-Cell	LLW-1
P	TK-L3	3AF	11	120	2.8	-	14.1		H-2-63608 H-2-63622	8.81E+01	11,740	SS	L-Cell	TRU
P	TK-L8	product receiver	0	10	0.3	2.5	8.0	H-2-63621	H-2-64696	6.67E+00	65	SS/Ti	L-Cell	TRU
x	TK-L9	Pu product sampler	0.05	11	1.7	1.9	15.2		H-2-64696 CVI 8098	4.84E+01	300	SS	L-Cell	TRU
x	TK-L10	alternate PCP sampler		14	1.7	1.9	15.2		H-2-52475 CVI 8098	4.84E+01	300	SS	L-Cell	TRU
E	TK-L11	Pu recycle	0	25	0.3	3.2	11.7		H-2-61890	1.23E+01	500		L-Cell	TRU
E	TK-L13-10	Pu loadout		2.4	0.5	-	2.5		H-2-63116	4.12E-01	50		L-Cell	TRU
x	TK-M1	equipment decon.		4,100	10.8	10.8	14.9		H-2-52511 CVI 8332	1.73E+03	7,900	SS	M-Cell	LLW-1
x	TK-M2	equipment decon.		1,800	5.3	5.3	14.3		H-2-52512 CVI 7910	4.07E+02	3,800	SS	M-Cell	LLW-1

Table 4-6. List of PUREX Tanks. (10 sheets)

	Tank	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
E	TK-M3	Pu nitrate sol'n storage	1	55	0.5	3.5	14.0		-	2.45E+01	1,000		M-Cell	TRU
E	TK-M4	Pu nitrate sol'n storage	1	55	0.5	3.5	14.0		-	2.45E+01	1,000		M-Cell	TRU
E	TK-M5	Pu nitrate sol'n storage	1	55	0.5	3.5	14.0		-	2.45E+01	1,000		M-Cell	TRU
E	TK-M6	Pu nitrate sol'n storage	1	55	0.5	3.5	14.0		-	2.45E+01	1,000		M-Cell	TRU
E	TK-N3	Pu nitrate feed	0	3	0.5	-	3.1		-	6.00E-01	400		N-Cell	TRU
E	TK-N4	H2O2 feed tank	1	1	0.3	-	1.8		-	1.54E-01	150		N-Cell	TRU
E	TK-N5	prereduction tank	0	8	0.5	-	2.9		-	5.62E-01	500		N-Cell	TRU
E	TK-N6	pump tank	0	4	0.5	-	3.3		-	6.38E-01	400		N-Cell	TRU
E	TK-N7	precipitator	0	0.8	0.5	-	-		-	-	150		N-Cell	TRU
x	TK-N11	filtrate receiver	0	6.3	0.7	1.7	5.8		CVI 20686	6.39E+00	92	G/SS	N-Cell	TRU
x	TK-N12	vent seal pot		0.5	0.5	1.7	1.7		CVI 20699	1.41E+00	55	G/SS	N-Cell	TRU
x	TK-N13	filtrate concentrator		6	1.1	2.5	12.3		CVI 20687	3.36E+01	463	SS/Ti	N-Cell	TRU
x	TK-N15	filtrate holding tank	0	26	0.7	4.0	7.4		CVI 20688	1.97E+01	591	SS	N-Cell	TRU
x	TK-N16	filtrate holding tank	0	26	0.7	4.0	7.4		CVI 20688	1.97E+01	591	SS	N-Cell	TRU
x	TK-N19	offgas scrubber tank	0	2.6	0.9	1.7	7.8		CVI 20689	1.20E+01	310	SS	N-Cell	TRU
x	TK-N20	liquid seal tank		2.4	0.6	1.2	1.8		CVI 20690	1.22E+00	58	SS	N-Cell	TRU
x	TK-N21	condensate receiver tank	0	24	0.6	4.0	7.6		CVI 20691	1.78E+01	642	SS	N-Cell	TRU
x	TK-N22	condensate receiver tank	0	24	0.6	4.0	7.6		CVI 20691	1.78E+01	642	SS	N-Cell	TRU
E	TK-N24	seal liquid separator			0.5	-	1.6		-	3.19E-01	150		N-Cell	TRU
E	TK-N30	vacuum tank		6	0.5	-	-		-	-	100		N-Cell	TRU
E	TK-N33	closed lp cooling exp tk		2.1	0.5	-	-		H-2-65550	-	100		N-Cell	TRU
x	TK-N34	H2O2 holding tank		66.0	2.3	-	4.5		CVI 20694	1.92E+01	353	SS	N-Cell	TRU
E	TK-N35	Oxalic Acid Feed Tank	16	161	3.0	-	-		-	8.00E+01	700		N-Cell	TRU

Table 4-6. List of PUREX Tanks. (10 sheets)

	Tank	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Location	Est. Waste Type
E	TK-N36	Oxalic Acid Feed Tank	16	161	3.0	-	-		-	8.00E+01	700		N-Cell	TRU
x	TK-N38	1.2 M nitric acid head tank		13	1.1	1.5	4.3		CVI 20696	6.84E+00	319	SS	N-Cell	TRU
x	TK-N39	vacuum drop-out		12.25	0.6	1.1	9.6		CVI 20736	5.95E+00	282	SS	N-Cell	TRU
x	TK-N40	vacuum drop-out		12.25	0.6	1.1	9.6		CVI 20736	5.95E+00	282	SS	N-Cell	TRU
E	TK-N43	vacuum drop-out		3.3						2.00E+00	150		N-Cell	TRU
E	TK-Q1	2PN concentrator feed		12	0.6	-	6.0		H-2-59509	1.78E+00	280		Q-Cell	TRU
E	TK-Q3	3X feed		110	4.0	-	5.5		H-2-59511	7.06E+01	550		Q-Cell	TRU
E	TK-Q5	3XW waste		500	4.0	-	7.0		H-2-59512	8.80E+01	2,400		Q-Cell	TRU
E	TK-Q6	3XN receiver		25	1.5	-	2.0		H-2-59513	3.53E+00	550		Q-Cell	TRU
E	TK-Q7	Np product loadout		1.5	0.6	-	1.0		H-2-59514	2.42E-01	100		Q-Cell	TRU
E	TK-Q8	sump tank		46	2.0	-	2.2		H-2-59515	6.81E+00	550		Q-Cell	TRU
E	TK-Q11	cooling water pump tank		315	3.0	-	6.0		H-2-59566	4.24E+01	1,500		Q-Cell	TRU
E	TK-Q13	chemical addition		9	0.5	-	6.3		H-2-59726	1.23E+00	200		Q-Cell	TRU
E	TK-Q21	wash tank		21	1.5		2		H-2-59516	3.53E+00	500		AMU	SW
E	TK-Q22	wash tank		256	3.5		4			3.85E+01	1,000		AMU	SW
E	TK-Q23	resin add tank		11.9	1		2.1		H-2-59518	1.64E+00	280		AMU	SW
E	TK-Q24	NaNO2 add tank		58.1	1		2.5		H-2-59519	1.96E+00	350		AMU	SW
E	TK-Q25	ANN add tank		11.6	1		2		H-2-59520	1.57E+00	280		AMU	SW
E	TK-Q26	Fe(NH2SO3)2 add tank		11.6	1		2		H-2-59521	1.57E+00	280		AMU	SW
E	TK-Q27	N2H4 add tank		4.9	1		1		H-2-59521	7.85E-01	150		AMU	SW
E	TK-Q31	HNO3 rinse tank		15.1	1.2		2		H-2-59547	2.14E+00	300		AMU	SW
E	TK-R1	2OF Solvent Washer	40	5,000	10.0	-	10.7		H-2-52523 CVI 8332	8.41E+02	11,125	SS	R-Cell	TRU
E	TK-R2	2OX	5	1,900	7.0	-	10.0		H-2-52522 CVI 8151	3.85E+02	4,000	SS	R-Cell	LLW-1
E	TK-R5	utility		9,000	10.0	-	14.0		H-2-54171	1.10E+03	20,000		R-Cell	LLW-1
x	TK-R6	utility decanter		430	4.0	5.0	7.1		H-2-52528 CVI 7847	1.43E+02	2,100	SS	R-Cell	LLW-1
E	TK-R7	2OO - organic	0	9,000	10.0	-	14.0		H-2-54172	1.10E+03	20,000		R-Cell	LLW-1

Table 4-6. List of PUREX Tanks. (10 sheets)

	Tank	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
E	TK-R8	20W Batch Waste	1,673	5,100	10.0	-	10.7		H-2-54172 CVI 8151	8.41E+02	11,125	SS	R-Cell	LLW-1
E	TK-U1	50% HNO3 storage	55	15,000	11.3	16.8	15.5		H-2-52524 CVI 8151	2.95E+03	33,000	SS	U-Cell	LLW-1
E	TK-U2	50% HNO3 storage	67	15,000	11.3	16.8	15.5		H-2-52524 CVI 8151	2.95E+03	33,000	SS	U-Cell	LLW-1
x	TK-U3	U Cell Sump Waste	5,368	8,000	10.0	-	20.0		CVI 8690	1.57E+03	10,500	SS	U-Cell	LLW-3
x	TK-U4	U Cell Sump Waste	2,374	8,000	10.0	-	20.0		CVI 8690	1.57E+03	10,500	SS	U-Cell	LLW-3
x	TK-U5	fractionator feed	0	9,000	10.0	-	20.0		CVI 10170	1.57E+03	12,700	SS/CS	U-Cell	LLW-1
E	TK-U7	chlorine purge		90	2.0		4.0		H-2-56264	1.26E+01	500		U-Cell	LLW-1
E	TK-A3-A	dissolver drown (H2O)		3000	7.5		9		CVI 7704	3.98E+02	2,000	A	P&O	SW
E	TK-B3-A	dissolver drown (H2O)		3000	7.5		9		CVI 7704	3.98E+02	2,000	A	P&O	SW
E	TK-C3-A	dissolver drown (H2O)		3000	7.5		9		CVI 7704	3.98E+02	2,000	A	P&O	SW
E	TK-B1-A	25% caustic addition*		250	3		5		H-2-56226	3.53E+01	1,000	SS	P&O	SW
E	TK-C2-A	AgNO3 Addition*		40	1.5		3		NA	5.30E+00	250	SS	P&O	SW
x	TK-E2-A	centrifuge spray*		90	2.5	2.5	7.2		CVI 7703	4.48E+01	400	SS	P&O	SW
E	TK-E3-A	not used		160	3.3		2.7		NA	2.31E+01	700	SS	P&O	SW
E	TK-F15-XA-	antifoam addition*		60	2.1		2.2		NA	7.62E+00	300	SS	P&O	SW
E	TK-F15-XA-	not used		10	0.54		6		NA	1.37E+00	50	SS	P&O	SW
x	TK-G3-A	not used		90	2.5	2.5	7.2		CVI 7703	4.48E+01	400	SS	P&O	SW
x	TK-G5-A	caustic/nitrite		3000	8	8.5	13.5		CVI 8690	9.18E+02	4,000	SS	P&O	SW
E	TK-J6-A	not used		250	3		5.4		NA	3.82E+01	1,000	SS	P&O	SW
E	TK-J6-B	not used		250	3		5.4		NA	3.82E+01	1,000	SS	P&O	SW
E	TK-L3-A	3AF addition*		15	1.375		1.375		H-2-56603	2.04E+00	100	SS	P&O	SW
x	TK-L9-A	plutonium cell addition		20	2	12.1	6.5		CVI 7703	1.57E+02	200	SS	P&O	SW
x	TK-M1-A	M1 solution addition		725	5.5	5.0	9.75		CVI 8661	2.68E+02	1,400	SS	P&O	SW
x	TK-R1-A	organic blend addition		3000	8	8.5	13.5		CVI 7703	9.18E+02	4,000	SS	P&O	SW

Table 4-6. List of PUREX Tanks. (10 sheets)

	Tank	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
x	TK-R3-A	not used		90	2.5	2.5	7.2		CVI 7703	4.48E+01	400	SS	P&O	SW
x	TK-R5-A	organic treatment add.		3000	8	8.5	13.5		CVI 7703	9.18E+02	4,000	SS	P&O	SW
E	TK-N34-1	H2O2									100		SG	SW
E	TK-N35-1	(COOH)2-2H2O									100		SG	SW
E	TK-N36-1	(COOH)2-2H2O									100		SG	SW
x	TK-P1	UNH product	100	100,000	26.0	25.0	32.4		H-2-54805 CVI 8422	2.11E+04	37,923	SS	203-A	LLW-1
x	TK-P2	UNH product/now recovered	100	100,000	26.0	25.0	32.4		H-2-54805 CVI 8422	2.11E+04	37,923	SS	203-A	LLW-1
x	TK-P3	UNH product	100	100,000	26.0	25.0	32.4		H-2-54805 CVI 8422	2.11E+04	37,923	SS	203-A	LLW-1
x	TK-P4	UNH product	100	100,000	26.0	25.0	32.4		H-2-54805 CVI 8422	2.11E+04	37,923	SS	203-A	LLW-1
E	TK-P5	waste pump tank	4,000	4,000	9.0	-	9.0		-	5.73E+02	5,500		203-A	LLW-1
E	TK-P6	steam rework tank	50	14,000	10.0	16.0	14.0		H-2-58430	2.24E+03	20,000		203-A	LLW-1
E	TK-P13	recovered acid receiver	50	8,000	10.0	-	14.0		H-2-54895	1.10E+03	10,500		203-A	LLW-1
E	TK-P14	recovered acid receiver	50	8,000	10.0	-	14.0		H-2-54895	1.10E+03	10,500		203-A	LLW-1
E	TK-P15	recovered acid receiver	50	15,000	10.5	16.0	14.0		H-2-52524	2.35E+03	20,000		203-A	LLW-1
E	TK-10	50% Cd(NO3)2		4600	9.5		9.8		H-2-54803	6.95E+02	5,500	SS	211-A	SW
x	TK-11	AFAN		100000	25		33		H-2-60105 CVI 8422	1.62E+04	37,745	SS	211-A	SW
x	TK-12	57% HNO3		100000	25		33		H-2-54803 CVI 8422	1.62E+04	37,745	SS	211-A	SW
x	TK-20	50% NaOH		30000	15		26.7		H-2-54804 CVI 8422	4.71E+03	16,700	CS	211-A	SW
x	TK-21	45% KOH		30000	15		26.7		H-2-54804 CVI 8422	4.71E+03	16,700	CS	211-A	SW
x	TK-30	demin. H2O		50000	25		35.0		H-2-54804 CVI 8422	1.72E+04	10,000	A	211-A	SW

Table 4-6. List of PUREX Tanks. (10 sheets)

	Tank	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
x	TK-40	NPH		65000	22		27		H-2-54803 CVI 8422	1.03E+04	25,000	CS	211-A	SW
x	TK-41	TBP		30000	15		26.7		H-2-54803 CVI 8422	4.71E+03	16,000	CS	211-A	SW
E	TK-42	ANN		7850	10		14		H-2-60105	1.10E+03	10,500	SS	211-A	SW
E	TK-50	93% H2SO4		8400	8		24		H-2-58870	1.21E+03	10,500	CS	211-A	SW
E	TK-XC	acid receiver	45	5,000	11.0	-	11.2		H-2-57003 CVI 10649	1.07E+03	7,000	SS	293-A	LLW-1
E	TK-XD	acid receiver	45	2,300	9.0	10.0	10.2		H-2-57004 CVI 10648	9.21E+02	3,500	SS	293-A	LLW-1
x	TK-X10	50% H2O2 Tank		10,000	11.8	11.8	16.7		SK-2-52799 CVI 21070	2.33E+03	3,500	A	293-A	SW
x	TK-X11	50% H2O2 Tank		10,000	11.8	11.8	16.7		SK-2-52799 CVI 21070	2.33E+03	3,500	A	293-A	SW
x	TK-X12	50% H2O2 Tank		10,000	11.8	11.8	16.7		SK-2-52799 CVI 21070	2.33E+03	3,500	A	293-A	SW
x	TK-51	resin wash (inactive)		75	3.0	2.5	6.7		CVI 8285	5.00E+01	450	CS	AMU	SW
x	TK-101	ferrous sulfamate		750	6.0	6.0	7.6		H-2-59450 CVI 7703	2.73E+02	1,400	SS	AMU	SW
E	TK-101A	HNO3 to TK-101		55	1.9		2.8		NA	7.94E+00	350	SS	AMU	SW
x	TK-103	hydroxylamine nitrate		750	6.0	6.0	7.5		H-2-59450 CVI 7703	2.70E+02	1,900	SS	AMU	SW
x	TK-104	sodium nitrate		3000	8.5	8.5	14.3		CVI 7429	1.03E+03	4,300	CS	AMU	SW
E	TK-105	utility		3000	8.0		8.0		CVI 7703	4.02E+02	4,300	SS	AMU	SW
x	TK-106	sodium nitrite		750	7.0	7.0	7.8		CVI 7429	3.80E+02	2,000	CS	AMU	SW
x	TK-107	Na2CO3/KMnO4		3000	8.5	8.5	14.3		CVI 7703	1.03E+03	4,000	CS	AMU	SW
E	TK-108	utility		2700	6.5		11		H-2-59661	3.65E+02	4,000	SS	AMU	SW
E	TK-150	3BX/HNO3		700	5.5		4		H-2-59452	9.50E+01	2,000	SS	AMU	SW
E	TK-151	Cd(NO3)2		700	5.5		4		H-2-59452	9.50E+01	2,000	SS	AMU	SW
E	TK-152	NaNO2 feed		700	5.5		4		H-2-59452	9.50E+01	2,000	SS	AMU	SW

Table 4-6. List of PUREX Tanks. (10 sheets)

	Tank	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
E	TK-153	NaOH		700	5.5		4		H-2-59452	9.50E+01	2,000	SS	AMU	SW
E	TK-155	3BX feed - HNO3		425	4		4.5		H-2-63469	5.65E+01	1,200	SS	AMU	SW
E	TK-156	3AS feed - HNO3		425	4		4.5		H-2-63469	5.65E+01	1,200	SS	AMU	SW
E	TK-201	NaOH (not in service)		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-202	NaOH (not in service)		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-203	NaOH (not in service)		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-204	sugar makeup/feed		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-205	Al(NO3)3-9H2O		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-206	KOH feed		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-207	NaNO3		3000	8		8		CVI 7703	4.02E+02	4,300	SS	AMU	SW
E	TK-208	Na2CO3/KMnO4		3000	8		8		CVI 7703	4.02E+02	4,300	SS	AMU	SW
E	TK-209	1BX-FeSA/SA		3000	8		8		CVI 7703	4.02E+02	4,300	SS	AMU	SW
E	TK-210	1BX-FeSA/SA		3000	8		8		CVI 7703	4.02E+02	4,300	SS	AMU	SW
E	TK-211	3AS - HNO3		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-212	AFAN		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-213	2BX - HN N2H4		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-214	2BX - HN N2H4		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-215	57% HNO3		50	2		2.6		NA	8.17E+00	300	SS	AMU	SW

Table 4-6. List of PUREX Tanks. (10 sheets)

	Tank	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
E	TK-216	FeSA		100	2		4		CVI 7703	1.26E+01	450	SS	AMU	SW
E	TK-217	N2H4		100	2		4		CVI 7703	1.26E+01	450	SS	AMU	SW
E	TK-218	HN		100	2		4		CVI 7703	1.26E+01	450	SS	AMU	SW
E	TK-219	HN		100	2		4		CVI 7703	1.26E+01	450	SS	AMU	SW
E	TK-220	2NS - HNO3/FeSA/N2H4		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-220/221	N2H4 head/metering		3	0.5		2		NA	3.93E-01	50	G	AMU	SW
E	TK-221	2NS - HNO3/FeSA/N2H4		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-222	57% HNO3		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-223	demineralized H2O		5000	8		12		CVI 7933	6.03E+02	2,500	A	AMU	SW
E	TK-224	2PX - HNO3		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-224/225	HNO3 metering		3	2		3		NA	9.42E+00	50	G	AMU	SW
E	TK-225	2PX - HNO3		750	5		5		H-2-59450	9.82E+01	2,000	SS	AMU	SW
E	TK-324	utility		3000	8		8		CVI 7703	4.02E+02	4,300	SS	AMU	SW
		number of tanks	195						TOTAL	2.52E+05	1.31E+06			

*Materials are:

A Aluminum

CS Carbon Steel

G Glass

SS Stainless Steel

Ti Titanium

Ta Tantalum

4.2.4 Condensers, Reboilers, and Concentrators

Table 4-7 lists condensers, reboilers and concentrators. As in the case of the miscellaneous equipment, most of the weights and volumes are estimates. Most of the materials of construction have not been identified, although they are likely to be stainless steel. Once unit contains some titanium. Of the 20 pieces of equipment, 12 are LLW-1, 6 are TRU, 1 is LLW-1, and 1 is TRU-3. The total volume is 32,500 ft^3 and the total weight is 305,000 lb.

4.2.5 Pumps, Agitators, and Pulse Generators

Table 4-8 lists pumps, agitators, and pulse generators. Most of these items are stainless steel. The pumps and agitators are associated with process and chemical tanks. Pulse generators are associated with process columns (towers). Of the 161 items identified, 70 are LLW-1, 63 are SW, 13 are LLW-3, 10 are TRU, and 5 are TRU-3. The total volume is 10,800 ft^3 and the total weight is 182,000 lb.

4.2.6 Summary

Table 4-9 and Figures 4-1, 4-2, and 4-3 show summary information for PUREX operating equipment described above. Table 4-9 shows the plant total volume to be 341,000 ft^3 and the plant total weight to be 2.31 million lb for 425 items. Figure 4-1 shows that 55% of the volume is LLW-1, followed by 29 volume percent SW, 5% LLW-3, 4% for TRU, 3% for TRU-3, and 2% or less each for LLMW-3, LLMW>3, and TRUMW-3.

Figure 4-2 similarly shows the weight distribution for each waste category. In this case LLW-1 is 60 wt% and SW is 15 wt%, with 7% LLW-3, 6% TRU, 4% LLMW-3, 4% TRU-3, 2% LLMW>3, and 2% TRUMW-3.

The distribution by number of items shown in Figure 4-3 differs quite a bit from the volume and weight distributions; 39% of the items are LLW-1 and 35% are SW. These are followed by 17% for TRU, 6% for LLW-3, 2% for TRU-3, and 1% or less each for LLMW-3, LLMW>3, and TRUMW-3.

4.3 PIPING

The PUREX Plant has a large amount of piping. Process Piping is located primarily in the hot pipe trench and in the canyon cells.

The hot pipe trench contains an array of pipe headers that connect the process cells, permitting intercell solution transfers. The hot pipe trench also contains piping for transfers to and from cells to facilities external to PUREX. The pipe trench, which is parallel to the cells, is 30-ft deep and 12-ft wide at the top. The width narrows to 11-ft as the wall between the cells and the pipe trench widens from 1.5-ft to 2.5-ft. The wall between the process cells and the hot pipe trench supports one edge of the 3-ft-thick concrete blocks covering the cells and the 2.5-ft-thick blocks covering the

Table 4-7. List of PUREX Condensers, Reboilers, and Concentrators. (2 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
	PUREX Est. Inventory at Deactivation													
	Basis 180 day Mark IA Fuel (12% Pu-240)													
E	E-F1	condenser						H-2-63152	H-2-52480	1.00E+03	12,000		F-Cell	LLW-1
E	E-F5	condenser						H-2-52551	H-2-52480	1.00E+03	12,000		F-Cell	LLW-1
E	E-F9	condenser						H-2-52538	H-2-52481 CVI 8171	1.00E+03	12,000		F-Cell	LLW-1
E	E-F11-1	ASW concentrator	15	2,500	14.5	7.8	29.6	H-2-58101	H-2-58106	3.32E+03	30,000		F-Cell	LLW-1
		tube bundle (east)						H-2-52550	H-2-58755				F-Cell	
		concentrator tower						H-2-58101	H-2-66047				F-Cell	
		condenser						H-2-68231	H-2-62616				F-Cell	
		tube bundle (west)						H-2-52550	H-2-58755				F-Cell	
E	E-F6-1	1WW concentrator	113	2,200	14.5	7.8	36.5	H-2-58101	H-2-58106	4.10E+03	30,000		F-Cell	TRU-3
		tube bundle (east)						H-2-52550	H-2-72337				F-Cell	
		concentrator tower						H-2-58101	H-2-58104				F-Cell	
		concentrator deentrainer						H-2-57499	H-2-57499				F-Cell	
		tube bundle (west)						H-2-52550	H-2-58755				F-Cell	
E	E-F11 #4 spare concentrator (stored)							H-2-52532	H-2-56213 CVI 8158	3.32E+03	30,000		G-Cell	LLW-1
E	E-H4-1	3WB concentrator	113	2,700	15.0	8.5	29.6	H-2-58101	H-2-66104 H-2-66046	3.77E+03	30,000		H-Cell	LLW-1
		tube bundle (east)						H-2-52550	H-2-94422				H-Cell	
		concentrator tower						H-2-58101	H-2-58102				H-Cell	
E	E-H4-2	condenser						H-2-52551	H-2-52480	1.00E+03	12,000		H-Cell	LLW-1
		tube bundle (west)						H-2-52550	H-2-94422				H-Cell	
E	E-J8-1	1CU concentrator	113	3,700	14.0	-	29.8	H-2-58101	H-2-52478 H-2-66104	4.58E+03	35,000		J-Cell	LLW-3
		tube bundle (east)						H-2-52550	H-2-59114				J-Cell	LLW-3
		concentrator tower T-J8						H-2-58101	H-2-58102				J-Cell	LLW-3
E	E-J8-2	condenser						H-2-52551	H-2-52480	1.00E+03	12,000		J-Cell	LLW-1
		tube bundle (west)						H-2-52550	H-2-59114				J-Cell	LLW-1
E	E-K4-1	2EU concentrator	9	3,700	14.0	-	28.0	H-2-52532	H-2-52477 CVI 8158	4.31E+03	35,000		K-Cell	LLW-1

Table 4-7. List of PUREX Condensers, Reboilers, and Concentrators. (2 sheets)

	Vessel	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Location	Est. Waste Type
		tube bundle (east)						H-2-52550	H-2-59114				K-Cell	LLW-1
E	E-K4-2	condenser						H-2-52551	H-2-52480	1.00E+03	12,000		K-Cell	LLW-1
		tube bundle (west)						H-2-52550	H-2-52453				K-Cell	LLW-1
E	E-L6	condenser						H-2-63615	H-2-63615	1.00E+03	12,000		L-Cell	TRU
P	E-L7-1	product concentrator	0	10	5.8	0.3	29.6	H-2-63618	H-2-63615	5.68E+01	600	SS/Ti	L-Cell	TRU
E	E-L7-2	condenser						H-2-63618	H-2-56742	1.00E+03	12,000		L-Cell	TRU
E	E-N13	filtrate concentrator	0	7.1						4.00E+01	450		N-Cell	TRU
E	E-Q2	stripper concentrator		10	0.5	4.2	27.6		H-2-59506	5.74E+01	800		Q-Cell	TRU
E	E-Q9	vent jet condenser		12							800		Q-Cell	TRU
x	E-U6-1	condenser			7.2	7.0	7.0		CVI 10170	3.51E+02	2,500	SS	U-Cell	LLW-1
x	E-U6-2	reboiler			5.3	11.2	5.6		CVI 10170	3.27E+02	13,500	SS	U-Cell	LLW-1
		number of items	20						TOTAL	3.22E+04	3.05E+05			

*Materials are:
A Aluminum
CS Carbon Steel
G Glass
SS Stainless Steel
Ti Titanium
Ta Tantalum

Diameter for cell agitators and pumps is assumed to be 3 ft unless dimensions are known.
Diameter for other agitators is for the impeller unless dimensions are known.
Height for cell agitators and pumps is for the shaft plus 4 feet to include the motor unless dimensions are known.
Height for other agitators and pumps is for the shaft unless dimensions are known.

Table 4-8. List of Pumps, Reboilers, and Pulse Generators. (6 sheets)

	Item	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
	PUREX Est. Inventory at Deactivation													
	Basis 180 day Mark IA Fuel (12% Pu-240)													
E	D1	agitator		10 HP	3.0		12.5			8.84E+01	2,250	SS	D-Cell	LLW-1
x	D2	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	D-Cell	LLW-1
x	D3	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	D-Cell	TRU-3
x	D4	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	D-Cell	TRU-3
x	D5	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	D-Cell	TRU
E	P-D5	pump		3 HP	3.0		13.4			9.47E+01	1,500	SS	D-Cell	TRU
x	E1	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	E-Cell	LLW-3
x	E3	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	E-Cell	LLW-3
x	E5	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	E-Cell	LLW-1
x	E6-1	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	E-Cell	TRU
x	E6-2	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	E-Cell	TRU
x	F3	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	F-Cell	LLW-1
E	P-F3	pump		10 HP	3.0	-	13.4			9.47E+01	1,400		F-Cell	LLW-1
E	F26	agitator		15 HP	3.0		12.5			8.84E+01	2,250		F-Cell	LLW-1
E	P-F7	pump		10 HP	3.0	-	13.4			9.47E+01	1,400		F-Cell	LLW-1
E	F8	agitator		15 HP	3.0		12.5			8.84E+01	1,400		F-Cell	LLW-1
x	F10	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	F-Cell	LLW-1
E	P-F10	pump		10 HP	3.0	-	13.4			9.47E+01	1,400		F-Cell	LLW-1
x	F12	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	F-Cell	LLW-1
E	P-F12	pump		10 HP	3.0	-	13.4			9.47E+01	1,400		F-Cell	LLW-1
x	F13	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	F-Cell	LLW-1
E	P-F13	pump		3 HP	3.0	-	13.4			9.47E+01	1,400		F-Cell	LLW-1
x	F15	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	F-Cell	LLW-1
x	F16	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	F-Cell	TRU-3
x	F18	agitator		10 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	F-Cell	TRU
x/E		pulse generator			3.5	2.7	7.0	H-2-53178	CVI 7335	6.53E+01	950	SS	G-Cell	LLW-1
E	P-G1-1	pump		10 HP	3.0		13.4			9.47E+01	1,400		G-Cell	LLW-3
E	P-G1-2	pump		10 HP	3.0		10.8			7.63E+01	1,400		G-Cell	LLW-3
E	P-G2	pump		3 HP	3.0		13.4			9.47E+01	1,400		G-Cell	LLW-1
x	G5-1	agitator		15 HP	3.9		17.4		CVI 8097	2.05E+02	2,400	SS	G-Cell	LLW-1
x	G5-2	agitator		15 HP	3.9		17.4		CVI 8097	2.05E+02	2,400	SS	G-Cell	LLW-1
E	P-G5-1	pump		5 HP	3.0		18.1			1.28E+02	1,400		G-Cell	LLW-1

Table 4-8. List of Pumps, Reboilers, and Pulse Generators. (6 sheets)

	Item	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
E	P-G5-2	pump		5 HP	3.0		18.1			1.28E+02	1,400		G-Cell	LLW-1
E	P-G5-3	pump		5 HP	3.0		18.1			1.28E+02	1,400		G-Cell	LLW-1
x	G7-1	agitator		15 HP	3.9		17.4		CVI 8097	2.05E+02	2,400	SS	G-Cell	LLW-1
x	G7-2	agitator		15 HP	3.9		17.4		CVI 8097	2.05E+02	2,400	SS	G-Cell	LLW-1
E	P-G7-1	pump		5 HP	3.0		9.4			6.64E+01	1,400		G-Cell	LLW-1
E	P-G7-2	pump		5 HP	3.0		9.4			6.64E+01	1,400		G-Cell	LLW-1
E	P-G7-3	pump		5 HP	3.0		18.1			1.28E+02	1,400		G-Cell	LLW-1
x	G8	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	G-Cell	LLW-3
x/E		pulse generator PG-K2			3.5	2.7	7.0	H-2-53178	CVI 7335	6.53E+01	950	SS	H-Cell	LLW-3
x	H1	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	H-Cell	TRU-3
E	P-H1	pump		3 HP	3.0		13.4			9.47E+01	1,400		H-Cell	TRU-3
E		pulser PG-K3 (hot spare?)						H-2-53178	CVI 7335	6.53E+01	950		H-Cell	LLW-1
E		pulser 2 PG-J4							H-2-56910	6.53E+01	950		J-Cell	LLW-3
x/E		pulser PG-J2			3.5	2.7	7.0	H-2-53178	CVI 7335	6.53E+01	950	SS	J-Cell	LLW-3
E	T-J7	1C column	5	1,770	4.0	-	27.0	H-2-58968	H-2-58966	3.39E+02	1,500	SS/CS	J-Cell	LLW-1
x/E		pulser 3 PG-G2			3.5	2.7	7.0		CVI 7335	6.53E+01	950	SS	J-Cell	LLW-1
E		pulser 3 PG-J4						H-2-58402	H-2-56360	6.53E+01	950		J-Cell	LLW-1
E		pulser PG-J23						H-2-58402	H-2-59351	6.53E+01	950		J-Cell	LLW-1
x	J1	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	J-Cell	LLW-1
E	P-J1	pump		3 HP	3.0		13.4			9.47E+01	1,400		J-Cell	LLW-1
E	P-J2	pump		7.5 HP	3.0		18.1			1.28E+02	1,400		J-Cell	LLW-1
x	J3	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	J-Cell	LLW-1
E	P-J3	pump		10 HP	3.0		13.4			9.47E+01	1,400		J-Cell	LLW-1
E	P-J5	pump		1.5 HP	3.0		12.8			9.05E+01	1,400		J-Cell	LLW-3
E	P-J21	pump		1.5 HP	3.0		18.5			1.31E+02	1,400		J-Cell	LLW-1
x/E		pulse generator 6 PG-G2			3.5	2.7	7.0	Atomics Int'l.	CVI 7335	6.53E+01	950	SS	K-Cell	LLW-1
x/E		pulse generator PG-H2			3.6	2.7	7.0	H-2-53178	CVI 7335	6.72E+01	950	SS	K-Cell	LLW-1
x	K1	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	K-Cell	LLW-3
E	P-K1	pump		3 HP	3.0		13.4			9.47E+01	1,400		K-Cell	LLW-3
x	K5	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	K-Cell	LLW-1
x	K6	agitator		15 HP	3.9		12.6		CVI 8097	1.48E+02	2,250	SS	K-Cell	LLW-1
E	P-K6	pump		10 HP	3.0		13.4			9.47E+01	1,400		K-Cell	LLW-1

Table 4-8. List of Pumps, Reboilers, and Pulse Generators. (6 sheets)

	Item	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Location	Est. Waste Type
E		pulser PG-J4						H-2-53177	H-2-56910 CVI 7335	6.53E+01	950		L-Cell	TRU
E		pulser PG-L2						H-2-53177	H-2-56910 CVI 7335	6.53E+01	950		L-Cell	TRU
E	P-G7-2	pump		3 HP	3.0		16.7			1.18E+02	1,400		L-Cell	TRU
x	Q21	agitator		0.25 HP	0.8		3.9		CVI 12490	2.14E+00	90	SS	AMU	SW
x	Q22	agitator		0.33 HP	0.8		6.2		CVI 12490	3.38E+00	100	SS	AMU	SW
x/E		pulser PG-R2			3.6	2.7	7.0	H-2-53178	CVI 7335	6.72E+01	950	SS	R-Cell	LLW-1
E	P-R1-1	pump		10 HP	3.0		13.2			9.33E+01	1,400		R-Cell	TRU
E	P-R1-2	pump		10 HP	3.0		13.2			9.33E+01	1,400		R-Cell	TRU
E	P-R2	pump		3 HP	3.0		10.7			7.56E+01	1,400		R-Cell	LLW-1
E	R5	agitator		15 HP	3.0		18.0			1.27E+02	1,400		R-Cell	LLW-1
x	P-R5-1	pump			4.5	1.5	1.6		CVI 7931	1.11E+01	505	SS	R-Cell	LLW-1
E	P-R5-1-1	pump									505		R-Cell	LLW-1
E	R7	agitator		15 HP	3.0		18.0			1.27E+02	2,250		R-Cell	LLW-1
E	P-R5-2	pump									505		R-Cell	LLW-1
x	P-R5-3	pump			3.8	1.0	1.6		CVI 7931	6.31E+00	505	SS	R-Cell	LLW-1
x	P-R5-4	pump			3.8	1.0	1.6		CVI 7931	6.31E+00	505	SS	R-Cell	LLW-1
x	R8	agitator		7.5 HP	3.9		12.4		CVI 7515	1.49E+02	1,050	SS	R-Cell	LLW-1
E	U1	agitator		15 HP	3.0		17.5			1.24E+02	2,250		U-Cell	LLW-1
E	P-U1-1	pump		10 HP	3.0	14.0	18.0			1.27E+02	1,400		U-Cell	LLW-1
E	P-U1-2	pump		10 HP	3.0	14.0	18.0			1.27E+02	1,400		U-Cell	LLW-1
E	U2	agitator		15 HP	3.0		17.5			1.24E+02	2,250		U-Cell	LLW-1
E	P-U2-1	pump		10 HP	3.0		18.0			1.27E+02	1,400		U-Cell	LLW-1
E	P-U2-2	pump		10 HP	3.0		18.0			1.27E+02	1,400		U-Cell	LLW-1
E	U3	agitator		15 HP	3.0		18.0			1.27E+02	2,250		U-Cell	LLW-3
E	U4	agitator		15 HP	3.0		18.0			1.27E+02	2,250		U-Cell	LLW-3
E	P-U5-1	pump			3.0						1,400		U-Cell	LLW-1
E	P-U5-2	pump			3.0						1,400		U-Cell	LLW-1
E	U7	agitator		0.33 HP	0.3		4.9			4.28E-01	150		U-Cell	LLW-1
E	P-U8-1	pump									500		U-Cell	LLW-1
E	P-U8-2	pump									500		U-Cell	LLW-1
x	E2A	agitator		0.5 HP	1.45		6.5		CVI 7515	1.07E+01	169	SS	P&O	SW
E	P-E2-A	pump									150		P&O	SW

Table 4-8. List of Pumps, Reboilers, and Pulse Generators. (6 sheets)

	Item	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
x	G3A	agitator		0.5 HP	1.45		6.5		CVI 7515	1.07E+01	169	SS	P&O	SW
E	P-G3-A	pump									150		P&O	SW
E	G5A	agitator		7.5 HP	0.33		10.5			9.16E-01	1,500		P&O	SW
E	M1A	agitator		1 HP	0.50		6.3			1.24E+00	300		P&O	SW
E	R1A	agitator		7.5 HP	2.17		10			3.69E+01	1,500		P&O	SW
x	R3A	agitator		0.5 HP	1.45		6.5		CVI 7515	1.07E+01	169	SS	P&O	SW
E	P-R3-A	pump								1.00E+01	150		P&O	SW
E	R5A	agitator		7.5 HP	2.17		10			3.69E+01	1,500		P&O	SW
x	P-P1	pump			4.2	1.3	1.5		CVI 8368	7.65E+00	600	SS	203-A	LLW-1
E	P-P3	pump								7.65E+00	600		203-A	LLW-1
E	P-13-1	pump								7.65E+00	600		203-A	LLW-1
E	P-13-2	pump								7.65E+00	600		203-A	LLW-1
E	P-13-3	pump								7.65E+00	600		203-A	LLW-1
E	P-15	pump								7.65E+00	600		203-A	LLW-1
E	P-10	pump								7.65E+00	600		211-A	SW
x	P-11-1	pump			5.6	2.0	3.2		CVI 8388	3.55E+01	1,010	SS	211-A	SW
x	P-11-2	pump			5.6	2.0	3.2		CVI 8388	3.55E+01	1,010	SS	211-A	SW
E	P-11-3	pump								3.55E+01	1,010		211-A	SW
E	P-11-4	pump								3.55E+01	1,010		211-A	SW
x	P-12-1	pump			4.5	1.5	1.6		CVI 7931	1.11E+01	505	SS	211-A	SW
x	P-12-2	pump			4.5	1.5	1.6		CVI 7931	1.11E+01	505	SS	211-A	SW
x	P-20	pump			4.6	1.5	3.2		CVI 8388	2.26E+01	700	SS	211-A	SW
x	P-21-1	pump			3.8	1.0	1.4		CVI 8368	5.27E+00	465	SS	211-A	SW
x	P-21-2	pump			3.8	1.0	1.4		CVI 8368	5.27E+00	465	SS	211-A	SW
E	P-21	pump								5.27E+00	465		211-A	SW
x	P-30-1	pump			4.0	1.6	2.5		CVI 8517	1.57E+01	1,295	SS	211-A	SW
x	P-30-2	pump			4.0	1.6	2.5		CVI 8517	1.57E+01	1,295	SS	211-A	SW
x	P-40-1	pump			5.6	2.0	3.2		CVI 8388	3.55E+01	1,010	SS	211-A	SW
x	P-40-2	pump			4.0	1.3	1.4		CVI 8368	7.03E+00	530	SS	211-A	SW
x	P-41-1	pump			4.6	1.5	3.0		CVI 8388	2.12E+01	610	SS	211-A	SW
E	P-41-1	pump								2.12E+01	600		211-A	SW
x	P-50	pump			4.6	1.5	3.0		CVI 8388	2.12E+01	610	SS	211-A	SW
E	P-51	pump								2.12E+01	610		211-A	SW
E	101	agitator		1 HP	0.50		6.3			1.24E+00	200		AMU	SW
x	P-101	pump			4.25	1.3	1.6		CVI 7931	8.74E+00	513	SS	AMU	SW

Table 4-8. List of Pumps, Reboilers, and Pulse Generators. (6 sheets)

	Item	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Loca-tion	Est. Waste Type
E	103	agitator		1 HP	0.50		6.3			1.24E+00	200		AMU	SW
x	P-103	pump			4.25	1.3	1.6		CVI 7931	8.74E+00	513	SS	AMU	SW
	104	agitator		7.5 HP	2.17		10.1			3.72E+01	600		AMU	SW
x	P-104	pump			4.0	1.3	1.4		CVI 8368	7.03E+00	530	SS	AMU	SW
E	105	agitator		7.5 HP	2.17		10.1			3.72E+01	600		AMU	SW
x	P-105	pump			4.4	1.5	1.6		CVI 8368	1.06E+01	775	SS	AMU	SW
	106	agitator		1 HP	0.50		6.3			1.24E+00	300		AMU	SW
x	P-106	pump			4.0	1.3	1.4		CVI 8368	7.03E+00	525	SS	AMU	SW
	107	agitator		7.5 HP	2.17		10.1			3.72E+01	600		AMU	SW
x	P-107	pump			4.4	1.5	1.6		CVI 8368	1.06E+01	775	SS	AMU	SW
E	108	agitator		5 HP	2.17		12			4.42E+01	500		AMU	SW
E	P-108	pump								1.06E+01	775		AMU	SW
E	150	agitator		3 HP	0.58		4.3			1.12E+00	300		AMU	SW
E	P-150	pump								4.42E+01	500		AMU	SW
E	151	agitator		3 HP	0.58		4.3			1.12E+00	300		AMU	SW
E	P-151	pump								4.42E+01	500		AMU	SW
E	204	agitator		1 HP	0.58		6.3			1.64E+00	300		AMU	SW
E	205	agitator		1 HP	0.58		6.3			1.64E+00	300		AMU	SW
E	206	agitator		1 HP	0.58		10			2.60E+00	300		AMU	SW
E	209	agitator		7.5 HP	2.17		10			3.69E+01	500		AMU	SW
E	210	agitator		7.5 HP	2.17		6.3			2.32E+01	300		AMU	SW
E	211	agitator		1 HP	0.58		6.3			1.64E+00	300		AMU	SW
E	212	agitator		1 HP	0.58		6.3			1.64E+00	300		AMU	SW
E	213	agitator		1 HP	0.58		6.3			1.64E+00	300		AMU	SW
E	214	agitator		1 HP	0.58		6.3			1.64E+00	300		AMU	SW
E	217	agitator		unk.	unk.		6.3			1.00E+01	150		AMU	SW
E	220	agitator		3 HP	0.58		5.8			1.51E+00	300		AMU	SW
E	221	agitator		3 HP	0.58		5.8			1.51E+00	300		AMU	SW
E	224	agitator		1 HP	0.58		5			1.30E+00	300		AMU	SW
E	225	agitator		3 HP	0.58		6.5			1.69E+00	300		AMU	SW
		number	161						TOTAL	1.08E+04	1.82E+05			
			*Materials are:											
			A Aluminum											
			CS Carbon Steel											

Table 4-8. List of Pumps, Reboilers, and Pulse Generators. (6 sheets)

Item	Function	Vol. (gal)	Capacity (gal)	Diameter or width (ft)	Length (ft)	Height (ft)	As Built	Constr. Drawing	Volume (ft3)	Est. Weight (lb)	Mat'l*	Location	Est. Waste Type
		G Glass											
		SS Stainless Steel											
		Ti Titanium											
		Ta Tantalum											
		Diameter for cell agitators and pumps is assumed to be 3 ft unless dimensions are known.											
		Diameter for other agitators is for the impeller unless dimensions are known.											
		Height for cell agitators and pumps is for the shaft plus 4 feet to include the motor unless dimensions are known.											
		Height for other agitators and pumps is for the shaft unless dimensions are known.											

Table 4-9. Summary of PUREX Operating Equipment.

Volume (ft3)						
Waste Type	Misc. Equip.	Towers	Tanks	Condensers, Reboilers, etc	Pumps, Agitators, Pulsers	Total
LLW-1	1.11E+04	1.96E+04	1.30E+05	2.14E+04	6.65E+03	1.89E+05
LLW-3		3.20E+03	8.08E+03	4.85E+03	1.40E+03	1.75E+04
LLMW-3			5.51E+03			5.51E+03
LLMW>3		4.92E+03				4.92E+03
TRU	1.20E+01	7.08E+03	4.47E+03	2.15E+03	1.12E+03	1.48E+04
TRU-3			4.29E+03	4.10E+03	6.89E+02	9.08E+03
TRUMW-3			2.76E+03			2.76E+03
SW			9.71E+04		8.95E+02	9.80E+04
TOTAL	1.11E+04	3.48E+04	2.52E+05	3.25E+04	1.08E+04	3.41E+05
Weight (lb)						
Waste Type	Misc. Equip.	Towers	Tanks	Condensers, Reboilers, etc	Pumps, Agitators, Pulsers	Total
LLW-1	1.34E+05	2.82E+05	6.63E+05	2.13E+05	9.94E+04	1.39E+06
LLW-3		2.90E+04	7.69E+04	3.50E+04	2.20E+04	1.63E+05
LLMW-3			8.40E+04			8.40E+04
LLMW>3		4.65E+04				4.65E+04
TRU	1.00E+03	2.14E+04	7.58E+04	2.67E+04	1.66E+04	1.42E+05
TRU-3			5.53E+04	3.00E+04	1.04E+04	9.57E+04
TRUMW-3			4.20E+04			4.20E+04
SW			3.15E+05		3.35E+04	3.49E+05
TOTAL	1.35E+05	3.79E+05	1.31E+06	3.05E+05	1.82E+05	2.31E+06
Number of Items						
Waste Type	Misc. Equip.	Towers	Tanks	Condensers, Reboilers, etc	Pumps, Agitators, Pulsers	Total
LLW-1	15	17	49	12	70	163
LLW-3		3	8	1	13	25
LLMW-3			2			2
LLMW>3		3				3
TRU	2	9	46	6	10	73
TRU-3			3	1	5	9
TRUMW-3			1			1
SW			86		63	149
TOTAL	17	32	195	20	161	425

Figure 4-1. Waste Type Volume Distribution.

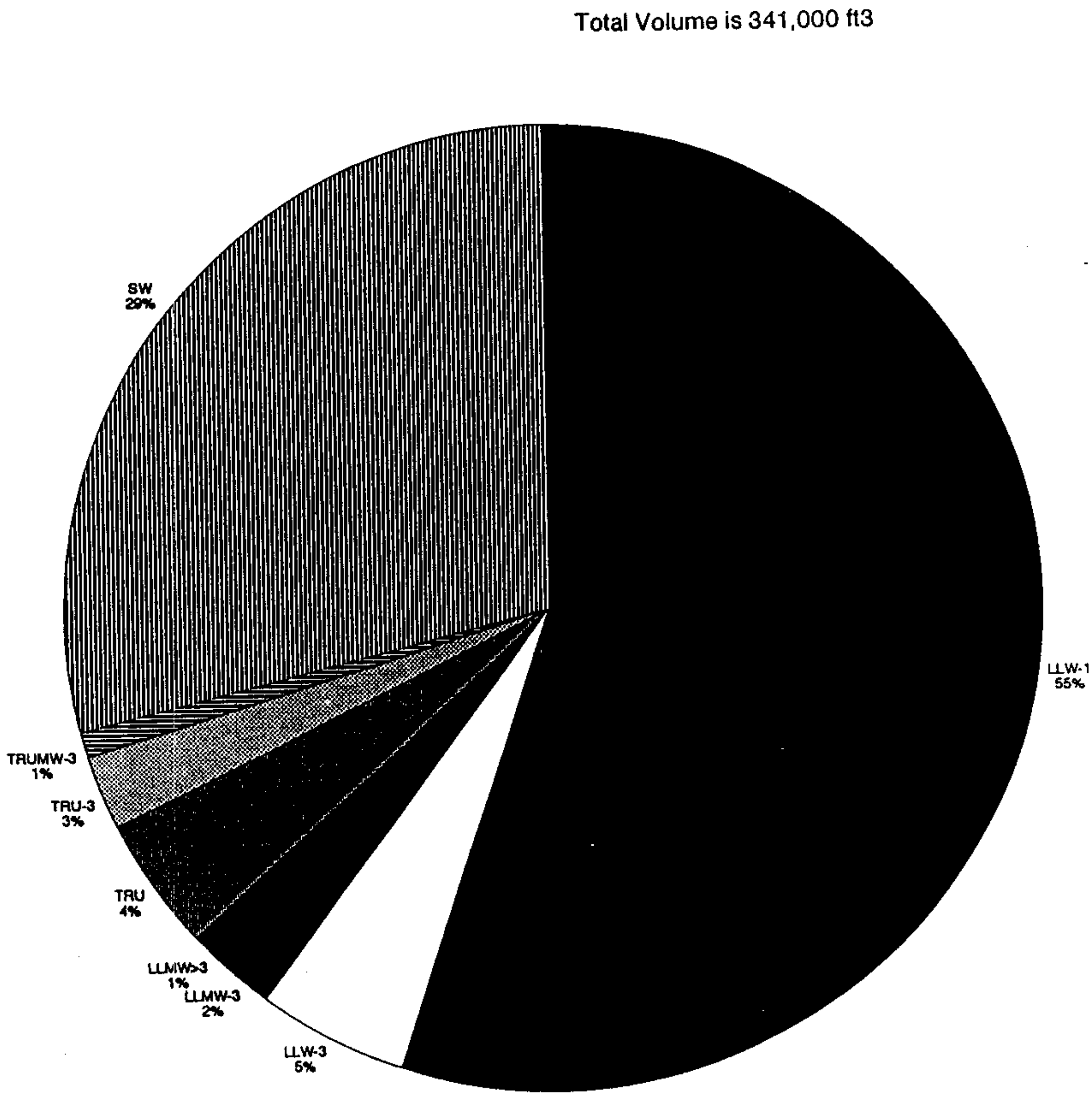


Figure 4-2. Waste Type Weight Distribution.

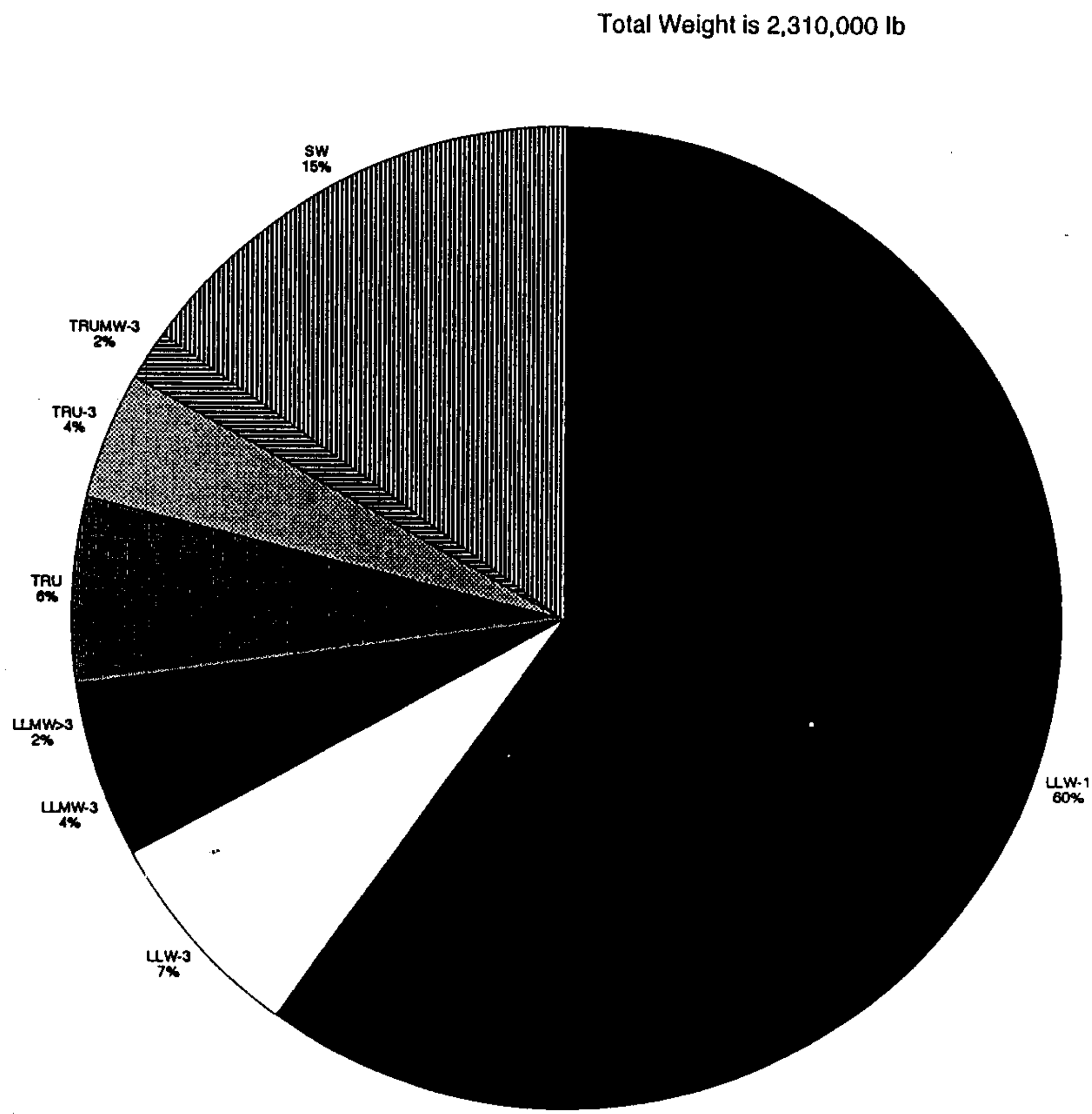
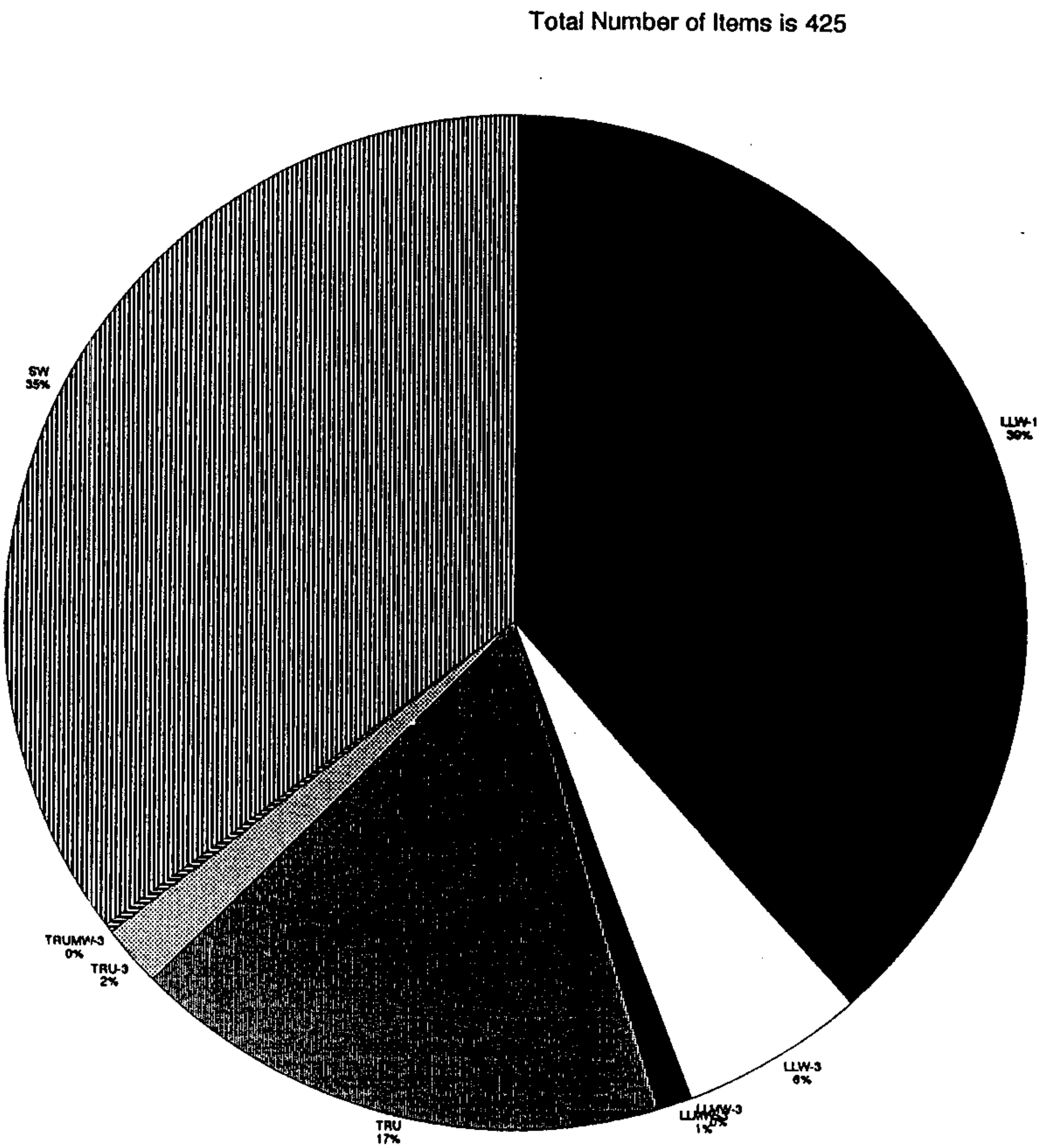


Figure 4-3. Waste Type Item Distribution.



trench (RHO 1983). The hot pipe trench contains primary and three spare piping systems.

The arrangement of pipes in the hot pipe trench is shown in drawings H-2-53101 through H-2-53157. Each drawing shows the piping for a certain area and elevation. The area is measured in "columns" along the length of the plant. The hot pipe trench occupies space in columns 5 through 43. (The drawings divide these into 14 sets of prints.) The piping is installed in layers, with individual pipes changing elevation as well.

Time restraints and the complexity of the piping did not permit an estimate based on measurements for all the pipes. The estimate of piping length and mass are based on evaluation for columns 41 through 43, which are at the east end of the Plant. For these columns, the horizontal length for each pipe was determined from the drawings. The vertical length of the pipes was estimated by subtracting the changes in elevation when the pipe was observed in more than one layer. The results of this effort are located in Table 4-10. This tables shows a total of 291 ft of 2 in. pipe, 150-ft of 3-in. pipe, 222-ft of 4-in. pipe, 38-ft of 6-in. pipe, and 111-ft of 8-in. pipe. The specifications for this piping are located in HWS-5500, which shows pipes 6-in. smaller to be Schedule 40S and pipes 8-in. and larger to be Schedule 10S.

The pipe volume and weight were then estimated using the outside and inside diameter for these types of pipe (Crane 1973), and the density of type 304L stainless steel (Perry 1973). These calculations are also shown in Table 4-10. The results show 98 ft^3 of piping weighing nearly 7,000 lb in columns 41-43.

The piping in columns 41 through 43 is generally less extensive and complex than in the other columns. Table 4-11 shows a listing of the other sets of columns comprising the hot pipe trench and the factor used to estimate their relative complexity and extent of piping versus columns 41 through 43. These factors were assigned after a brief visual inspection of the piping drawings, and are subjective. The sum of the factors is 40, resulting in a total piping estimate for the hot pipe trench of 3,900 ft^3 of pipe and total weight of 280,000 lb. The majority of the piping will likely be classified LLW-1.

This estimate contains a significant uncertainty, since only one set of columns was analyzed and because the set analyzed was among the least complicated. Improvements would likely result from analyzing a few more set of columns. The hot pipe trench contains at least 108 pipe supports, which are not included in the volume or weight. Mr. Bob Campbell, of Kaiser Engineers Hanford, also indicated that there are also about 20 jumpers located in the hot pipe trench, which are not included in the total estimated weight and volume.

Additional piping is located in the process cells. Short intracell transfers between adjacent pieces of equipment are made by direct jumper connections within the cell. Longer transfers require jumpers to the process cell/pipe trench wall. The jumpers are manufactured precisely to fit both nozzles on the cell wall and equipment connections. Jumpers are equipped with

Table 4-10. Estimate of PUREX Piping Based on Columns 41-43. (6 sheets)

Piping Estimate - Columns 41-43										
Reference Drawings for Hot Pipe Trench: H-2-53101 to H-2-53157										
Pipe ID	Diameter (in)	Horizontal (ft)	Elevation (ft)	Vertical (ft)	Total (ft)	Total 2"	Total 3"	Total 4"	Total 6"	Total 8"
A014(3)-4"-UD	4	2.3	714.0	0.0	2.3					
A014(3)-4"-UD	4	0.0	710.5	3.5	3.5					
A014(3)-4"-UD	4	0.0	707.7	2.8	2.8					
A014(3)-4"-UD	4	0.0	705.3	2.3	2.3					
A014(3)-4"-UD	4	17.8	703.0	2.3	20.1			31.1		
A014(2)-4"-UD	4	2.3	714.0	0.0	2.3					
A014(2)-4"-UD	4	0.0	710.5	3.5	3.5					
A014(2)-4"-UD	4	0.0	707.7	2.8	2.8					
A014(2)-4"-UD	4	0.0	705.3	2.3	2.3					
A014(2)-4"-UD	4	19.6	703.0	2.3	21.9			32.9		
A014(1)-4"-UD	4	2.3	714.0	0.0	2.3					
A014(1)-4"-UD	4	0.0	710.5	3.5	3.5					
A014(1)-4"-UD	4	0.0	707.7	2.8	2.8					
A014(1)-4"-UD	4	0.0	705.3	2.3	2.3					
A014(1)-4"-UD	4	14.0	703.0	2.3	16.3			27.3		
A095-3"-P	3	0.0	714.0	0.0	0.0					
A096-3"-P	3	32.6	714.0	0.0	32.6					
A097-3"-P	3	34.3	714.0	0.0	34.3		66.8			
T026-3"-P	3	0.0	714.0	0.0	0.0					
T026-3"-P	3	0.0	710.5	3.5	3.5					
T026-3"-P	3	0.0	707.7	2.8	2.8					
T026-3"-P	3	0.0	705.3	2.3	2.3					
T026-3"-P	3	17.8	703.0	2.3	20.1		28.8			
A017-2"-P	2	22.1	707.7	0.0	22.1					
A017-2"-P	2	0.0	705.3	2.3	2.3					

Table 4-10. Estimate of PUREX Piping Based on Columns 41-43. (6 sheets)

Piping Estimate - Columns 41-43										
Reference Drawings for Hot Pipe Trench: H-2-53101 to H-2-53157										
Pipe ID	Diameter (in)	Horizontal (ft)	Elevation (ft)	Vertical (ft)	Total (ft)	Total 2"	Total 3"	Total 4"	Total 6"	Total 8"
A017-2"-P	2	1.8	703.0	2.3	4.2	28.6				
A018-2"-P	2	29.5	707.7	0.0	29.5					
A018-2"-P	2	0.0	705.3	2.3	2.3					
A018-2"-P	2	1.8	703.0	2.3	4.2	36.0				
D005-2"-P	2	27.4	707.7	0.0	27.4					
D005-2"-P	2	0.0	705.3	2.3	2.3					
D005-2"-P	2	1.8	703.0	2.3	4.2	33.9				
F309-3"-P	3	17.5	705.3	0.0	17.5					
F309-3"-P	3	2.7	703.0	2.3	5.0		22.5			
A001-8"-E	8	43.5	703.0	0.0	43.5					43.5
A001(4)-8"-E	8	4.8	703.0	0.0	4.8					
A001(4)-8"-E	8	0.0	699.5	3.5	3.5					
A001(4)-8"-E	8	15.7	695.8	3.8	19.4					27.8
A001(3)-4"-E	4	0.0	703.0	0.0	0.0					
A001(3)-4"-E	4	0.0	699.5	3.5	3.5					
A001(3)-4"-E	4	10.0	695.8	3.8	13.8			17.3		
A001(2)-4"-E	4	0.0	703.0	0.0	0.0					
A001(2)-4"-E	4	0.0	699.5	3.5	3.5					
A001(2)-4"-E	4	10.0	695.8	3.8	13.8			17.3		
A001(1)-4"-E	4	0.0	703.0	0.0	0.0					
A001(1)-4"-E	4	0.0	699.5	3.5	3.5					
A001(1)-4"-E	4	10.0	695.8	3.8	13.8			17.3		

Table 4-10. Estimate of PUREX Piping Based on Columns 41-43. (6 sheets)

Piping Estimate - Columns 41-43										
Reference Drawings for Hot Pipe Trench: H-2-53101 to H-2-53157										
Pipe ID	Diameter (in)	Horizontal (ft)	Elevation (ft)	Vertical (ft)	Total (ft)	Total 2"	Total 3"	Total 4"	Total 6"	Total 8"
A006-2"-UD	2	3.4	703.0	0.0	3.4					
A006-2"-UD	2	16.2	699.5	3.5	19.7	23.1				
A020-2"-P	2	1.8	703.0	0.0	1.8	1.8				
A020-3"-P	3	0.0	699.5	3.5	3.5					
A020-3"-P	3	22.5	695.8	3.8	26.3		29.8			
A021-4"-UD	4	3.4	703.0	0.0	3.4					
A021-4"-UD	4	11.7	699.5	3.5	15.2			18.6		
A066-2"-P	2	3.5	703.0	0.0	3.5	14.3				
A066-2"-P	2	7.3	699.5	3.5	10.8					
A083-2"-UD	2	3.4	703.0	0.0	3.4					
A083-2"-UD	2	19.6	699.5	3.5	23.1	26.5				
A084-4"-UD	4	2.7	703.0	0.0	2.7					
A084-4"-UD	4	13.1	699.5	3.5	16.6			19.3		
A127-2"-P	2	4.3	703.0	0.0	4.3	4.3				
B001-8"-E	8	7.5	703.0	0.0	7.5					7.5
B001(4)-4"-E	4	0.0	703.0	0.0	0.0					
B001(4)-8"-E	8	0.0	699.5	3.5	3.5					3.5
B001(3)-4"-E	4	0.0	703.0	0.0	0.0					
B001(3)-4"-E	4	0.0	699.5	3.5	3.5			3.5		

Table 4-10. Estimate of PUREX Piping Based on Columns 41-43. (6 sheets)

Piping Estimate - Columns 41-43

Reference Drawings for Hot Pipe Trench: H-2-53101 to H-2-53157

Pipe ID	Diameter (in)	Horizontal (ft)	Elevation (ft)	Vertical (ft)	Total (ft)	Total 2"	Total 3"	Total 4"	Total 6"	Total 8"
B001(2)-4"-E	4	0.0	703.0	0.0	0.0					
B001(2)-4"-E	4	0.0	699.5	3.5	3.5			3.5		
B001(1)-4"-E	4	0.0	703.0	0.0	0.0					
B001(1)-4"-E	4	0.0	699.5	3.5	3.5			3.5		
B068-2"-P	2	8.9	703.0	0.0	8.9	8.9				
B114-2"-E	2	3.8	703.0	0.0	3.8	3.8				
5001(4)-8"-E	8	28.9	703.0	0.0	28.9					28.9
7518-2"-P	2	17.6	703.0	0.0	17.6					
7518-2"-P	2	4.0	699.5	3.5	7.5	25.1				
A116-2"-E	2	0.0	699.5	0.0	0.0					
A116-2"-E	2	0.0	695.8	3.8	3.8	3.8				
C006-2"-UD	2	22.8	699.5	0.0	22.8	22.8				
C021-4"-UD	4	14.0	699.5	0.0	14.0			14.0		
C083-2"-UD	2	20.5	699.5	0.0	20.5	20.5				
C084-4"-UD	4	16.5	699.5	0.0	16.5			16.5		
7702-6"-P	6	38.0	699.5	0.0	38.0				38.0	
7703-3"-P	3	2.3	699.5	0.0	2.3		2.3			

Table 4-10. Estimate of PUREX Piping Based on Columns 41-43. (6 sheets)

Piping Estimate - Columns 41-43										
Reference Drawings for Hot Pipe Trench: H-2-53101 to H-2-53157										
Pipe ID	Diameter (in)	Horizontal (ft)	Elevation (ft)	Vertical (ft)	Total (ft)	Total 2"	Total 3"	Total 4"	Total 6"	Total 8"
8066-2"-P	2	3.0	699.5	0.0	3.0	3.0				
8114-2"-E	2	0.0	699.5	0.0	0.0					
8114-2"-P	2	0.0	695.8	3.8	3.8	3.8				
A151-2"-P	2	31.0	695.8	0.0	31.0	31.0				
					Total 2"	291				
					Total 3"		150			
					Total 4"			222		
					Total 6"				38	
					Total 8"					111

Table 4-10. Estimate of PUREX Piping Based on Columns 41-43. (6 sheets)

Piping Estimate - Columns 41-43										
Reference Drawings for Hot Pipe Trench: H-2-53101 to H-2-53157										
Pipe ID	Diameter (in)	Horizontal (ft)	Elevation (ft)	Vertical (ft)	Total (ft)	Total 2"	Total 3"	Total 4"	Total 6"	Total 8"
Calculation of piping weight										
Density Type 304L SS=		0.29	lb/cubic inch							
Pipe	OD (in)	ID (in)	Vol Pipe (in3)	Vol Metal (in3)	lb					
2" Schedule 40S	2.375	2.067	15479	3754	1089					
3" Schedule 40S	3.5	3.068	17337	4016	1165					
4" Schedule 40S	4.5	4.026	42353	8452	2451					
6" Schedule 40S	6.625	6.065	15719	2545	738					
8" Schedule 10S	8.625	8.329	77941	5258	1525					
		Total	168829	24026	6967					
		Total Vol (ft3)	97.7	13.9						

Table 4-11. Estimate of Total Piping for All Columns.

Area	Multiplication Factor	Support Frames
Columns 41-43	1	1 through 6
Columns 39-41	2	7 through 14
Columns 36-39	2	15 through 22
Columns 33-36	3	23 through 31
Columns 31-33	3	32 through 38
Columns 28-31	4	39 through 46
Columns 26-28	4	47 through 54
Columns 23-26	4	55 through 62
Columns 20-23	3	63 through 70
Columns 17-20	3	71 through 79
Columns 14-17	3	80 through 86
Columns 10-14	3	87 through 95
Columns 7-10	3	96 through 102
Columns 5-7	2	103 through 108
Total	40	108 piping support frames
Total Estimated Pipe Volume		3,908 ft^3
Total Estimated Weight		278,697 lb

counterweights, as needed, so that they can be installed with a crane. (The original counterweights were made of lead.) Replacement jumpers manufactured in recent years, however, have steel counterweights in recognition of waste minimization activities that seek to reduce the amount of lead that might require disposal. Approximately 3,000 jumpers of various sizes are located in the PUREX canyon. An estimate of the total volume and weight of jumpers was not available as this report was being completed.

Additional pipes are used to carry chemicals in the chemical tank farms, AMU and product storage areas. Process piping is made of stainless steel. Utility piping, such as for raw water, is made of carbon steel.

4.4 SOLID WASTE REMOVAL AND CELL INTEGRITY

The PUREX canyon is approximately 1,000-ft long and is divided into 12 remote cells. The cell floors consist of 5-ft of reinforced concrete plus 1-ft of "sacrificial" concrete (grout) on top. Two cells, L and M, have stainless steel liners, as does part of A cell.

Over the years acid solutions have leaked to floors. The solutions drain to sumps and are jetted or vacuum transferred to various tanks for recycle/disposal.

Photographs and videotapes of cell floors show conditions ranging from no corrosion in cell G to extensive corrosion in parts of F and J cells. Based on "crud" removal during past cell cleanup operations, an estimated 2 to 5-in. of grout could be eaten through in some places.

In addition to cell floor degradation, PUREX dissolver cells A, B, and C contain some N Reactor fuel elements that could not be retrieved after they were inadvertently spilled to the floor during dissolver charging operations. Most of the spilled fuel was retrieved immediately following the spillage. However, because some of the fuel could not be retrieved without removing most of the equipment in the cell, it was left for future retrieval efforts. Accountability records indicate that these fuel elements contain 240 kilograms of 0.95% enriched uranium and 17.3 kilograms of depleted uranium (WHC 1993).

A recent inspection of the fuel was performed to determine the condition and location of the fuel. The video tape of the inspection showed that the fuel condition varied from little or no evidence of degradation to evidence that the fuel cladding had obviously been breached. The fuel was shown to be situated in various locations that are not accessible unless most of the canyon equipment is removed from the cell. Therefore, the proposed plan for recovery and disposition of this fuel is to remove the dissolver cell equipment one cell at a time, recover the fuel using a special crane-operated recovery tool, package the fuel in canisters, and transfer the fuel back to 105-K west basin for storage (WHC 1993).

The fuel from all three dissolver cells will be combines so only one cask shipment to the K west basin will be required. Following retrieval of the fuel, the dissolver cell equipment will be placed into the cell. Failed equipment will either be stored in the dissolver cell or transferred to the number 2 PUREX storage tunnel. Jumpers will be replaced when possible, but failed jumpers possible, but failed jumpers will be placed in a burial box liner for storage in PUREX storage tunnel (WHC 1993).

5.0 APPLICABILITY TO OTHER CANYON-TYPE FACILITIES

The deactivation and decontamination and decommissiong (D&D) of the Plutonium-Uranium Extraction (PUREX) Plant will provide a model for similar activities at other facilities. The facilities with the greatest similarities to PUREX include the H and F Canyon Facilities at Savannah River Site, which also use a PUREX process, and the Idaho Chemical Processing Plant, which uses another solvent extraction process. Although these four facilities differ in their size, capacity, and specific chemistry (due to plant specific feed fuel constituents, cladding, and the final product produced), the experience gained at PUREX will provide a substantial knowledge base for the subsequent deactivation and D&D of these facilities.

In addition to the aforementioned fuel reprocessing facilities, which use a solvent extraction process, there are many other canyon reprocessing facilities that have similarities to PUREX. The PUREX Plant has three semi-distinct operating areas: the head end, where fuel elements were chemically declad and the irradiated fissile materials dissolved; solvent extraction, where the dissolved fuel was separated and purified; and the N Cell area, where purified plutonium was either loaded out as nitrate solution or transformed into an oxide. Although other canyon facilities, such as B Plant, U Plant, and the Reduction-Oxidation Plant at Hanford, did not use a solvent extraction process, there are commonalities with the head end and tail end of the PUREX process. While reprocessing operations are, of necessity, fuel specific, the lessons learned at PUREX will be applicable to the future deactivation and D&D of these facilities.

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6.0 REFERENCES

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APPENDIX A

GENERAL PUREX PROCESS

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APPENDIX A

GENERAL PUREX PROCESS

To understand the discussion of individual items that are potential candidates for decontamination and decommissioning, it is necessary to have a general idea of the processes in which these items were used and the products they produced.

The Plutonium-Uranium Extraction (PUREX) Plant process was designed for the individual separation of uranium, plutonium, neptunium, and fission products present in irradiated fuel elements. The constituents were separated and purified using a solvent extraction process utilizing an organic phase tributyl phosphate dissolved in a normal paraffin hydrocarbon and a nitric acid (HNO_3) aqueous phase. The separation and purification were accomplished by controlling the relative phase distribution of the desired constituents between the organic and aqueous phases.

A1.0 PUREX PRODUCTS

During the operating life of the PUREX Plant, the following products were produced:

- Weapons grade plutonium
- Fuel grade plutonium
- Deplete uranium
- Slightly enriched uranium
- Neptunium-237
- Thorium.

A1.1 PLUTONIUM PRODUCTS

The initial plutonium product was in the form of a plutonium nitrate - HNO_3 solution containing approximately 350 grams plutonium per liter and approximately 7 Molar HNO_3. The plutonium nitrate-HNO_3 product was loaded into product recovery cans and transported to the Plutonium Finishing Plant for conversion to metal or oxide. In the 1977 to 1981 time frame, a plutonium nitrate to oxide conversion process was installed in N Cell. The conversion process was employed to produce plutonium oxide (PuO_2). The plutonium products were used in weapon production or in the breeder reactor program based upon the isotopic content of the plutonium involved.

A1.2 URANIUM PRODUCTS

The uranium product was recovered in the form of a uranyl nitrate solution containing approximately 4.2 pounds uranium per gallon with a HNO_3 concentration of <0.1 pound HNO_3/gallon. The plutonium content was <10 parts per billion uranium. The uranium-235 content ranged from depleted to a slight enrichment of 2.1 percent. The uranium product solution was shipped to Building 244-U, located in the 200 West Area, for calcination to uranium trioxide (UO_3). The oxide product was subsequently shipped offsite for future use as a nuclear fuel product.

A1.3 NEPTUNIUM PRODUCT

The neptunium-237 product was produced in the form of a nitrate-HNO_3 solution with a neptunium concentration of approximately 40 grams neptunium per liter and a HNO_3 concentration of <0.3 Molar HNO_3. Initially, the neptunium nitrate solution was shipped to the Savannah River Plant for use in the production of plutonium-238 oxide. Later, a nitrate to oxide conversion process was designed to produce neptunium oxide. However, this conversion process was never used.

A1.4 THORIUM PRODUCT

A thorium process flowsheet was developed in 1965, modified after a PUREX Plant process test, and used for thorium processing campaigns in 1966 and 1970.

A2.0 PUREX PROCESSING UNITS

The overall PUREX Plant process consisted of seven fundamental processing units that interfaced with each other. These seven processing units are as follows:

- Feed preparation
- Solvent extraction separation and purification
- Solvent treatment
- Backcycle waste system
- Acid recovery
- Waste treatment
- Offgas treatment.

An eighth processing unit was added to N Cell to convert the plutonium nitrate product solution to a PuO_2 product. The following section describes the PUREX process as it was conducted in the 1970's and 1980's.

A2.1 FEED PREPARATION

In the original feed preparation process for aluminum-clad fuel, the fuel elements were declad with a sodium hydroxide solution, containing sodium nitrate to suppress formation of hydrogen gas. After rinsing the bare metal fuel elements, two or more dissolution cuts were taken with HNO_3. The number of dissolution cuts depended on the total metal inventory remaining in the dissolver. The individual cuts or batches of the resulting uranyl nitrate solution were then transferred to feed storage tanks. The feed was clarified by batch centrifugalizing. After clarification, the dissolved metal solution was chemically adjusted to assure reasonably uniform HNO_3 and uranyl nitrate concentrations and then used as feed for the solvent extraction system.

The PUREX Plant was later modified to handle the reprocessing of fuel elements from N Reactor, which are uranium metal with a zircaloy cladding. In this process, properly aged N Reactor fuel elements in the canisters were charged (dumped) to dissolvers. To remove the Zircaloy cladding from the fuel elements, the Zirflex process was used. This process employs a boiling solution of ammonium fluoride and ammonium nitrate to dissolve the cladding. Potassium hydroxide was then used to convert uranium and plutonium fluoride compounds to hydrated oxides (metathesis). The cladding waste, metathesis waste, and rinse solutions were then centrifuged to remove solid uranium and plutonium compounds. These compounds were metathesized (if required) and/or dissolved in HNO_3. The resulting acid solution was then blended with the feed.

A2.2 SOLVENT EXTRACTION SEPARATION AND PURIFICATION

Pulsed solvent extraction columns were employed in the PUREX process to effect the decontamination necessary to produce acceptable products. A number of cycles made up the total solvent extraction process.

A2.2.1 Codecontamination Cycle (No Neptunium Recovery)

In this cycle, the uranium and plutonium were extracted into an organic solvent to separate them from the bulk of the fission products, the americium, the neptunium, and the curium that remain in the aqueous stream. The organic solvent used was a 30 volume percent tributyl phosphate extractant in hydrocarbon diluent. The aqueous waste stream was concentrated, partially denitrated, made alkaline, and stored in underground storage tanks.

A2.2.2 Partition Cycle (No Neptunium Recovery)

The uranium-plutonium organic solvent stream was then contacted in a partitioning column with an aqueous countercurrent stream containing a chemical reducing agent. This caused the plutonium to transfer into the aqueous phase, thus to be contained in the stream leaving the bottom of the column. This aqueous product solution entered the scrub column where it was scrubbed with fresh organic solvent to remove residual uranium. This solution was then routed to the second plutonium cycle. The bulk of the uranium remained in the organic solvent stream that flowed out the top of the partitioning column.

The exiting organic stream was then fed to another column where the uranium was stripped countercurrently from the organic phase into a dilute aqueous HNO_3 stream. The stripped organic solvent was treated in the organic recovery system and was reused in the process.

The exiting aqueous uranium product stream was fed to the tower of a steam-heated concentrator, where it was concentrated by a factor of 7 to 8. The concentrator was designed and operated to remove, by steam-stripping, entrained organic solvent that might have entered with the product stream. This prevented accumulation of an organic phase in the concentrator and reduced the possibility of formation of potentially explosive "red oil," a complex of nitrated degraded solvent with uranium or other heavy metals. The process condensate stream was recycled as makeup water for various solvent-extraction streams.

A2.2.3 Second and Third Plutonium Cycles

The plutonium stream was processed through a second extraction and stripping cycle for continued purification from uranium, fission products, and other metallic impurities. A third plutonium cycle further reduced the fission products and other metallic impurities to complete the purification of the plutonium product.

The product stream was also steam-stripped to remove residual organic solvent and to reduce the probability of the red oil formation. The product stream was then concentrated to product level concentration and transferred to storage tanks where it was sampled, analyzed, and held. The product could then be converted into PuO_2 or transported to the Plutonium Finishing Plant for conversion to metal or oxide.

The overhead process condensates from the stripper and concentrator, normally containing only trace amounts of plutonium, were routed to the third plutonium cycle feed tank for rework and recovery.

A2.2.4 Plutonium Oxide Production

The plutonium nitrate solution was converted to PuO_2 by precipitating the plutonium as oxalate, which was then calcined to produce oxide. The PuO_2 then went to a blender, where it was thoroughly mixed and sampled. If the sample analyses indicated that the PuO_2 met product specifications, it was transferred to the canning operation; if not, it was returned for recycling through the second stage calciner or the plutonium oxide rework (dissolution) facility. The final product was chemically and radiolytically stable.

Can filling operations were remotely controlled. The cans were weighed, filled, the slip-lid placed on the can, and the filled can weighed. The can lid was then tape sealed. After tape sealing, the can was bagged out and placed into a second can, which was sealed by a commercial can-sealing machine. The can assembly was sent by conveyor to a final canning location where the assembly was loaded into a third can. The third can was then labeled, sealed, and the can assembly placed into a shipping container for transfer to storage.

A2.2.5 Final Uranium Cycle

The concentrated uranium product solution from the partition cycle was adjusted as feed for the final uranium cycle. This cycle provided final decontamination from plutonium and fission products, and consists of extraction into the organic phase followed by stripping back into the aqueous phase. The uranium product solution was steam stripped to remove residual organic solution, concentrated, transferred to 203-A for interim storage, and then shipped to the Uranium-Trioxide Plant.

The final uranium concentration step included essentially the same elements as described previously for the partition cycle uranium stream, except that the relatively uncontaminated process condensate was sent to an underground crib for final disposal instead of being recycled within the process.

The aqueous waste contained a small percentage of the uranium, plus the residual plutonium and fission products. It was routed to the backcycle waste concentrator, and subsequently fed, along with virgin feed metal solution, to the codecontamination cycle.

A2.2.6 Neptunium Recovery (Deactivated)

With adequate preparations, the PUREX Plant could be modified to produce a neptunium product. When neptunium recovery was not employed, most of the neptunium was in the codecontamination cycle aqueous waste stream, where it was rejected with the fission products and americium.

The aqueous waste stream from both the uranium and plutonium cycles contained neptunium. These streams were collected in the backcycle waste system and concentrated for recycle back to the codecontamination cycle to minimize losses of associated uranium, plutonium, and HNO_3. If neptunium recovery was required, a portion of the concentrated backcycle waste stream was used as feed for the neptunium recovery cycle, where in a continuous extraction-stripping cycle, neptunium would continue to accumulate, as other nuclides (e.g., plutonium, uranium, and fission products) are removed and returned to the backcycle waste system. This operation would continue until the neptunium concentration reached the desired level subsequent to the neptunium cycle isolated and operated on total neptunium recycle until the concentrations of plutonium, uranium, and fission products were low enough for neptunium product transfer to the final purification system.

In the final purification system, neptunium would be loaded on an ion exchange resin that would then be washed to remove residual fission products and plutonium, and would be eluted from the resin. Neptunium would be retained in a storage tank or packaged for eventual shipment offsite. The remaining effluent stream and the wash would be either retained in tankage or routed to the backcycle waste system.

A2.3 SOLVENT TREATMENT

The organic solvent was washed after use to remove impurities, chemicals, and radiolytic degradation products that would interfere with proper process operation. Two separate solvent treatment systems were used. The first solvent and treatment system processed all the solvent except from the final uranium cycle, which was then processed separately in the second system.

A2.4 BACKCYCLE WASTE SYSTEM

The backcycle waste system accumulated product-bearing aqueous waste streams from the uranium and plutonium cycles following the partition cycle, and then concentrated and recycled this material to the solvent extraction process. The backcycle waste system provided recovery of products routed from the individual product purification cycles by reextraction in the codecontamination cycle. The backcycle waste system also provided the HNO_3 needed for the efficient extraction operation of this cycle.

The overhead condensate from the waste concentrator was routed to the first-cycle uranium concentrator, where the condensate was reevaporated along with the principal uranium product stream.

A2.5 ACID RECOVERY

HNO_3 was one of the principal chemicals used in the PUREX process. In addition to HNO_3 being used to dissolve irradiated fuels, it was also used as the "salting" agent in the solvent extraction cycles to help force the transfer of plutonium and uranium from the aqueous phase into the organic extractant. Because of the large volume used, HNO_3 was recovered and reused.

A major recovery source of HNO_3 was the aqueous high-acid waste from the solvent extraction cycles. Most of the acid was recovered by evaporation in the high-level waste concentrator. Further treatment of the concentrated waste by sugar denitration reduced acid levels and produced oxides of nitrogen. These oxides of nitrogen were partially converted to acid in the acid absorber, which treated the vapor from the high-level waste concentrator. The resulting dilute HNO_3 stream was fed to the acid fractionator along with the acid streams returned from the dissolver offgas facility and from the Uranium Trioxide Plant.

A2.6 WASTE TREATMENT

Aqueous waste from the codecontamination cycle contained essentially all of the fission products that entered the PUREX process except the radioactive gases, a fraction of the halogens, and part of the tritium. This acid waste was routed to the high-level waste feed tank where it was diluted to enhance acid recovery, before delivery to the waste concentrator.

The concentrated waste, partially deacidified by boiling acid overhead, overflowed continuously from the concentrator to a waste receiver tank. After the concentrated waste had been sampled, analyzed, and confirmed for transfer, it was partially denitrated by the addition of a sugar solution. The gases produced, principally carbon dioxide and oxides of nitrogen, were routed back to the vapor tower of the concentrator and then to the acid absorber where the oxides of nitrogen were partially recovered as HNO_3.

The concentrated, denitrated waste was made alkaline and transferred from the PUREX Plant to underground storage in the tank farms.

A2.7 OFFGAS TREATMENT

The offgas from the decladding step contained hydrogen and ammonia, both kept well below their lower explosive limit concentrations by water scrubbing or dilution with the large flow of process air through the system. (The presence of the nitrate ion inhibits hydrogen formation in the dissolvers.) The decladding offgas was water vapor scrubbed to remove ammonia. It was then passed through steam and electric heaters, a silver reactor (for the removal of radioiodine), two fiberglass filters in series, and out the main ventilation stack to the atmosphere. The ammonia-bearing offgas stream from the ammonia removal system was scrubbed with water, filtered, and then discharged to the atmosphere via a separate stack. The ammonia scrubber water containing some radionuclides was concentrated and sent to underground storage tanks. The concentrator condensate was sent to a crib.

The offgas from the dissolving step was passed through steam and electric heaters, a silver reactor (for the removal of radioiodine), the in-cell fiberglass filter, the secondary fiberglass filter, and into the backup facility. In the backup facility, much of the remaining iodine and oxides of nitrogen were removed from the offgas by two acid absorbers in series. The offgas was then discharged through the main ventilation stack to the atmosphere. The dilute HNO_3 produced in the absorbers was recycled to the PUREX acid recovery system where it was concentrated and recycled to the process.

A fourth stage of high-efficiency particulate air (HEPA) filters was installed in the main exhaust plenum of the PUREX Plant. The HEPA filter banks were installed downstream from the fiberglass filters. The design, installation, and activation (placed in service) occurred in the 1983 to 1986 time frame.

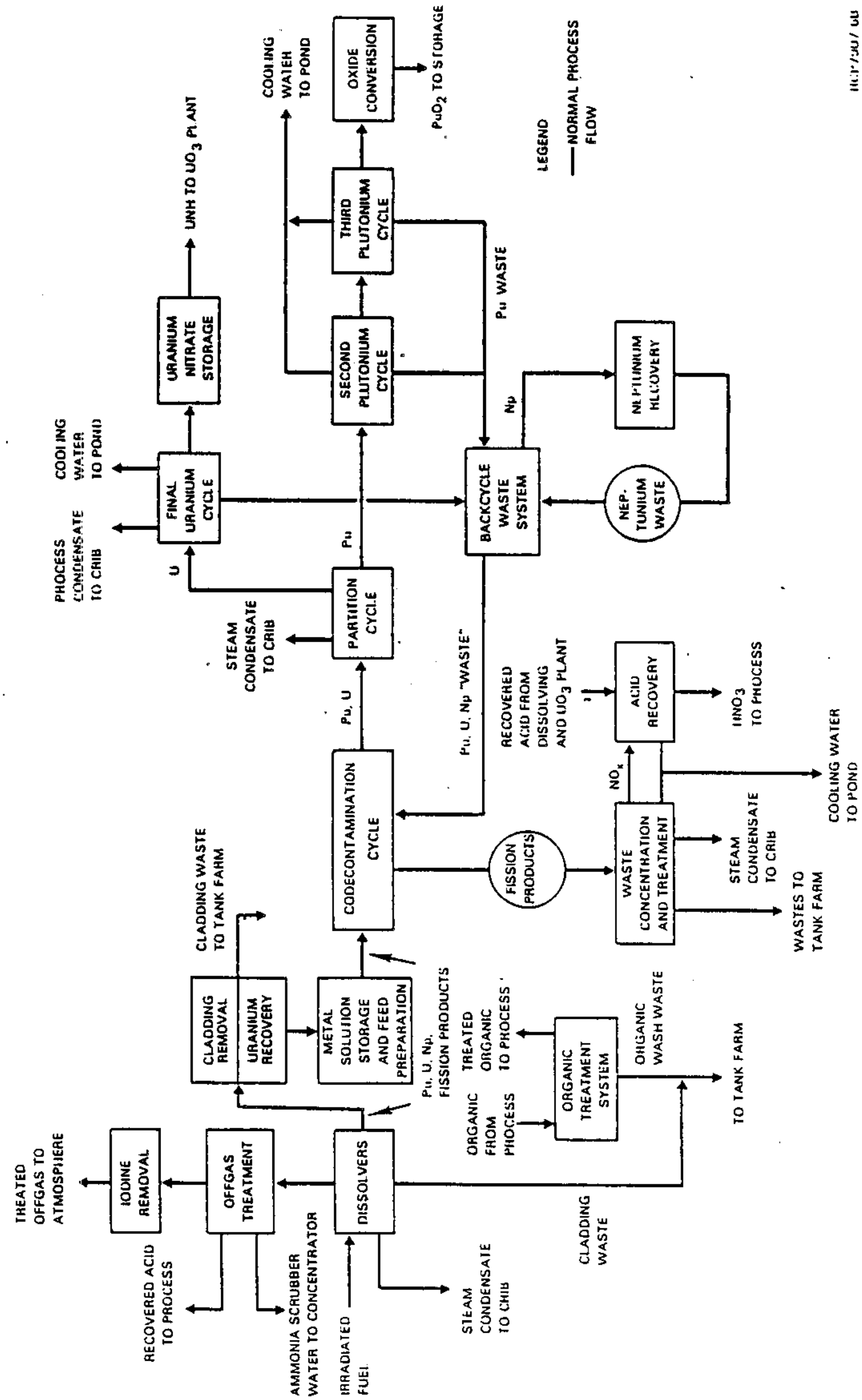
Before the fourth filter stage installation, plutonium releases to the atmosphere were borderline. The fourth stage of HEPA filters reduced the plutonium releases to acceptable levels.

A3.0 PROCESS FLOW DIAGRAM

A simplified flow diagram of the PUREX process, employing a block diagram to illustrate processing unit interfaces, is shown in Figure A-1, PUREX Plant Simplified Flow Diagram. This flow diagram is reprinted from the *PUREX Final Safety Analysis Report* (Manry and Prosk 1985), and described the PUREX process as it was conducted in the mid-to-late 1980's.

A more detailed flow diagram follows in Figure A-2. This second diagram identifies the major pieces of equipment and the input and output streams for each item.

Figure A-1. PUREX Plan Simplified Flow Diagram.



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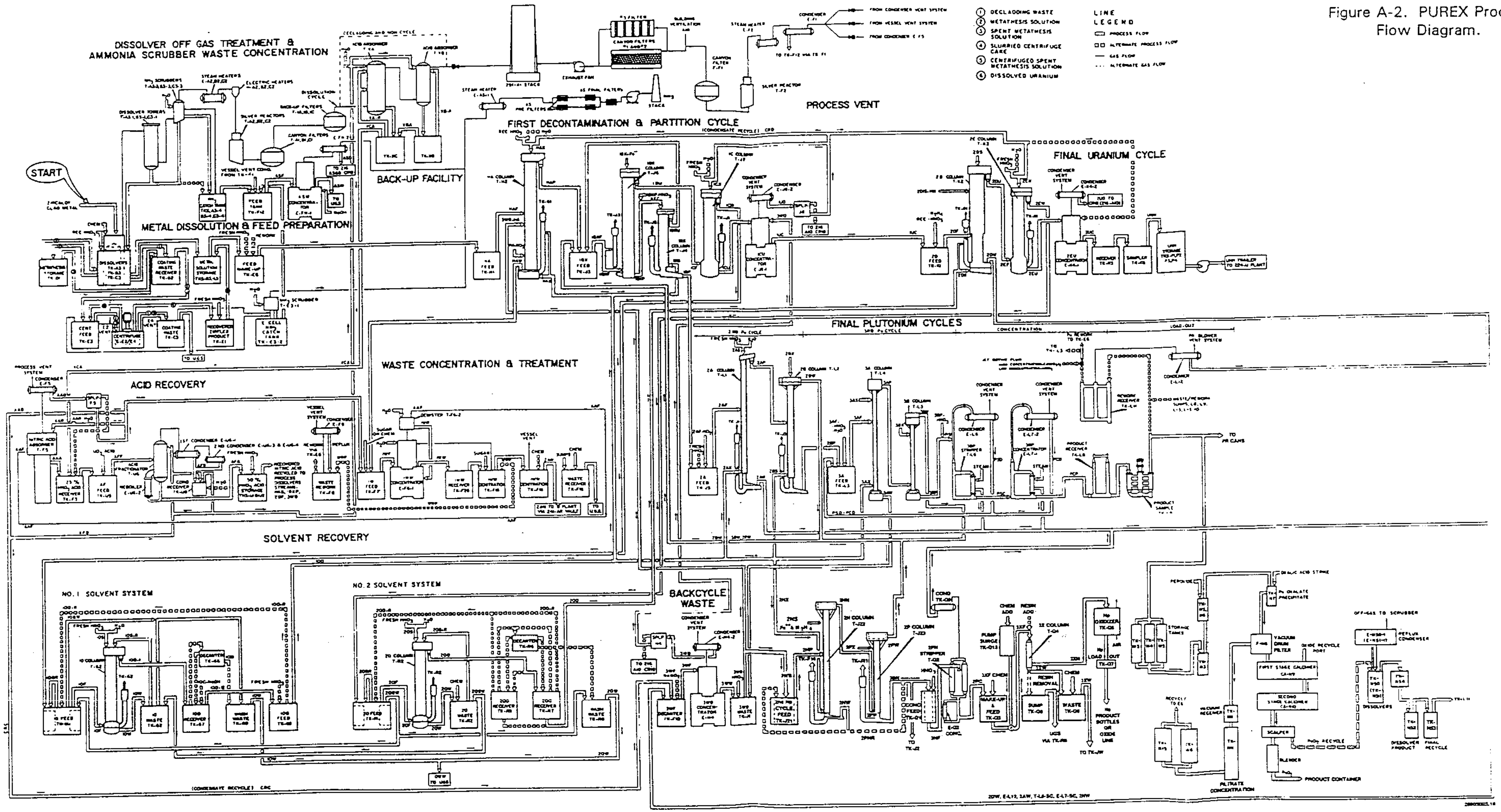

Figure A-2. PUREX Process Flow Diagram.

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APPENDIX B

FACILITY HISTORY

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APPENDIX B

FACILITY HISTORY

The following brief facility history was provided so that the equipment listed as stored in the Plutonium-Uranium Extraction (PUREX) Plant tunnels (beginning in 1960) can be considered in historical context, rather than by recent operational events.

The U.S. Atomic Energy Commission authorized the design and construction of the PUREX Plant in 1952. The PUREX process was an improvement over the reduction oxidation process because it employed a recoverable salting agent, resulting in a significant reduction in unit costs and waste generation. The PUREX Plant was brought on stream in 1956 and operated continuously until its shutdown in September 1972. The shutdown was caused by the closure of eight of the nine materials production reactors located at the Hanford Site.

The PUREX Plant was in a "wet standby" condition from 1972 to 1978. During this standby period, major plant equipment was operated periodically to ensure its operability and its availability for a mission assignment. The plant's extraction columns, associated tankage, pumps, column pulsers, jets, and other mechanical equipment were operated on a regular basis. Equipment that failed was either replaced or upgraded accordingly; if the equipment was not replaced or upgraded, the identified failures were formally documented for future replacement action.

From 1978 to 1983, the PUREX Plant underwent considerable upgrading and replacement to prepare for the restart of operations. Cold startup tests were carried out to establish the plant's readiness to commence irradiated fuels processing. In November 1983, the PUREX Plant resumed operations to reprocess the inventory of stored N Reactor fuel to provide plutonium for nuclear weapons programs, research, reactor development, and other ancillary safety programs. In addition to plutonium production, the PUREX Plant provided slightly enriched uranium for reactor fuel.

Operations were terminated in December 1989 to readdress safety requirements. The plant was operated from February 1990 until March 1990 in order to stabilize the plant for an extended shutdown period while a new Environmental Impact Statement was being prepared.

In February 1991, the PUREX Plant was terminated by the U.S. Department of Energy. The plant has been in a standby cleanout mode in preparation for deactivation. An official deactivation notice was issued in December 1992.

Originally, the PUREX Plant was designed to reprocess aluminum-clad uranium metal fuel to recover weapons-grade plutonium and depleted uranium. The head-end of the plant was modified and upgraded to reprocess zirconium alloy (zircaloy) clad fuel from N Reactor to recover fuels-grade plutonium, slightly enriched uranium and neptunium-237. The recovery of fuel grade plutonium from N Reactor required a plutonium oxide end product. Consequently, N Cell was modified to accept a plutonium oxide conversion facility. Over the life of the PUREX Plant (1956-1990), significant improvements, upgrades, and processing enhancements were made to increase production rates, provide for more diverse reprocessing capability, provide higher quality products, decrease environmental releases, and improve the safety of the overall operation.

During the operating life (1956 to 1990) of the PUREX Plant, there were many major and minor upgrades to the processing facilities and systems. These upgrades improved operational efficiencies, enhanced safety, improved environmental emission control, instituted waste minimization efforts, and expanded the reprocessing versatility and capability.

APPENDIX C

ESTIMATES OF RADIOACTIVITY IN PUREX PROCESS VESSELS AND RAILROAD STORAGE TUNNELS

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APPENDIX C

ESTIMATES OF RADIOACTIVITY IN PUREX PROCESS VESSELS AND RAILROAD STORAGE TUNNELS

This appendix describes the calculations that were used to estimate the inventory of activity in Plutonium-Uranium Extraction (PUREX) Plant process vessels and in the equipment located in the PUREX Railroad Storage Tunnels. The calculations were taken from an earlier effort to estimate the upper inventory limits for PUREX operations.

The radioactivity and chemicals associated with PUREX process vessels are based on an estimate that began with the assumption that all vessels were full and that the plant was running 180 day old Mark IA fuel from N Reactor that was irradiated to 12 percent plutonium-240. This fuel was chosen in order to provide an estimate of maximum inventory. The contents in each vessel were estimated based on information in the PUREX Flowsheet, Technical Manual, and in ORIGEN2 computer runs that describe the isotopic content of N Reactor fuels. Subsequent inventory estimates manipulated the initial data to provide an estimate of inventory at the end of deactivation. The deactivation estimate included reductions in volume to minimum heels, and reductions in concentration to account for vessel flushes. The isotopic content is shown for each process vessel in the table in Section 3.2 of this report, however, this table shows activity based on processing 180 day old fuel. These amounts are likely higher than expected, because the plant has been shut down for some time, and was processing fuel older than 180 days when it ceased operations. There is a current effort to sample as many vessels as possible. Results of the sampling effort will be more accurate than this estimate.

The estimate of activity associated with the equipment stored in the railroad tunnels began with the equipment list and activities given in the Railroad Tunnels Engineering Study, WHC-EN-ES-003, Rev. 0. The activities given in the engineering study, however, were as determined at the time of placement. Because the equipment was installed over a period of time, (June 1960 to August 1989), decay calculations were made to estimate the inventory as the same dates. Each item was decayed the appropriate amount of time to arrive at estimates for 1989 and 1993. The activity associated with the equipment was assumed to be from 180 day old, Mark IA, 12 percent plutonium-240 fuel at the time it was installed.

The decay calculations were performed for three categories: actinides, fission products, and activation products. Actinides include the isotopes of thorium, protactinium, uranium, plutonium, americium, curium, and neptunium. The fission products and activation products are the balance of the radioactivity, coming from the fuel and its cladding. Most of the time the actinides, as a group, decay more slowly than the activation products and fission products, particularly when first discharged from the reactor. The storage tunnels engineering study did not indicate the type of isotopes associated with the equipment activity, showing only the associated curies. As a result, where the vessel was identified, the fractions of the curies belonging to the actinides, and to the fission and activation products were estimated based on the distributions that were obtained for the PUREX process vessel inventory. If the equipment in the storage tunnel was not specifically identified, the distributions were assumed to be the average over the whole PUREX Plant.

The results of this exercise are likely to be low for two reasons. First, the activity in the equipment when stored was probably from fuel older than 180 days, making the 180 day old fuel assumption causes the decay to be calculated over the steep part of the decay curve. (Overall decay is more rapid for younger fuels because younger fuels have a higher concentration of short-lived isotopes). Second, a subsequent check was made to measure the curies associated with each package. A conversation with J. D. Anderson indicated that the activity measurements were taken at the door of the railroad tunnels, particularly when the packages were very hot. Because alpha activity does not travel far and would have been blocked by any packaging, it would not have been included in the measurement, causing the estimated current total activities to be low.