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1993 Report on Hanford Site Land Disposal Restrictions for Mixed Wastes

D. Black

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United States
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P.O. Box 550
Richland, Washington 99352

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EXECUTIVE SUMMARY

This report was submitted to meet the requirements of *Hanford Federal Facility Agreement and Consent Order*[1] Milestone M-26-01C.

Since the early 1940s, the contractors at the Hanford Site have been involved in the production and purification of nuclear defense materials. These production activities have resulted in the generation of large quantities of liquid and solid radioactive mixed waste (RMW). This waste is subject to regulation under authority of both the *Resource Conservation and Recovery Act of 1976*[2] (RCRA) and *Atomic Energy Act*.[3] This report covers mixed waste only. Hazardous waste that is not contaminated with radionuclides is not addressed in this report.

The Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy have entered into an agreement, the *Hanford Federal Facility Agreement and Consent Order*[1] (commonly referred to as the Tri-Party Agreement) to bring the Hanford Site operations into compliance with dangerous waste regulations. The Tri-Party Agreement required development of the original land disposal restrictions (LDR) plan and its annual updates to comply with LDR requirements for RMW. This report is the third update of the plan first issued in 1990.

The Tri-Party Agreement requires, and the baseline plan and annual update reports provide, the information that follows.

- **Waste Characterization Information**--Provides information regarding the characterizing of each LDR mixed waste. The sampling and analysis methods and protocols, past characterization results, and a schedule for providing the characterization information, where available, are discussed.

- **Storage Data**--Identifies and describes the mixed waste at the Hanford Site, including the following: the RCRA dangerous waste code(s), process information necessary to identify the waste and make LDR determinations, quantities stored, generation rates, location and method of storage, an assessment of storage unit compliance status, storage capacity, and the bases and assumptions used in making the estimates.

- **Treatment Information**--Identifies the current treatment processes, plans, and schedules for developing treatment technologies that meet

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[1]Ecology, EPA, and DOE, 1990, *Hanford Federal Facility Agreement and Consent Order*, Vol. 1 and 2, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

[2]*Resource Conservation and Recovery Act of 1976*, as amended, 42 USC 6901, et seq.

[3]*Atomic Energy Act of 1954*, as amended, 42 USC 2011.

LDR treatment standards. Also included are discussions of treatment alternatives and accelerated treatment.

- **Waste Reduction Information**--Identifies methods for reducing the generation of land disposal restricted waste. Includes treatment methods and process changes made or planned to reduce the generation of LDR waste, methods to minimize the volume of LDR waste, and methods to minimize the toxicity of newly generated waste.

- **Schedule**--Provides schedules depicting the events necessary to achieve compliance with LDR requirements, including variances, exemptions, or time extensions necessary to achieve LDRs compliance.

- **Progress**--Identifies progress made in achieving compliance since the previous LDRs report.

A Tri-Party Agreement change request for the LDR report milestone was approved in 1992. This change request consolidated another LDR report, Milestone M-25-00, that emphasized LDR treatment alternatives with this report. Therefore, this LDR report now includes increased discussion of treatment alternatives.

The Hanford Site waste primarily resulted from defense materials production. Usable defense materials were separated from fission products waste through precipitation and solvent extraction processes. Large quantities of liquid waste resulted from these separation processes and were stored in underground single-shell tanks (SST) and double-shell tanks (DST). Additional waste volumes resulted from nuclear fuel fabrication activities, process laboratories activities, decontamination and cleaning of equipment and building structures, closure of process and storage units, and research and development activities such as Fast Flux Test Facility operation.

Projected generation rates, after waste reduction, range from approximately 25,900 cubic meters per year during 1997 to approximately 61,800 cubic meters per year during 1996.

The waste addressed in this report includes mixed waste (i.e., hazardous waste that contains radionuclides) designated as characteristic dangerous waste; designated as toxic, carcinogenic, and persistent by the Washington State criteria; and listed waste because it contains small amounts of spent solvents and discarded pure chemical products. The waste consists of liquid, sludges, hard crystalline material (salt cake), and materials such as contaminated equipment, paper, and rags. Much is already known about the waste characteristics from process information and sampling and analysis programs. Action schedules have been developed to further characterize the waste.

The waste currently is stored in underground SSTs and DSTs, in containers placed in storage units such as the Hanford Solid Waste Operations Complex, caissons, and retrievable storage units. A surface impoundment, the Liquid Effluent Retention Facility (LERF), has been constructed to store large quantities of waste that contain radionuclide concentrations low enough to allow surface storage. The waste will be removed from these storage units,

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treated to meet LDR standards, and sent to final disposal in accordance with schedules established in Tri-Party Agreement milestones M-17 and M-26.

Total Hanford Site storage capacity for LDR waste is approximately 500,000 cubic meters. About 370,000 cubic meters of this capacity is in units such as SSTs that no longer actively receive waste. Approximately 237,770 cubic meters of waste currently are in storage. The DSTs currently available are essentially filled to capacity. To alleviate the space shortage, up to four new DSTs are planned. The LERF basins dedicated to 242-A Evaporator process condensate will be filled in 1993 and the storage space currently available at the Solid Waste Operations Complex is anticipated to be filled in 1999; however, additional buildings will be constructed as required to store waste generated in the future.

The waste treatment processes for these wastes include the current treatment processes to reduce corrosion of storage tanks and planned treatment processes to reduce waste toxicity and immobilize waste constituents. Current waste treatment consists of the addition of pH adjustment and corrosion inhibitors, and use of absorbents and solidifying agents. Planned waste treatment processes include development of neutralization and toxic constituent destruction processes (corrosivity neutralization processes), development of waste separation and pretreatment processes (Waste Receiving and Processing Facility), use of a large-volume solidification unit for low-activity liquid waste (the Grout Treatment Facility), use of a vitrification plant to treat high-activity and transuranic DST waste (the Hanford Waste Vitrification Plant and its associated pretreatment facility), and development of an organic destruction process (the Effluent Treatment Facility).

The Hanford Site has developed a sitewide waste minimization plan that sets minimization goals and establishes processes for measuring progress toward these goals. Each plant or process has a plan to implement the sitewide goals. Current waste minimization plans are expected to reduce dangerous waste generation by approximately 100,000 cubic meters per year.

Hanford Site First-, Second-, and Third-Third mixed wastes, which include characteristic wastes, are all subject to the 2-year national capacity variance (55 Federal Register 22520).[4] California list waste (40 Code of Federal Regulations [CFR] 268.32)[5] and solvent waste at the Hanford Site (40 CFR 268.30) are not covered by the national capacity variance. The continued storage of these wastes until sufficient treatment and disposal capacity is available for these wastes was negotiated as part of the Tri-Party

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[4]EPA, 1990, *Land Disposal Restrictions for Third Third Scheduled Wastes, Final Rule*, Title 40, Code of Federal Regulations, Parts 148, 261, 262, 264, 265, 268, 270, 271, and 302, Federal Register, U.S. Environmental Protection Agency, Washington, D.C.

[5]EPA, 1990, *Land Disposal Restrictions*, Title 40, Code of Federal Regulations, Part 268, as amended, U.S. Environmental Protection Agency, Washington, D.C.

Agreement. Schedules to implement the dangerous waste management compliance activities until treatment capacity is available are described in the Tri-Party Agreement. Any newly identified compliance actions will be scheduled in accordance with procedures established in the agreement.

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ACRONYMS AND ABBREVIATIONS

CAW	CA Column Aqueous Waste Stream
CCW	constituent concentrations in waste
CCWE	constituent concentration in the waste extract
CERCLA	*Comprehensive Environmental Response Compensation and Liability Act*
CFR	Code of Federal Regulations
CUU	CU Column Aqueous Waste Stream
CXP	CX Column Aqueous Waste Stream
D&AL	Development and Analytical Laboratories
DBP	Di-Butyl Phosphate
DOE	U.S. Department of Energy
DST	double-shell tank
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ETF	Effluent Treatment Facility
FFTF	Fast Flux Test Facility
FR	Federal Register
GTF	Grout Treatment Facility
HEPA	high-efficiency particulate air (filter)
HLW	high-level waste
HOC	halogenated organic carbon
HSW	High-Salt Waste
HWVP	Hanford Waste Vitrification Plant
IEMC	Interim Examination and Maintenance Cell
LDR	land disposal restriction
LERF	Liquid Effluent Retention Facility
LLBG	low-level burial grounds
LLW	low-level waste
LSA	low specific activity
LSW	Low-Salt Waste
MBP	Mono-Butyl Phosphate
NA	not applicable
National Report	National Report on Prohibited Waste and Treatment Options (DOE 1990)
NCAW	neutralized current acid waste
NCRW	neutralized cladding removal waste
PCB	polychlorinated biphenyl
PFP	Plutonium Finishing Plant
PNL	Pacific Northwest Laboratory
PRF	Plutonium Reclamation Facility
PUREX	Plutonium-Uranium Extraction (Plant)
RCRA	*Resource Conservation and Recovery Act of 1976*
RL	U.S. Department of Energy, Richland Field Office
RMC	Remote Mechanical "C" Line
RMW	radioactive mixed waste
SALDS	state-approved land disposal structure
SST	single-shell tank
SWOC	Solid Waste Operations Complex
TBD	to be determined
TBP	Tri-Butyl Phosphate

TCLP	toxic characteristic leach procedure
TOC	Total Organic Carbon
TOX	total organic halide
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TRU	transuranic
TRUEX	transuranic extraction
TRUPACT	transuranic package transporter
TRUSAF	Transuranic Waste Storage and Assay Facility
WAC	Washington Administrative Code
WDOE	Washington State Department of Energy
WIPP	Waste Isolation Pilot Plant
WRAP	Waste Receiving and Processing (Facility)

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1.0 INTRODUCTION

The baseline land disposal restrictions (LDRs) plan was prepared in 1990 in accordance with the *Hanford Federal Facility Agreement and Consent Order* (commonly referred to as the Tri-Party Agreement) Milestone M-26-00 (Ecology et al. 1990). The text of this milestone is below.

> LDR requirements include limitations on storage of specified hazardous wastes (including mixed wastes). In accordance with approved plans and schedules, the U.S. Department of Energy (DOE) shall develop and implement technologies necessary to achieve full compliance with LDR requirements for mixed wastes at the Hanford Site. LDR plans and schedules shall be developed with consideration of other action plan milestones and will not become effective until approved by the U.S. Environmental Protection Agency (EPA) (or Washington State Department of Ecology [Ecology]) upon authorization to administer LDRs pursuant to Section 3006 of the *Resource Conservation and Recovery Act of 1976* (RCRA). Disposal of LDR wastes at any time is prohibited except in accordance with applicable LDR requirements for nonradioactive wastes at all times. The plan will include, but not be limited to, the following:
>
> - Waste characterization plan
> - Storage report
> - Treatment report
> - Treatment plan
> - Waste minimization plan
> - A schedule depicting the events necessary to achieve full compliance with LDR requirements
> - A process for establishing interim milestones.

The original plan was published in October 1990. This is the third of a series of annual updates required by Tri-Party Agreement Milestone M-26-01. A Tri-Party Agreement change request approved in March 1992 changed the annual due date from October to April and consolidated this report with a similar one prepared under Milestone M-25-00. The reporting period for this report is from April 1, 1992, to March 31, 1993.

The 1990 baseline plan was a follow-on document to both the *National Report on Prohibited Wastes and Treatment Options* (DOE 1990) (commonly referred to as the National Report), which identified all solvent (40 Code of Federal Regulations [CFR] 268.30) and California list (40 CFR 268.32) wastes that are restricted from land disposal, and a subsequent effort by the DOE (WHC 1990d) to identify any additional waste that was restricted from land disposal as a result of First-, Second-, and Third-Third LDRs promulgation (55 Federal Register [FR] 22520).

1.1 BACKGROUND AND PURPOSE

On September 19, 1989, the DOE entered into a federal facilities compliance agreement with the EPA and the Colorado Department of Health regarding the storage of certain radioactive mixed wastes at the Rocky Flats Plant. The agreement required the DOE to prepare and submit to the EPA the National Report. This report (DOE 1990) was submitted to EPA in January 1990. It included information on all DOE sites that store radioactive mixed waste subject to the LDRs in effect at the time of report preparation.

Since that time additional LDRs for dangerous waste have been promulgated by the EPA (55 FR 22520). These restrictions resulted in additional waste being restricted from land disposal. These wastes were not included in the National Report. To assess the impact of these new restrictions on DOE facilities, a survey of all DOE sites was conducted by the DOE to identify any additional waste that was restricted from land disposal as a result of this Thirds rule.

This report is a detailed description of the generation and management of LDR mixed waste generated, treated, and stored at the Hanford Site. Hazardous waste that is not a mixed waste is not included in this report. Discussions focus on the hazardous aspects of mixed wastes, although treatment, storage, and disposal can be complicated by the radioactive components. This report discusses the LDR mixed waste managed at the Hanford Site by a combination of point of generation and current storage locations. The waste is separated into groups based on the future treatment of the waste before disposal. This grouping resulted in the definition of 16 groups or streams of LDR waste. The 16 stream names used for this plan are shown in Table 1-1. Where a "stream" is actually a storage unit, the individual waste streams that make it up are discussed in this report as applicable.

The 16 waste streams identified for this plan combine several of the waste streams identified in the National Report and the case-by-case extension petition. This petition is to allow additional time to develop treatment capability. The relationship among the stream names used for this plan and those used for the National Report and the case-by-case petition is shown in Table 1-2. Table 1-2 indicates that some of the streams included in the National Report were not included in the case-by-case petition and vice versa. These exclusions result from a difference in the scope of each specific report. The National Report included solvent waste (40 CFR 268.30) and California list (40 CFR 268.32) wastes, whereas the case-by-case petition was to include all nonsolvent waste that was restricted from land disposal. This report encompasses the Hanford Site-specific aspects of the National Report (DOE 1990) and the case-by-case petition, as well as newly identified LDR waste.

As this report was being prepared, discussions with the regulators were under way regarding major modifications to the Tri-Party Agreement milestones that address the Tank Waste Remediation System. Included were key areas of this report such as modifying concepts of SST and DST waste retrieval and changes to the HWVP schedule. An agreement-in-principle was signed on March 31, 1993. Further negotiations and formal modifications to the Tri-Party Agreement milestones through the change control process will be

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forthcoming. These changes will be incorporated into the 1994 revision of this report.

1.2 ASSUMPTIONS

This section lists key milestones and assumptions used in the preparation of this plan.

The most significant Tri-Party Agreement (Ecology et al. 1990) milestones related to the management of LDR waste are identified below, including approved change requests.

- Complete 14 grout campaigns of double-shell tank (DST) waste by December 1996 (M-01-00).

- Initiate pretreatment of DST waste (M-02-00). The date is still to be determined (was October 1993) because of changes in plans from use of B Plant to an undetermined facility. There is currently a target milestone to initiate the settling/bump test in a high-level waste tank by December 31, 1993, although our internal schedules show April 1994. The start of washing for high-level sludges has still not been renegotiated.

- Initiate Hanford Waste Vitrification Plant (HWVP) operations by December 1999 (M-03-00).

- Complete single-shell tank (SST) interim stabilization by September 1995 (M-05-00).

- Initiate full-scale demonstration of SST waste retrieval technology by October 1997 (M-07-00).

- Complete analysis of at least two complete core samples from each SST by September 1998 (M-10-00).

- Complete construction and initiate operations of expanded laboratory hot cells for high-level mixed waste by June 1994 (M-11-00).

- Complete construction and initiate operations of a low-level mixed waste laboratory by January 1992 (M-14-00). This milestone was formally deleted and replaced in January 1993. The new concept is to use a combination of existing laboratory capacity plus the downsized Waste Sampling and Characterization Facility under construction and commercial analytical services to meet Hanford Site low-level mixed waste analytical requirements. Milestone M-14-03 specifies that the Waste Sampling and Characterization Facility will initiate operations in April 1994. Milestone M-14-04 requires commencement of local commercial laboratory operations in October 1995.

- Initiate operation of 242-A Evaporator PUREX Plant Process Condensate Treatment Facility by October 1994.

- Complete Waste Receiving and Processing (WRAP) Facility, Module 1, construction and initiate operations by March 1997 (M-18-00).

- Complete WRAP Facility, Module 2A, construction and initiate operations by September 1999 (M-19-00).

- Cease discharges to and clean out residues in Liquid Effluent Retention Facility (M-26-03 and M-26-04).

The following are key assumptions that have been used to develop the treatment plans and schedules for DST waste (WHC 1990a):

- The pretreatment methods to be developed (the facility is not yet determined) will include acceptable technology to separate the transuranic (TRU) elements from the bulk constituents in neutralized cladding removal waste (NCRW), neutralized current acid waste (NCAW), Plutonium Finishing Plant (PFP) waste, and complexant concentrate waste.

- The HWVP will be able to treat the pretreated NCAW, NCRW, PFP waste, and complexant concentrate waste without blending.

- Organics in complexant concentrate waste can be destroyed by high-temperature and -pressure ozonization, moderate temperature and pressure, high temperature and ambient pressure (molten salt), heat and digest at ambient pressure, or electrochemical processes.

- Space in DSTs, including four proposed new tanks, will be available to support all DST waste disposal activities.

- The HWVP process equipment will be provided to remove TRU elements from the HWVP process effluent streams, and process effluents from HWVP operations can be disposed of at the Grout Treatment Facility (GTF) without additional treatment.

Below are key assumptions with respect to the generation and treatment of DST waste and the use of tank space.

- The 242-A Evaporator will restart in April 1993. A treatment unit for 242-A Evaporator process condensate will be available in October 1994.

- The Plutonium-Uranium Extraction (PUREX) Plant received official notification to begin shutdown activities. Stored irradiated reactor fuel will not be processed in the PUREX Plant; thus, no additional DST waste will be generated.

- During PUREX Plant shutdown, no PUREX aging waste, PUREX process condensate, or PUREX ammonia scrubber waste will be generated. Any future PUREX process condensate and PUREX ammonia scrubber condensate streams will not be dangerous wastes.

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- Liquid waste from SSTs will continue to be transferred to DSTs, as space is available, as part of the stabilization and isolation program for the SSTs.

1.3 SCHEDULE AND MECHANICS OF PLAN UPDATE

Information in the baseline plan will be updated by additional future annual reports in accordance with Tri-Party Agreement (Ecology et al. 1990) Milestone M-26-01. The annual reports include the following:

- Addition of new LDR waste streams as they are identified or regrouped
- Revision of the stream generation rates to reflect current operating plans and schedules
- Revision to treatment plans and schedules to reflect further defined waste treatments and treatment schedules
- Revision to the stream characterizations to reflect additional sample analyses or process changes
- Revision to the compliance status of the units to reflect future compliance assessments and permitting activities
- Reevaluation of the adequacy of the capacity of current units for the storage of LDR waste
- Addition of new or proposed milestones, as applicable.

1.4 MILESTONE PLANNING PROCESS

Milestones and work schedules for activities related to the management of LDR mixed waste shall be consistent with the comprehensive work schedules contained in Appendix D of the Tri-Party Agreement (Ecology et al. 1990) and the annual update to the work schedule. The scope of these schedules includes interim milestones and additional target dates to accomplish the major milestones contained in Section 2.0 of the Tri-Party Agreement. Summary milestone schedules for activities related to the management of LDR mixed waste are discussed in Chapter 3.0 of the Tri-Party Agreement. Any new or additional LDR milestones, as well as changes to approved LDR milestone schedules, shall be implemented via the Change Control System process defined in Section 12.0 of the Tri-Party Agreement.

Tri-Party Agreement Milestone M-26-01 (Ecology et al.) also requires that appropriate new milestones be proposed through this annual report. No new milestones are proposed for this reporting period. Negotiations currently under way with the regulators are expected to change and add a significant number of milestones, particularly regarding SST and DST retrieval and treatment.

In addition to the procedural requirements of the Tri-Party Agreement, the LDR milestone planning process exercised by the DOE and its contractors also involves consideration of the DOE and federal budget process, integration with other concurrent Hanford Site operations (including waste management and environmental restoration activities), and overall sitewide regulatory compliance and coordination with other milestone initiatives described in the Tri-Party Agreement. Because these planning elements are numerous and complex, coordination and resolution of issues shall be accomplished through the ongoing project managers' and unit managers' meetings within the broader framework provided by Section 8.0 of the Tri-Party Agreement. Also, LDR waste management activities shall be included, as appropriate, in Tri-Party Agreement quarterly progress reports, and summarized each year, as required by Milestone M-26-01, in this annual report.

1.5 ACTIVITIES AND ACHIEVEMENTS

This section summarizes major activities and accomplishments related to compliance with LDRs for the period of approximately April 1, 1992, through March 31, 1993.

- Continued developing methods for sampling and analyses for 57 drums of degreaser solvent stored at 303-K in FY 1993.
- Idaho National Engineering Laboratory and the Hanford Site initiated an effort to devise treatability groups based on an earlier draft Pacific Northwest Laboratory (PNL) report. Currently, these treatability groups are being used to create a report in response to the Federal Facility Compliance Act (FFCA) of 1992. This report is being compiled by Sandia National Laboratory and will be submitted to the state per the provisions of the FFCA. Also, these treatability groups are being integrated into the Waste Information Management System database and future Integrated Database submittals.
- Completed definitive design and started construction of expanded laboratory hot cells for analysis of high-level radioactive mixed waste.
- Started construction on the Hanford Waste Vitrification Plant which will glassify high-level wastes for final disposal in a geologic repository.
- Broke ground for the 200 Area Effluent Treatment Facility.
- Obtained 20 core samples from 10 SSTs.
- Completed conceptual design for up to four new DSTs.
- Initiated waste retrieval testing in a scale-model tank.
- Completed construction of four grout vaults (102 through 105), and initiated construction of four additional grout vaults (106 through 109).

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- Installed two additional groundwater monitoring wells, for a total of 35, around the SSTs.
- Initiated definitive design of the new Multi-Function Waste Tank Facility.
- Initiated construction of the Canister Storage Building or Multi-Purpose Storage Building.
- Initiated construction of the Vitrification Building Foundation.
- Completed distillation and offsite incineration of hexone waste formerly located in the 200 West Area except for 900 gallons of solvent-saturated water.
- Began information gathering and alternative analysis to facilitate a decision regarding the fate of thermal treatment of radioactive mixed waste at the Hanford Site. Hanford's thermal treatment initiative includes a site-specific engineering design and cost estimation study, thermal treatment privatization assessment and planning, and public awareness efforts.
- Completed analysis of the bottom ash from the steam plants; the ash is not regulated.
- Completed construction on three additional mixed waste storage buildings in the Solid Waste Operations Complex (SWOC) for a total additional storage capacity of 125,000 square feet.
- Started the WRAP Facility, Module 1, Title II design.
- Submitted the delisting petition for the 242-A/PUREX Plant Condensate Treatment Facility effluent.
- Established the Tank Waste Remediation System Pretreatment Project at PNL to manage and coordinate the technology development work in progress at PNL. Similar projects are being set up at Sandia National Laboratory in Albuquerque and at Los Alamos National Laboratory to develop alternative technologies. The Richland Office is responsible for overall management and reporting of Tank Waste Remediation System related work at all of the DOE sites.
- Awarded a contract in March 1993 for the conceptual design of the initial pretreatment module for treatment of high-level tank wastes to Ebasco Services, Incorporated.
- Conducted pumping operations of free liquids from SST 241-T-101, an assumed leaker, to a nearby DST.

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Table 1-1. Stream Names for the *Hanford Land Disposal Restrictions Plan for Mixed Wastes.* (sheet 1 of 2)

Stream name	Waste source
1. DST Waste	Widely varying wastes from chemical separations processes (e.g., PUREX Plant, PFP, cesium and strontium separations) used 1970 to date
2. PUREX Aging Waste (inventory in DSTs)*	First extraction column fission products from PUREX Plant
3. SST Waste (inventory)*	Waste from spent nuclear fuel processing between 1944 and 1980
4. 242-A Evaporator Process Condensate	Condensed vapor from concentrating DST waste
5. 4843 Sodium Storage Facility Waste (inventory)*	Waste sodium from FFTF operations
6. PUREX Ammonia Scrubber Waste (inventory in DSTs)*	Waste generated from adsorption of gaseous ammonia from fuel processing operations
7. PUREX Process Condensate (generated during PUREX operation, inventory in DST)*	Condensed vapors from PUREX Plant operations
8. Hexone Waste (has been treated offsite)*	Hexone that had been planned for use in 202-S solvent extraction
9. 183-H Solar Evaporation Basins Waste (inventory)*	Solid remains from solar evaporation basins for 300 Area fuel fabrication wastes, 1973 to 1985
10. PUREX Storage Tunnel 2 Waste (mercury)	Mercury sealed in discarded PUREX fuel dissolvers
11. PUREX Storage Tunnels 1 and 2 Waste (lead and silver)	Lead from discarded equipment and shielding, silver from discarded silver reactors at PUREX
12. PUREX Canyon Deck Storage (lead and cadmium)	Discarded lead and cadmium shielding and weights from PUREX
13. Solid Waste Operations Complex Stored Low-Level, Transuranic, and PCB Waste	Onsite and offsite solid wastes from many generators, primarily from routine operations after 1987.
14. Retrievably Stored Low-Level and Transuranic Wastes (inventory)*	Containers of contaminated debris generated onsite and offsite up to 1987.
15. TRUSAF Stored Waste	Transuranic waste from onsite and offsite, packaged for eventual WIPP disposal.

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Table 1-1. Stream Names for the *Hanford Land Disposal Restrictions Plan for Mixed Wastes*. (sheet 2 of 2)

16. 303-K Stored Waste	Temporary storage of 300 Area fuel fabrication solid and liquid wastes.

*No longer being generated.

DST = double-shell tank
FFTF = Fast Flux Test Facility
PCB = polychlorinated biphenyl
PFP = Plutonium Finishing Plant
PUREX = Plutonium-Uranium Extraction (Plant)
SST = single-shell tank
TRUSAF = Transuranic Waste Storage and Assay Facility
WIPP = Waste Isolation Pilot Plant

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Table 1-2. Relationship of Streams in the *Hanford Land Disposal Restrictions Plan for Mixed Wastes* to those Previously Reported. (sheet 1 of 7)

Case-by-case petition stream name	National Report stream name
1. DST Waste	
DST Miscellaneous LLW	
2[a] T Plant Equipment Decontamination Waste	Existing DST Waste
8 PUREX E5 zirconium Cladding Removal (liquid)	Existing DST Waste
10 PUREX TK-F18 Waste	PUREX F18
10 PUREX TK-F18 Waste	Existing DST Waste
12 PUREX TK-U3/U4 Miscellaneous Waste	PUREX U3/U4, Miscellaneous Waste
12 PUREX TK-U3/U4 Miscellaneous Waste	Existing DST Waste
28 100 Area Phosphate LLW in DSTs	Existing DST Waste
30 221-T Decontamination Wastewater Solution	Existing DST Waste
31 100 Area Sulfate LLW in DST	Existing DST Waste
32 Fuel Fabrication Noncomplexed Waste in DSTs	Existing DST Waste
35 Pre-1980 Dilute Noncomplexed Waste in DSTs	Existing DST Waste
36 300-400 Area Noncomplexed Waste in DSTs	Existing DST Waste
38 Salt Well Dilute Noncomplexed and Complexed Waste	Existing DST Waste
41 PRF Laboratory Waste, PRF/RMC Low/High Salt Waste	PRF Low-Salt Waste
41 PRF Laboratory Waste, PRF/RMC Low/High Salt Waste	PRF Development and Analytical Laboratory Waste
41 PRF Laboratory Waste, PRF/RMC Low/High Salt Waste	PRF High-Salt Waste
41 PRF Laboratory Waste, PRF/RMC Low/High Salt Waste	Existing DST Waste
45 222-S Treatment Tanks	Existing DST Waste

Table 1-2. Relationship of Streams in the *Hanford Land Disposal Restrictions Plan for Mixed Wastes* to those Previously Reported. (sheet 2 of 7)

Case-by-case petition stream name	National Report stream name
50 B Plant Dilute Noncomplexed Waste	Existing DST Waste
9 PUREX E5 zirconium Cladding Removal Waste Solids	PUREX TK-E5
26 Double-Shell Slurry Feed	Existing DST Waste
26 Double-Shell Slurry	Existing DST Waste
37 Complexed Concentrate in DSTs	Existing DST Waste
47 PFP TRU Solids	Existing DST Waste
37 Dilute Complexed Concentrate	Not included
28 Concentrated Phosphate Decontamination Waste	Not included
2. PUREX Aging Waste	
27 PUREX Aging Waste	PUREX TK-F15/F16
3. SST Waste	
25 SST Waste	SST Waste
4. 242-A Evaporator Process Condensate	
Not included[b]	Not included[b]
5. 4843 Sodium Storage Facility Waste	
34 Alkali Metal Waste LSA	Not included
6. PUREX Ammonia Scrubber Waste	
6 PUREX ammonia scrubber distillate	Not included

Table 1-2. Relationship of Streams in the *Hanford Land Disposal Restrictions Plan for Mixed Wastes* to those Previously Reported. (sheet 3 of 7)

Case-by-case petition stream name	National Report stream name
7. PUREX Process Condensate	
11 PUREX Process Condensate	Not included
8. Hexone Waste	
Not included[c]	Hexone
9. 183-H Solar Evaporation Basins Waste	
300 Fuels Fabrication Waste	Newly Generated 183-H Waste
13 183-H Solar Evaporation Basins Waste	Retrievably Stored 183-H Waste
10. PUREX Storage Tunnel 2 Waste (mercury)	
39 PUREX Tunnels Mercury Waste	Not included[d]
11. PUREX Storage Tunnels 1 and 2 Waste (lead and silver)	
PUREX Tunnels Silver Waste	Not included
40 PUREX Tunnels Lead Waste	Not included
12. PUREX Canyon Deck Storage (lead and cadmium)	
46 PUREX Canyon Waste Pile	Not included
13. Solid Waste Operations Complex Stored LLW, TRU, and PCB Wastes	
LLW	
4 PFP LLW Laboratory and Maintenance Waste[d]	Not included
14 PNL Laboratory and Plant Operations LLW	Included in SWOC Stored LLW Waste
14 PNL Laboratory and Plant Operations LLW	PNL SST Solid Sample Waste
16 325 Building Soil	Not included

Table 1-2. Relationship of Streams in the *Hanford Land Disposal Restrictions Plan for Mixed Wastes* to those Previously Reported. (sheet 4 of 7)

Case-by-case petition stream name	National Report stream name
17 LLW Lead (majority of this stream is stored in SWOC)[d]	Not included
20 FFTF Sodium Cleanup Waste	Included in SWOC Stored LLW Waste
21 100 Area Laboratory and Plant Operations LLW	Ammonia Analysis Waste
21 100 Area Laboratory and Plant Operations LLW	Defense Reactor Spent Decontamination Solutions
21 100 Area Laboratory and Plant Operations LLW	Defense Reactors Hydrazine Container
21 100 Area Laboratory and Plant Operations LLW	Included in SWOC Stored LLW Waste
24 340 Facility Cleanup Waste	Not included
27 B Plant Mixed Waste	Included in SWOC Stored LLW Waste
42 222-S Laboratory Waste[d]	Included in SWOC Stored LLW Waste
44 PUREX LLW RMW[e]	Not included
48 Crushed Fluorescent Tubes LLW	Not included
Not included[c]	Defense Reactor Hydrazine Analysis Waste
Not included[c]	Defense Reactor Maintenance Waste
Not included[c]	Defense Reactor Paint Waste
Not included[c]	Defense Reactor Decontamination Agents
Not included[c]	222-S Waste
Not included[c]	Existing TRUEX Pilot Plant Waste
Not included[c]	PUREX Chemsearch SS-80
Not included[c]	PNL Spent Solvents

Table 1-2. Relationship of Streams in the *Hanford Land Disposal Restrictions Plan for Mixed Wastes* to those Previously Reported. (sheet 5 of 7)

Case-by-case petition stream name	National Report stream name
Transuranic	
43 PUREX TRU Maintenance Waste	Not included
1 TRU Miscellaneous Paint Waste	Not included
3 PFP TRU Laboratory and Maintenance Waste	Not included
18 TRU Lead[d]	Not included
22 TRU Crushed Fluorescent Tubes TRU	Not included
Not included[c]	PFP Analytical Laboratory Solvents
Not included[c]	PRF Spent Solvent Extraction Solutions
Not included	Defense Reactor Miscellaneous Waste
PCB	
23 TRU PCBs	Existing TRU PCBs
23 TRU PCBs	PFP PCB Contaminated Hydraulic Fluids
29 LLW RMW PCBs	Defense Reactor Miscellaneous Waste
Not included[c]	PFP PCB Contaminated Hydraulic Fluid (LLW)
14. Retrievably Stored Low-Level and Transuranic Wastes	
Not included	Retrievably Stored TRU
Not included	Retrievably Stored LLW
18 TRU Lead[e]	Not included
4 PFP LLW Laboratory and Maintenance Waste[e]	Not included

Table 1-2. Relationship of Streams in the *Hanford Land Disposal Restrictions Plan for Mixed Wastes* to those Previously Reported. (sheet 6 of 7)

Case-by-case petition stream name	National Report stream name
42 222-S Laboratory Waste[e]	Included in SWOC Stored LLW Waste
44 PUREX LLW RMW[e]	Included in SWOC Stored LLW Waste
43 PUREX TRU RMW	Not included
49 202A TRU Mixed Waste	Not included
3 PFP TRU Laboratory and Maintenance Waste	Not included
15. TRUSAF Stored Waste	
Not included	Included in SWOC Stored TRU Waste
17 LLW Lead (majority of this stream is stored in SWOC)[e]	Not included
15 PNL Laboratory and Plant Operations TRU	Not included
33 2345Z TRU RMW	Not included
16. 303-K Stored Waste	
19 333 & 334-A Buildings	Waste Acid Tanks B&C 334-A
19 333 & 334-A Buildings	HF and HNO_3 on Absorbent

Table 1-2. Relationship of Streams in the *Hanford Land Disposal Restrictions Plan for Mixed Wastes* to those Previously Reported. (sheet 7 of 7)

Case-by-case petition stream name	National Report stream name
Not included	Fuel Fabrication Degreaser Solvents
Not included	333 Building Waste Oil with HOC

[a]Numbers preceding stream name used for reporting purposes in case-by-case petition.
[b]Stream was not being generated when report was prepared.
[c]Solvent waste not in scope of petition.
[d]Stream identified in National Report but not included at publication.
[e]Stream stored in multiple locations.

DST = double-shell tank
FFTF = Fast Flux Test Facility
HOC = halogenated organic carbon
LLW = low-level waste
LSA = low specific activity
PCB = polychlorinated biphenyl
PFP = Plutonium Finishing Plant
PNL = Pacific Northwest Laboratory
PRF = Plutonium Reclamation Facility
PUREX = Plutonium-Uranium Extraction Facility
RMC = Remote Mechanical "C" Line
RMW = radioactive mixed waste
SWOC = Solid Waste Operations Complex
TRU = transuranic
TRUEX = transuranic extraction
TRUSAF = Transuranic Waste Storage and Assay Facility.

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2.0 SITE SUMMARY

This section summarizes the generation, characterization, storage, treatment, and reduction of radioactive LDR waste at the Hanford Site. It also discusses the variances, exemptions, and time extensions required to manage this waste within the requirements established by 55 FR 22520 and 40 CFR 268.

2.1 WASTE GENERATION

The projected volumes of radioactive mixed waste to be generated are shown in Table 2-1. The assumptions governing these generation rates are discussed in detail in Chapter 1.0, Section 1.2. These assumptions can be summarized by the three general statements below.

- The operation of waste pretreatment, treatment (e.g., GTF, HWVP, WRAP), and disposal (e.g., GTF) units will proceed as scheduled in the Tri-Party Agreement (Ecology et al. 1990).

- It is assumed that obligations of the DOE arising under the Tri-Party Agreement will be fully funded. The DOE shall take all necessary steps and make efforts to obtain timely funding to meet its obligations under the Tri-Party Agreement. Ecology and the EPA shall assist U.S. Department of Energy, Richland Field Office (RL) in determining the specific tasks required to support the corresponding negotiated work schedule for each fiscal year, but will not become involved with the internal DOE budget process.

- Site production plants (e.g., PFP) will continue to operate within their current planning bases.

The annual waste generation volumes presented in Table 2-1 represent the current best estimates of future waste generation for each of the LDR mixed waste streams or storage units. These estimates are based on detailed evaluation of plant operating schedules, past operating history, and projections of future waste generation. The projected generation volumes may be higher or lower than the actual generation rates because of changes in waste treatment or production schedules or waste minimization activities.

Decommissioning and remediation activities are anticipated to generate large volumes of contaminated soils and debris (e.g., contaminated structures, drums, tanks, piping, equipment, and cleanup debris) that may be subject to regulation under the LDR Program. Volumes will be defined during the Programmatic environmental impact statement (EIS) process. Volumes cannot be accurately determined until RCRA Facility Investigation/Corrective Measures Studies, *Comprehensive Environmental Response Compensation and Liability Act* (CERCLA) Remedial Investigation/Feasibility Studies, and Decontamination and Decommissioning Work Plans have been completed and remedies have been selected. Treatment standards for debris were promulgated by EPA on August 18, 1992 (57 FR 37194). Specific treatment standards for LDR soils have not been promulgated as of March 1993. However, upon promulgation of these standards, treatment and possibly expanded storage capacity for generated

wastes from decommissioning and remediation activities will require planning and development. Should promulgated standards not be feasible for these soils and debris, variances from such standards will be applied for. Extended storage of these wastes would be allowable pursuant to Tri-Party Agreement provisions dealing with LDR waste. Planning information as it is developed for these wastes will be incorporated into future revisions of this report.

2.2 WASTE CHARACTERIZATION

The radioactive mixed waste at the Hanford Site has been characterized, as documented in this plan, based on current process knowledge and, where available, waste sample analyses. Sampling and characterization of the waste will continue until the waste is disposed. Future characterization plans for the waste are summarized in Table 2-2. Descriptions for individual waste streams are located in Chapter 3.0 of this report and contain additional detail.

The dangerous waste designations for the waste in storage are summarized in Table 2-3. This table shows the dangerous waste codes applicable to each of the waste streams. The assigned dangerous waste codes are based on the generation process and analyses of the waste streams. The waste designations shown in this table are based on the best available information. However, future waste characterization may show that additional or fewer waste codes are applicable to a waste stream. Any changes will be included in updates of this report.

The waste stored in the SSTs, the DSTs, and the silver nitrate waste stored in the PUREX Storage Tunnels have been assigned the D001 (ignitable) waste designation because of the presence of oxidizers, nitrates, and/or nitrites. They are not ignitable by themselves, and the designation results from the possibility of reaction with other materials.

The use of the F003 (spent nonhalogenated solvents) waste code to characterize the waste stored in the SSTs and DSTs has been assigned to the waste not because the waste contains significant quantities of spent nonhalogenated solvents, but because a small quantity of waste discharged to the tanks in the past may have contained spent nonhalogenated solvents. The potential for the past discharge of spent nonhalogenated solvents to have contaminated essentially all of the waste in the tanks has resulted in the waste being designated F003. The tank waste does not comprise large quantities of organic solvents, as is typically the case for waste designated F003. The tank waste primarily is inorganic in nature with trace contamination by F003 solvents.

The schedule and means for reporting waste characterization data are outlined in the Tri-Party Agreement (Ecology et al. 1990) as amended by new Section 9.6, "Data Reporting Requirements." This section states that the DOE will make available to Ecology and the EPA all validated laboratory analytical data collected pursuant to the Tri-Party Agreement within 15 work days of data validation. Within 1 week after the laboratory data are validated, the DOE will notify Ecology and EPA of its availability in the Hanford Environmental Information System. This notification will include the time and location of the sampling, the type of data available, and a list of the sample parameters

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or a target compounds list. The time limits for reporting sample analyses are SST analyses, 180 days; hot cell analyses, 100 days; and low-level and mixed waste, 75 days (after the date of sampling).

Before any sampling or analysis, the appropriate level of quality assurance/quality control will be defined and documented in accordance with *Guidelines and Specifications for Preparing Quality Assurance Program Plans* (EPA 1983a) and *Interim Guidance and Specifications for Preparing Quality Assurance Project Plans* (EPA 1983b). All laboratories that analyze samples for DOE also are required to have a quality assurance/quality control plan approved by the EPA and Ecology before being used to conduct analyses.

2.3 WASTE STORAGE

The Hanford Site has 16 units, as specified in this report, that currently store mixed waste. These 16 units can be divided into two groups: (1) eight that no longer actively are receiving waste (SST waste, PUREX aging waste, PUREX ammonia scrubber waste, PUREX process condensate, 4843 Sodium Storage Facility Waste, hexone waste, 183-H Solar Evaporation Basins waste, and retrievably stored LLW and TRU waste) and (2) eight that currently are receiving or could receive waste for storage to await treatment and disposal (DST waste, 242-A Evaporator Process Condensate, the three PUREX tunnel streams, SWOC, Transuranic Waste Storage and Assay Facility (TRUSAF), and the 303-K Facility). The key characteristics of these units are summarized in Table 2-4.

The storage unit capacity for radioactive mixed waste at the Hanford Site is projected to be adequate for all currently generated mixed waste until at least 1996, assuming the availability of additional storage facilities such as part of the SWOC and up to four new DSTs. After startup, the Liquid Effluent Retention Facility (LERF) will be near its storage capacity for 242-A Evaporator process condensate (Chapter 3.0, Section 3.4). Current plans are to suspend 242-A Evaporator operations temporarily until waste treatment at the Effluent Treatment Facility can treat the stored process condensate and receive process condensate from the 242-A Evaporator. After the Effluent Treatment Facility has treated the process condensate stored in LERF (projected to be completed in 1994), it will treat process condensate directly without further storage at the LERF.

In 1993, the currently available DSTs are essentially filled to capacity. The latest plans are to design and construct up to four additional tanks. This is in accordance with Tri-Party Agreement (Ecology et al. 1990) Milestone M-31-00, with a completion date to be determined. Conceptual design was completed in 1992. The new tanks eventually should alleviate tank space shortages. The space shortage occurs because the schedule for filling grout vaults has been delayed while the schedule for pretreatment is based on pretreatment facility startup in October 1993 (a previous Tri-Party Agreement Milestone M-02-00). Per agreement between Ecology and EPA, DOE conducted a DST waste program redefinition study. This 1991 study included facility options for pretreatment. Based on this study and a subsequent Tri-Party Agreement change request submitted in January 1992, schedules for pretreatment operations should be established in August 1993.

The SWOC is projected to reach its capacity in 1999. This projection is based on the individual projections of all generators who ship waste to the SWOC. The projection of waste generation rates is refined annually. Should future projections indicate that increased storage capacity is required, additional storage units will be constructed and permitted on an as-needed basis.

The storage units for mixed waste at the Hanford Site have not released any dangerous constituents to the environment with the exception of the SSTs and the 183-H Solar Evaporation Basins. This has been determined through all available information such as monitoring data, inspections, and operational history. The SSTs have released an estimated 2,600 cubic meters of liquid waste to the ground. This estimate excludes any cooling water added to tanks after they were known to be leaking. This volume estimate currently is being reviewed for accuracy and may be revised. To minimize further releases from this storage unit, the pumpable liquid portion of the waste stored in the SSTs is being transferred to the DSTs. The amount of hazardous constituents released from the 183-H Solar Basins has not been estimated as this time. This will be a part of the data evaluation report for this unit.

The Part B submittal date for the mixed waste storage unit also is shown in Table 2-4. The date when each unit will be in full compliance with the interim status requirements is shown as the "Compliance Date." The date for submittal of the Part B permit application for each unit also is indicated in the table. The schedule for the permitting of the storage and treatment units currently used for mixed waste storage or planned for use in treating LDR waste is shown in Figure 2-1. The permitting and compliance schedules for these units have been negotiated as part of the Tri-Party Agreement Milestone M-20-00. The permitting schedules shown in Figure 2-1 have not been approved as of this writing. They are included because they are more informative than the out-of-date approved schedules.

The general characteristics of the radioactive mixed waste currently in storage at the Hanford Site are summarized in Table 2-5. The table shows that the Hanford Site currently stores approximately 237,770 cubic meters of radioactive mixed waste. The bulk of this waste (98.2%) is stored in the SSTs (58.7%) and DSTs (39.5%). The table also gives an indication of how much of the waste is LLW, TRU waste, or high-level waste (HLW).

2.4 WASTE TREATMENT

The LDRs for dangerous waste (55 FR 22520 and Washington Administrative Code [WAC] 173-303-140) (WAC 1990) specify a series of treatment technologies or treatment standards for each dangerous waste code that is restricted from land disposal. If a treatment technology is specified for a waste code, that technology must be used to treat the waste before land disposal of the treatment residues. If a constituent concentration treatment standard is specified for a waste code, any treatment method may be used before land disposal so long as the treatment standard is met and so long as the waste is not impermissibly diluted. If a waste exhibits multiple waste codes, it must be treated in accordance with the technologies or constituent concentration standards associated with each of the waste codes present. For example, if a waste is ignitable (D001) and toxic characteristic leach procedure (TCLP)

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toxic for chromium (D007), the waste must be treated for both the characteristics of ignitability and TCLP toxicity.[1]

This plan summarizes the treatment standards applicable and those proposed for the Hanford Site waste; included are discussions of the following waste categories:

- DST Waste (Chapter 3.0, Section 3.1)
- PUREX Aging Waste (Chapter 3.0, Section 3.2)
- SST Waste (Chapter 3.0, Section 3.3)
- 242-A Evaporator Process Condensate (Chapter 3.0, Section 3.4)
- 4843 Sodium Storage Facility Waste (Chapter 3.0, Section 3.5)
- PUREX Ammonia Scrubber Waste (Chapter 3.0, Section 3.6)
- PUREX Process Condensate (Chapter 3.0, Section 3.7)
- Hexone Waste (Chapter 3.0, Section 3.8)
- 183-H Solar Evaporation Basins Waste (Chapter 3.0, Section 3.9)
- PUREX Storage Tunnel 2 Waste (mercury) (Chapter 3.0, Section 3.10)
- PUREX Storage Tunnels 1 and 2 Waste (lead and silver) (Chapter 3.0, Section 3.11)
- PUREX Canyon Deck Storage (lead and cadmium) (Chapter 3.0, Section 3.12)
- SWOC Stored LLW, TRU waste, and Polychlorinated Biphenyl (PCB) Waste (Chapter 3.0, Section 3.13)
- Retrievably Stored LLW and TRU Waste (Chapter 3.0, Section 3.14)
- Transuranic Waste Storage and Assay Facility (TRUSAF) Stored Waste (Chapter 3.0, Section 3.15)
- 303-K Stored Waste (Chapter 3.0, Section 3.16).

The applicable treatment standards (required by 55 FR 22520 and WAC 173-303-140) and the proposed treatments for the Hanford Site mixed waste are summarized in Table 2-6. The schedule for the operation of the treatment units is provided in Figure 2-1.

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[1]Wastes that exceed TCLP standards are not subject to the LDRs due to this characteristic. Wastes that exceed Extraction Procedure (the older test method) standards are subject to the restrictions. However, EPA prefers that facilities use the TCLP test method to determine if the waste meets treatment standards.

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Applicable treatment alternatives are described in Chapter 3. The use of offsite commercial treatment technologies is not currently under consideration for any wastestream due to radioactivity and transportation concerns. (The hexone wastestream, containing very low levels of radioactivity, has previously been incinerated offsite.) The use of onsite commercial technologies is possible, but is not currently identified in this report. Current planning assumes that the major treatment facilities (i.e., HWVP, Grout Treatment Facility, and WRAP) will become operational as planned. The use of commercial technologies is very likely, however, to play a major role in site remediation work (primarily under CERCLA regulations).

The Tri-Party Agreement specifies the required dates for construction, startup, and waste treatment in the major treatment facilities. There are no requirements for accelerated treatment beyond these dates. All of these wastes are considered to be stored in a relatively environmentally sound manner with the exception of SST wastes and several DSTs with unique safety problems due to chemical content. Further details on accelerated treatment are located in the individual waste stream treatment discussions in Chapter 3.0.

2.4.1 Double-Shell Tank Waste

The DST waste consists of LLW, TRU waste, and HLW. In the interim storage mode, however, the waste is managed as HLW. Before treatment for disposal, some of the waste (e.g., complexant concentrate, aging waste) will be separated (i.e., pretreated) into two streams: a LLW stream and a TRU waste and/or HLW stream. The low-level stream will continue to be evaporated at the 242-A Evaporator to concentrate waste and applicable waste will be solidified at the GTF; the high-level and TRU streams will be vitrified at the HWVP. (The GTF will treat organic waste only where it is below LDR concentrations as it is not a best-demonstrated-available technology for this waste. The GTF can treat inorganic waste above LDR concentrations because best-demonstrated-available-technology is not required for inorganics.)

Four waste types have been identified for pretreatment followed by vitrification: NCAW, complexant concentrate, PFP waste, and NCRW. Each waste has certain chemical properties and constituents that require specialized pretreatment to reduce the disposal cost. This pretreatment is accomplished by separating these wastes into a low-volume, high-level, and TRU waste fraction and a relatively high-volume, LLW fraction. Certain other DST waste types, such as double-shell slurry and phosphate-sulfate waste, are anticipated to be disposed directly as grout without pretreatment. However, a process to remove cesium from double-shell slurry grout feed is being pursued to reduce the radioactivity of this waste in near-surface disposal. These wastes are considered LLWs not requiring best-demonstrated-available-technology.

Before disposal, appropriate testing of the solidification treatment for LLW and vitrification for HLW will be conducted to ensure the disposed waste will comply with the LDR standards. The HLW subsequently will be disposed of at a HLW repository in a still-to-be determined national location; the TRU waste is planned to be disposed of at the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico; and acceptable LLW subsequently will be disposed of

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at the Grout Disposal Area located on the Hanford Site. Figures 2-2 and 2-3 depict the DST separation, treatment, and disposal processes.

Several Hanford Site plants are planned to perform treatment and disposal processes. A pretreatment facility will be constructed to perform the necessary waste separations. Initial pilot testing of some DST waste is scheduled to begin thereafter and pretreatment operations are scheduled to begin in 1996. The GTF is scheduled to begin treating and disposing of liquid LLW in 1993. The HWVP is scheduled to begin treating HLW in December 1999; subsequent disposal of treated HLW will begin when a national repository is available. The schedule for these treatment processes is shown in Figure 2-1.

2.4.2 PUREX Plant Aging Waste

Treatment of the PUREX Plant aging waste stored in DSTs is addressed in Section 2.4.1.

2.4.3 Single-Shell Tank Waste

The SST waste consists of LLW, TRU Waste, and HLW; however, in the interim storage mode it is managed as HLW. The physical forms of SST waste are sludge, salt cake, and liquid. Liquid waste, which includes supernatant and interstitial liquid within the salt cake, will be transferred to DSTs for subsequent treatment as necessary. The SST waste is currently being sampled and analyzed to address safety issues and regulatory requirements and provide characterization data to evaluate technical alternatives for closure of SSTs. This includes retrieval, separations, treatment, and disposal. Figure 2-4 depicts the SST treatment and disposal processes.

2.4.4 242-A Evaporator Process Condensate

The 242-A Evaporator process condensate waste (containing trace organic solvents) will be stored in a surface impoundment (LERF) for a short time while a treatment plant is constructed. The Effluent Treatment Facility is being designed and will be constructed and operated to destroy organic constituents and to remove radioactive and certain inorganic constituents. The Effluent Treatment Facility will treat the waste streams to allow discharge to the ground. A petition was submitted to delist the process condensate after it is treated.

There is a research, development, and demonstration permit in work that is intended to permit the testing of the proposed treatment technologies on actual waste from the 242-A Evaporator when it becomes available. This permit is currently in preparation by EPA, Region 10, and was scheduled to be issued in October 1992. The permit will allow testing of actual 242-A feed at the 1706-KE Facility in the 100 Area at the Hanford Site.

2.4.5 4843 Sodium Storage Facility Waste

The 4843 Sodium Storage Facility presently is not receiving additional material. A closure plan has been developed and transmitted to Ecology. All but one container of nonradioactive waste has been shipped offsite for ultimate disposal by independent contractors. Mixed waste will be transported to the SWOC. A considered treatment for 4843 Sodium Storage Facility waste is deactivation by reacting it to form a sodium hydroxide/water solution and then reacting this solution with carbon dioxide to form sodium carbonate.

2.4.6 PUREX Plant Ammonia Scrubber Waste

The PUREX ammonia scrubber waste is generated when ammonia gas from the N Reactor fuel decladding process is sprayed with water. In the past the ammonia-bearing solutions were boiled in a concentrator to separate the bulk of the entrained fission products from the ammonia scrubber discharge that was disposed in a crib. The remaining ammonia scrubber waste was transferred to DSTs.

In late 1987, it was determined that the ammonium hydroxide concentrations in the ammonia scrubber discharge sometimes exceeded 1%, making it a dangerous (toxic) waste as designated by state regulations and, therefore, not appropriate for discharge to the crib. The remaining ammonia scrubber feed no longer was concentrated for discharge, but treated for tank storage and transferred as ammonia scrubber waste to underground storage tanks. The last ammonia scrubber waste was generated during December 1989. The treatment consisted of adding caustic to adjust the pH to greater than 12 and adding sodium nitrite to minimize tank corrosivity.

The PUREX Plant has received official notification to begin shutdown activities. Ammonia scrubber waste will no longer be generated.

2.4.7 PUREX Plant Process Condensate

The PUREX Plant process condensate is generated by condensing the vapors resulting from evaporative concentrations of N Reactor fuel solutions.

Until 1987 the PUREX Plant process condensate stream was discharged directly to a crib if radioactivity was sufficiently low. After closure of the old crib and to prevent corrosive (pH <2) waste from being discharged into the new crib, potassium hydroxide was added and the stream was routed through a tank with calcium carbonate (limestone) before being discharged. In early 1989 the stream was rerouted temporarily to underground storage tanks pending resolution of its dangerous waste designation. The last PUREX Plant process condensate was generated in March 1990.

The PUREX Plant has received official notification to begin shutdown activities. Process condensate will no longer be generated.

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2.4.8 Hexone Waste

Hexone waste was removed from the storage tanks in the 200 West Area in 1990 and distilled to remove radionuclides (except for tritium). The distillate was temporarily stored in tank cars and was then trucked offsite for incineration. The treatment reduces the hexone to carbon dioxide and water. Incineration is 97 percent complete, with the final waste batch to be incinerated in March or April 1993. Spent distillation vessels will be sent to the SWOC for storage and treatment.

2.4.9 183-H Solar Evaporation Basins Waste

The 183-H Solar Evaporation Basins waste, designated for toxicity (chromium), and trace listed commercial chemical products (formic acid, cyanide salts, vanadium pentoxide) resulted from closure of the 183-H Basins storage unit. The contaminants and residues remaining in the 183-H Basins were placed in containers and transported to the SWOC for storage. Subsequently, the waste will be treated at the WRAP Facility and disposed of in a near-surface disposal unit. The required treatment technology for formic acid is incineration; therefore, a treatability variance may be required before ultimate disposal of this waste. (The total amount of formic acid was 2 pounds diluted in 2.5 million gallons total waste volume.)

2.4.10 PUREX Storage Tunnels 1 and 2 Waste (Lead, Mercury, and Silver) and PUREX Canyon Deck Storage (Lead and Cadmium)

The PUREX Plant waste includes lead solids, mercury, and silver waste stored in the PUREX tunnels and lead and cadmium solids waste stored in the PUREX canyon. The required treatment for lead solids is microencapsulation and/or surface decontamination. If surface decontamination is selected, the treatment residue must meet the lead characteristic treatment standard of 5 milligrams per liter. Amalgamation or retorting and recovery are the required treatments for mercury waste. Any treatment that will achieve the constituent concentration limits is applicable for the silver waste.

Treatment options for this waste are being reviewed. Treatments have not been selected yet.

2.4.11 Solid Waste Operations Complex Stored Low-Level, Transuranic, and Polychlorinated Biphenyl Waste; TRUSAF Stored Waste; and Retrievably Stored Low-Level, Transuranic, and Polychlorinated Biphenyl Waste

Waste stored in the SWOC consists of low-level and TRU mixed waste, much of which is co-contaminated with polychlorinated biphenyls (PCB). The retrievably stored suspect-TRU waste will be assayed and separated at the WRAP Facility into TRU and low-level streams. This TRU waste plus TRU waste stored at the TRUSAF and the SWOC will be certified and shipped to WIPP for disposal. The LLW will be disposed of in a near-surface disposal unit. Mixed waste will

be treated as necessary at the WRAP Facility to separate the radioactive and hazardous components. The hazardous components may be shipped offsite for treatment and disposal. Retrievably stored LLW and TRU wastes primarily are contained in 0.21-cubic-meter drums, metal boxes, wood boxes, and fiberglass reinforced plastic boxes. They are stored in various configurations of underground storage units. After retrieval, the waste will be treated at the WRAP Facility so it is acceptable for permanent disposal. The proposed treatments will comply with the 55 FR 22520 and WAC 173-303-140 treatment requirements. The specific processes to be used currently are being selected. Incineration in a planned thermal treatment unit may be used. The PCBs will continue to be stored until treatment capacity is identified. Figure 2-5 depicts the SWOC treatment and disposal processes.

2.4.12 303-K Stored Waste

The 303-K waste consists of container-stored waste. Current plans are to move the pyrophoric chips and fines to the 304 Building for concretion and then burial as LLW, and to move the remainder of the waste to storage at the SWOC for treatment by the WRAP Facility. The SWOC treatment plans are discussed in Section 2.4.11.

2.5 WASTE MINIMIZATION

2.5.1 Waste Minimization Program Elements

Six basic elements comprise the overall waste minimization program: top management support, characterization of waste generated and the process that generates it, waste minimization assessments, cost allocation, technology transfer, and program evaluation.

2.5.1.1 Statement of Management Support/Commitment. The RL Manager and contractor management are committed to minimizing the generation of waste by giving preference to source reduction, material substitution, and environmentally sound recycling over treatment, storage and disposal of such waste. Management takes appropriate action to provide adequate personnel, budget, training, and resources on a continuing basis to ensure that the objectives of the waste minimization program are met.

Annual goals have been established by both RL and contractor management for all types of waste generated at the Hanford Site. Through the performance of waste minimization assessments and selection of economically practicable options, the site goals are translated into specific goals for each facility.

Management support is further evidenced by including waste minimization training in the Hanford General Employee Training program, through incentives programs that reward individual and group contributions, and inclusion of waste minimization in job performance evaluations of persons having waste minimization responsibilities.

2.5.1.2 Characterization of Waste Generation. Hazardous waste that is generated is tracked from the point of generation to final disposal by using a computerized database. Information that is tracked includes, but is not

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limited to, generation date, quantity generated, hazardous constituents and their concentration, the process or activity that generated the waste, a specific waste stream name, and the current disposition of the waste. This tracking system provides useful information for assessing waste minimization potential and waste generation rates for federal and state required reports.

2.5.1.3 Periodic Waste Minimization Assessments. Waste minimization is to be considered as an integral part in the design of any new facility or the modification of an existing facility or process. Waste that is nonetheless generated will periodically be assessed for waste minimization potential through a methodology called process waste assessments. This methodology requires that a process waste assessment team be formed to evaluate each waste generating process selected.

Currently, the following approach is used to organize an assessment team and perform process waste assessments on hazardous waste streams:

- Select a team leader who is familiar with the facility and its production and waste management operations to head the team.

- Include other line, staff and/or consultant organizations as needed to provide the following expertise:

  - knowledge of federal, state, and local hazardous waste statutes and regulations

  - production and waste minimization principles and techniques

  - quality control requirements

  - purchasing and material control/inventory.

  Other skills and expertise are considered in conjunction with the process being evaluated and added to the team on a part-time or as-needed basis; for example:

  - Chemical Engineering
  - Environmental
  - Facilities and Maintenance
  - Finance and Accounting
  - Research and Development
  - Maintenance
  - Processing Engineering
  - Safety and Health.

- Collect baseline information including process flow diagrams, material balances, waste quantities, and process description.

- Develop waste minimization options including costs and savings.

- Evaluate options and recommend course of action.

- Document all work on process waste assessment forms and place them in the appropriate appendix of the facility's waste minimization plan.

2.5.1.4 Cost Allocation System. A cost accounting system that accounts for the "true cost" of waste that is generated by the facility must include short- and long-term costs arising from (1) underutilization of raw materials found in the waste stream, (2) management of the wastes that are generated, (3) waste disposal, and (4) third-party liabilities if the waste is improperly disposed. Associated costs will include personnel, recordkeeping, transportation, pollution control, equipment, treatment, storage, disposal, liability, compliance, and oversight costs.

Presently, only estimates of some of the cost contributors are available. These estimates are combined with "known" costs to evaluate waste minimization alternatives in the process waste assessment process.

2.5.1.5 Technology Transfer. The transfer of federally developed technology between laboratories and potential users is a contractual responsibility of DOE facilities and laboratories. Activities involving technology transfer must be coordinated through the contractor's office that has been designated to represent the facility on the Federal Laboratory Consortium for Technology Transfer. The Federal Laboratory Consortium promotes technology transfer through links to the public and private sectors and through support services such as training and assistance in implementing partnership opportunities. Transfer of technologies specific to waste minimization may develop from information exchange systems, workshops, or topical conferences.

2.5.1.6 Program Evaluation. The waste minimization program is evaluated semiannually by the facility. The evaluations document program achievements and identify potential areas for improvement. Achievements and milestones in the program will be a part of the contractor's performance evaluation and determination of award fees. The results of this evaluation by the contractor are reported by the Waste Minimization and Reduction group of the prime contractor to RL in semiannual reports.

The following success criteria are available to aid in the demonstration of effective waste minimization efforts:

- Reduced amount of hazardous waste
- Reduced amount of all waste
- Reduced waste management costs
- Improved regulatory compliance
- Reduced health risks
- Increased production efficiency
- Reduced accident risk
- Improved public relations.

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2.5.2 Program Objectives

The objectives of the waste minimization program are as follows:

- Foster a philosophy to conserve resources and minimize waste and pollution while achieving Hanford Site strategic objectives
- Promote the use of nonhazardous materials in operations to minimize the potential risks to human health and the environment
- Reduce or eliminate the generation of waste through input substitution, process modification, improved housekeeping, and closed-loop recycling to achieve minimal adverse effects to the air, water, and land
- Comply with federal and state regulations and DOE requirements for waste minimization, waste reduction, and pollution prevention
- Characterize waste streams and develop a baseline of waste generation data
- Identify and implement methods and technologies for waste minimization
- Target policies, procedures, or practices that may be barriers to waste minimization
- Enhance communication of waste minimization objectives, goals, and ideas
- Promote integration and coordination of waste generators and waste managers on waste minimization matters
- Develop specific goals and schedules for waste minimization activities
- Create incentives for waste minimization
- Collect and exchange waste minimization information through technology transfer, outreach, and educational networks
- Develop mechanisms for fully disseminating current technical information to Hanford Site users.

2.5.3 Facility-Specific Waste Minimization

All facilities that generate waste are required to have a waste minimization program in place. The effectiveness and implementation of the

programs are audited on a regular basis. The following are key components of the program:

- To the extent practical, all mixed waste is segregated and packaged separately from LLW or TRU Waste that contains no hazardous or dangerous constituents
- The volume of mixed waste is reduced by compaction when possible
- To minimize the generation of mixed waste, generators actively seek nondangerous alternatives for the dangerous constituents in their processes
- Waste is characterized and the potential for minimization is investigated
- Minimization goals are set annually and tracked on a quarterly basis
- If allowed by regulation, mixed waste is treated to remove the dangerous constituents
- Corrosive materials are neutralized (if allowed by regulation) removing their corrosive character or packaged in a manner ensuring integrity of the containment barriers
- Waste handling, segregation, and certification will be performed following detailed procedures when the disposal criteria are promulgated
- A Quality Assurance Program Plan and implementing procedures are required.

Table 2-7 summarizes the waste reduction (minimization and treatment) methods currently in place or planned for the 16 waste units addressed in this plan. The table also shows schedules for implementation and the projected effectiveness of the method.

Future mixed-waste generation rates are dominated by the process condensate from the 242-A Evaporator (Table 2-1). In a typical year, more than five times more process condensate is generated than all other waste streams combined. However, the planned Effluent Treatment Facility will reduce, by greater than 99 percent, the volume of process condensate designated as dangerous waste.

Next to the planned treatment of the 242-A Evaporator process condensate stream, the most significant waste reduction is seen for DST waste. Evaporation of the dilute waste received into the DST reduces an annual average generation of 10,000 cubic meters to approximately 2,000 cubic meters.

The waste currently stored at the SWOC will be processed at the WRAP Facility (described in Chapter 3.0, Section 3.13) before disposal. This facility will minimize the amount of LDR waste by separating the dangerous constituents from the nondangerous constituents.

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In a typical year, waste reduction practices at the Hanford Site will reduce the volume by well over 100,000 cubic meters. The majority of the reduction is from treatment.

In addition to specific waste reduction sections in Chapter 3.0 of this report, waste reduction at the Hanford Site is described in an the *Hanford Site Annual Waste Reduction Report* (RL 1991b).

2.6 VARIANCES, EXEMPTIONS, AND TIME EXTENSIONS

Removal and treatment of the Hanford Site stored mixed waste to meet LDR requirements are summarized in Section 2.4.

The national capacity variance for Third-Third Waste (55 FR 22520) provided for a 2-year national capacity variance from the LDR for third-third mixed waste expiring on May 8, 1992. This variance allowed continued storage of these wastes. A Federal Register notice dated May 26, 1992, stated that EPA could not grant a case-by-case extension for Third-Third mixed waste due to questions regarding the DOE's demonstration that they have entered into binding contractual commitments to construct or otherwise provide treatment capability. A final decision has yet to be made. This extension would allow DOE to store LDR mixed wastes until May 8, 1993, and this date could be extended for up to an additional year. The Tri-Party Agreement will allow continued storage of these wastes in accordance with the schedules in the Tri-Party Agreement. The Federal Facility Compliance Act of 1992 also allows DOE facilities to store their wastes for 3 years if compliance with the Act's provisions for providing waste inventory and treatment plans are met.

If additional variances, exemptions, or time extensions are required as a result of delays in the development of treatment, storage, or disposal capacity, they will be applied for in accordance with the procedures detailed in the Tri-Party Agreement (Ecology et al. 1990).

The Tri-Party Agreement provides for extension of a schedule or a deadline when good cause exists for an extension. An extension is requested in writing and the Tri-Party Agreement requires that it be accompanied by the following information:

- Identification of the scheduled deliverable for which an extension is sought
- The length of the extension sought
- The good cause for the extension
- Identification of any related schedule affected by the extension.

Good cause for an extension may include the following:

- Force majeure
- A delay caused by another party's failure to meet a requirement of the Tri-Party Agreement

- A delay caused by good faith invocation of dispute resolution procedures or initiation of judicial action
- A delay resulting from an extension granted to a related schedule
- Any other event mutually agreed to as constituting good cause.

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Table 2-1. Summary of Annual Waste Generation Projections.*

Waste stream	Projected generation (m^3)				
	1993	1994	1995	1996	1997
1. DST Waste (before evaporation)	8,300	20,300	21,100	17,600	13,600
2. PUREX Aging Waste	0	0	0	0	0
3. SST Waste	0	0	0	0	0
4. 242-A Evaporator Process Condensate	28,500	20,700	15,100	41,200	9,100
5. 4843 Sodium Storage Facility Waste	0.21	0	0	0	0
6. PUREX Ammonia Scrubber Waste	0	0	0	0	0
7. PUREX Process Condensate	0	0	0	0	0
8. Hexone Waste	0	0	0	0	0
9. 183-H Solar Evaporation Basins Waste	0	0	0	0	0
10. PUREX Storage Tunnel 2 Waste (mercury)*	0	0	0	0	0
11a. PUREX Storage Tunnels 1 and 2 Waste (lead)	0	0	0	0	0
11b. PUREX Storage Tunnels 1 and 2 Waste (silver)	0	0	0	0	0
12. PUREX Canyon Deck Storage (lead and cadmium)	0	0	0	0	0
13. SWOC Stored Low-Level, TRU, and PCB Waste	1,052	1,636	2,771	2,695	2,897
14. Retrievably Stored Low-Level and TRU Waste	0	0	0	0	0
15. TRUSAF Stored Waste	266	266	266	266	266
16. 303-K Stored Waste	2	0	0	0	0
Total Projected Generation	38,120	42,902	39,237	61,761	25,863

*These generation rates are based on the assumptions of Chapter 1.0, Section 1.2. Generation rate depends upon the need to move failed equipment containing mercury, lead, and/or silver. Reliable predictions can be made only 1 year in advance.

DST = double-shell tank
PCB = polychlorinated biphenyl
PUREX = Plutonium-Uranium Extraction (Plant)
SST = single-shell tank
SWOC = Solid Waste Operations Complex
TRU = transuranic
TRUSAF = Transuranic Waste Storage and Assay Facility

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Table 2-2. Waste Stream Characterization. (sheet 1 of 3)

Waste stream	Schedule	Method, protocol, specific analyses
1. DST Waste	1990-1995 (M-23-03, Ecology et al. 1990)	• Waste analysis plan completed. • Weighted bottle method for supernate and slurry. • Core sampling for sludge. • Protocol: EPA-SW-846 (EPA 1986) with Ecology-approved deviations. • Specific analysis: physical characteristics, 33 inorganics, organics, radioisotopes.
2. PUREX Aging Waste	1989-1992	• Core samples will be characterized. Analyses to be conducted have not been determined at this time.
3. SST Waste	1989-1998 (M-10-00)	• At least two core samples from each SST. • Core sampling in accordance with Ecology-approved Waste Analysis Plan (Sasaki 1990) and subsequent revisions. • Protocol: EP-SW-846. • Samples will be tested for several organics, inorganics, metals, isotopes, and physical parameters.
4. 242-A Evaporator Process Condensate	Waste to be sampled in accordance with 242-A permit conditions (currently being developed)	• Future characterization will be negotiated among the EPA, DOE, and Ecology. • Treated stream will be characterized after treatment facility startup.
5. 4843 Sodium Storage Facility Waste	No future characterization is planned	NA
6. PUREX Ammonia Scrubber Waste	1990-1995, with other DST waste	• Waste analysis plan completed per M-23-03 (Ecology et al. 1990).
7. PUREX Process Condensate	1990-1995, with other DST waste	• Waste analysis plan completed per M-23-03 (Ecology et al. 1990).
8. Hexone Waste	Waste characterization and treatment complete	• Distillation residue has been characterized.
9. 183-H Solar Evaporation Basins Waste	Waste characterization complete	• Characterization details contained in DOE/RL-90-39 (RL 1991a).

Table 2-2. Waste Stream Characterization. (sheet 2 of 3)

Waste stream	Schedule	Method, protocol, specific analyses
10. PUREX Storage Tunnel 2 Waste (mercury)	Waste characterization complete	• Characterization details contained in RL (1990a).
11a. PUREX Storage Tunnels 1 and 2 Waste (lead)	Waste characterization complete	• Characterization details contained in RL (1990a).
11b. PUREX Storage Tunnel 2 Waste (silver)	Waste characterization complete	• Characterization details contained in RL (1990a).
12. PUREX Canyon Deck Storage (lead and cadmium)	No further characterization is planned	NA
13. SWOC Stored, Low-Level, TRU, and PCB Waste	Waste will be characterized before treatment beginning 1996 (WRAP, Module 1)	• A summary of the process descriptions in the WRAP Facility, Module 1, including sampling and treatment activities, are in the detail design package. This includes field screening already planned in WRAP, Module 1 such as pH, conductivity, and organic vapor analysis. Other characterization activities in WRAP, Module 1, are nondestructive evaluation or analysis. The development work for field screening techniques are (or will be) listed in the engineering development plan for the various WRAP projects and other solid waste projects. Items planned for development this year are raman spectroscopy and x-ray fluorescence.
14. Retrievably Stored Low-Level and TRU Waste	• In situ characterization 1991-1994 • Waste will be characterized before disposal after processing at WRAP Facility	• Real-time radiography will help identify liquids and lead in pre-1980 drums. • Gas within containers will be sampled and analyzed to ascertain whether explosive gas mixtures are present.
15. TRUSAF Stored Waste	No further characterization is planned	• Certified and shipped to the Waste Isolation Pilot Plant.

Table 2-2. Waste Stream Characterization. (sheet 3 of 3)

Waste stream	Schedule	Method, protocol, specific analyses
16. 303-K Stored Waste	Methods for sampling and analysis are being developed in FY 1993	NA

DOE = U.S. Department of Energy
DST = double-shell tank
Ecology = Washington State Department of Ecology
EPA = U.S. Environmental Protection Agency
NA = not applicable
PCB = polychlorinated biphenyl
PUREX = Plutonium-Uranium Extraction (Plant)
RL = U.S. Department of Energy, Richland Field Office
SST = single-shell tank
SWOC = Solid Waste Operations Complex
TRU = transuranic
TRUSAF = Transuranic Waste Storage and Assay Facility
WRAP = Waste Receiving and Processing (Facility)

Table 2-3. Hazardous Waste Designations of Plan Waste Streams.[a]
(sheet 1 of 5)

Waste stream	Designated waste code(s)
1. DST Waste[b]	D001 (ignitable)[a,c] D002 (corrosive) D003 (reactive) D004 (TCLP arsenic) D005 (TCLP barium) D006 (TCLP cadmium) D007 (TCLP chromium) D008 (TCLP lead) D009 (TCLP mercury) D010 (TCLP selenium) D011 (TCLP silver) F001 (1,1,1-trichloroethane) F002 (methylene chloride) F003 (acetone and hexone) F004 (cresylic acid) F005 (methylethyl ketone) WC01 (carcinogenic extremely hazardous waste)[c] WC02 (carcinogenic dangerous waste)[c] WP01 (persistent extremely hazardous waste)[c] WP02 (persistent dangerous waste)[c] WT01 (toxic)[c] WT02 (toxic)[c]
2. PUREX Aging Waste	D001 (ignitable)[a,c] D002 (corrosive) D006 (TCLP cadmium) D007 (TCLP chromium) D008 (TCLP lead)[c]
3. SST Waste	D001 (ignitable) D002 (corrosive) D005 (TCLP barium) D006 (TCLP cadmium) D007 (TCLP chromium) D008 (TCLP lead) D009 (TCLP mercury) D010 (TCLP selenium) D011 (TCLP silver) F003 (acetone and hexone) F005 (nonspent halogenated solvents) WT01 (toxic)
4. 242-A Evaporator Process Condensate	F003 (acetone and hexone) F005 (methyl ethyl ketone) WT01 (toxic, extremely hazardous) WT02 (toxic)

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Table 2-3. Hazardous Waste Designations of Plan Waste Streams.[a]
(sheet 2 of 5)

Waste stream	Designated waste code(s)
5. 4843 Sodium Storage Facility Waste	D001 (ignitable) D002 (corrosive) D003 (reactive) WT01 (toxic) WT02 (toxic)
6. PUREX Ammonia Scrubber Waste	D002 (corrosive) WT01 (toxic)
7. PUREX Process Condensate	D002 (corrosive) WT02 (toxic)
8. Hexone Waste	D001 (ignitable) F003 (hexone) WC02 (carcinogenic) WT02 (toxic)
9. 183-H Solar Evaporation Basins Waste[d]	D007 (TCLP chromium) P029 (copper cyanides) P030 (soluble cyanide salts) P098 (potassium cyanide) P106 (sodium cyanide) P120 (vanadium pentoxide) U123 (formic acid) WT01 (toxic)
10. PUREX Storage Tunnel 2 Waste (mercury)	D001 (ignitable) D009 (TCLP mercury) D011 (silver nitrate) WT01 (toxic)
11a. PUREX Storage Tunnels 1 and 2 Waste (lead)	D008 (TCLP lead) WT01 (toxic)
11b. PUREX Storage Tunnel 2 Waste (silver)	D001 (ignitable) D011 (TCLP silver) WT01 (toxic)
12. PUREX Canyon Deck Storage (lead and cadmium)	D006 (TCLP cadmium) D008 (TCLP lead) WT01 (toxic)

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Table 2-3. Hazardous Waste Designations of Plan Waste Streams.[a]
(sheet 3 of 5)

Waste stream	Designated waste code(s)
13. SWOC Stored Low-Level, TRU, and PCB Waste NOTE: Due to the nature of this facility, an extensive number of waste codes apply. Some of the major codes are presented here. (This also applies to Table 2-6.) The Part A permit application contains a complete listing.	D001 (ignitable)[a,c] D002 (corrosive) D003 (reactive) D004 (TCLP arsenic) D005 (TCLP barium) D006 (TCLP cadmium) D007 (TCLP chromium) D008 (TCLP lead) D009 (TCLP mercury) D010 (TCLP selenium) D011 (TCLP silver) D012 (TCLP Endrin) D016 (TCLP 2,4-D) F001 (spent halogenated degreasing solvents) F002 (spent halogenated solvents) F003 (acetone) F004 (cresols) F005 (spent non-halogenated solvents) P029 (copper cyanides) P030 (soluble cyanide salts) P098 (potassium cyanide) P106 (sodium cyanide) P120 (vanadium pentoxide) U080 (dichloromethane) U123 (formic acid) U161 (methylisobutylketone) W001 (PCBs) WC01 (carcinogenic extremely hazardous waste) WC02 (carcinogenic dangerous waste) WP01 (persistent extremely hazardous waste) WP02 (persistent dangerous waste) WP03 (polycyclic) WT01 (toxic) WT02 (toxic)

Table 2-3. Hazardous Waste Designations of Plan Waste Streams.[a]
(sheet 4 of 5)

Waste stream	Designated waste code(s)
14. Retrievably Stored Low-Level and TRU Waste	D001 (ignitable)[a,c] D003 (reactive) D005 (TCLP barium) D006 (TCLP cadmium) D007 (TCLP chromium) D008 (TCLP lead) D009 (TCLP mercury) D011 (TCLP silver) F001 (spent halogenated degreasing solvents) F003 (acetone) F005 (spent non-halogenated solvents) P015 (beryllium dust) WC01 (carcinogenic extremely hazardous waste) WC02 (carcinogenic dangerous waste) WP01 (persistent extremely hazardous waste) WP03 (polycyclic dangerous waste) WT01 (toxic) WT02 (toxic)
15. TRUSAF Stored Waste	D002 (corrosive) D005 (TCLP barium) D006 (TCLP cadmium) D007 (TCLP chromium) D008 (TCLP lead) D009 (TCLP mercury) WC01 (carcinogenic extremely hazardous waste) WC02 (carcinogenic dangerous waste) WP01 (persistent extremely hazardous waste) WT01 (toxic)

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Table 2-3. Hazardous Waste Designations of Plan Waste Streams.[a]
(sheet 5 of 5)

Waste stream	Designated waste code(s)
16. 303-K Stored Waste	D001 (ignitable) D006 (TCLP cadmium) D007 (TCLP chromium) D008 (TCLP lead) D037 (pentachlorophenol) D039 (perchlorethylene) D040 (trichlorethylene) F001 (spent halogenated degreasing solvents) F003 (spent nonhalogenated solvents) WC01, WC02 (carcinogenic) WP01, WP02 (persistent) WT02 (toxic)

[a]Further information is given in Section 2.2.

[b]TCLP waste codes D018, D019, D022, D028, D029, D030, D033, D035, D036, and D038 through D043 are listed in the DST Part A permit application but are not listed in this table or in Table 2-6 because analysis of tank waste has not yet confirmed these to be present.

[c]Designation is based on process knowledge; waste has not been laboratory analyzed for these components.

[d]This waste has been removed and transferred to the SWOC (waste stream 13 in this report).

DST = double-shell tank
PCB = polychlorinated biphenyl
PUREX = Plutonium-Uranium Extraction (Plant)
SST = single-shell tank
SWOC = Solid Waste Operations Complex
TCLP = toxic characteristic leach procedure
TRU = transuranic
TRUSAF = Transuranic Waste Storage and Assay Facility

Table 2-4. Storage Unit Characteristics. (sheet 1 of 2)

Waste stream	Facility	Capacity (m^3)	Anticipated capacity fill date	Part B/Closure Plan (Latest Revision)	Known Release of hazardous constituents
1. DST Waste	DSTs	111,000	1993	6/91	none
2. PUREX Aging Waste	DSTs	7,400	1993	6/91	none
3. SST Waste	SSTs	357,500[a]	NA[b]	9/89[c]	yes (Table 3-6)
4. 242-A Evaporator Process Condensate	LERF	49,000	1994	6/91	none
5. 4843 Sodium Storage Facility Waste	4843 Building	84,000 kg	NA[b]	6/91*	none
6. PUREX Ammonia Scrubber Waste	DSTs	111,800	NA[b]	6/91	none
7. PUREX Process Condensate	DSTs	111,800	NA[b]	6/91	none
8. Hexone Waste	276-S-141 276-S-142	178[a]	NA[b]	11/92[c]	none
9. 183-H Solar Evaporation Basins Waste	183-H Basins	8,200[a]	NA[b]	9/91[c]	yes (Section 3.9.3)
10. PUREX Storage Tunnel 2 Waste (mercury)	PUREX Tunnel 2	d	NA[e]	12/91	none
11a. PUREX Storage Tunnels 1 and 2 Waste (lead)	PUREX Tunnels 1, 2	d	NA[e]	12/91	none
11b. PUREX Storage Tunnels 1 and 2 Waste (silver)	PUREX Tunnel 2	d	NA[e]	12/91	none
12. PUREX Canyon Deck Storage (lead and cadmium)	PUREX canyon	b	NA[e]	9/92	none
13. SWOC Stored Low-Level, TRU, and PCB Waste	Various	23,898	1999	10/91	none
14. Retrievably Stored Low-Level and TRU Wastes	Various	15,440[a]	NA[a]	10/91	none

Table 2-4. Storage Unit Characteristics. (sheet 2 of 2)

Waste stream	Facility	Capacity (m^3)	Anticipated capacity fill date	Part B/Closure Plan (Latest Revision)	Known Release of hazardous constituents
15. TRUSAF Stored Waste	224-T Building	420	NA[b]	6/92	none
16. 303-K Stored Waste	303-K Building	42	NA[a]	11/91	none

[a]This unit is no longer used for active storage; capacity noted is for information only.
[b]No future generation, or no significant generation (303-K), of this waste.
[c]Closure plan.
[d]PUREX Storage Tunnel 1 has a total capacity for 8 railcars, equivalent to 600 cubic meters, and is filled. PUREX Storage Tunnel 2 has a total capacity for 40 railcars, equivalent to 3,080 cubic meters, and currently contains 17 railcars or 1,360 cubic meters. The total capacity of both tunnels is 3,680 cubic meters with 1,720 cubic meters unfilled.
[e]Capacity is sufficient for all future generation.

DST = double-shell tank
LERF = Liquid Effluent Retention Facility
NA = not applicable
PCB = polychlorinated biphenyl
PUREX = Plutonium-Uranium Extraction (Facility)
SST = single-shell tank
TRUSAF = Transuranic Waste Storage and Assay Facility

Table 2-5. Stored Waste Characteristics. (sheet 1 of 2)

Waste stream	Facility	Amount in storage (m^3)	Date first waste in storage	Liquid (%)	Solid (%)	Sludge (%)	LLW	TRU/LLW	HLW
1. DST Waste	DSTs	86,806[a]	1975	80	11	9	b	b	b
2. PUREX Aging Waste	DSTs	7,132[a]	1975	93	0	7	0	0	100
3. SST Waste	SST	139,500	1944	31	44	25	b	b	b
4. 242-A Evaporator Process Condensate	LERF	none		100	0	0	100	0	0
5. 4843 Sodium Storage Facility Waste	4843 Building	8.5	1987	0	100	0	100	0	0
6. PUREX Ammonia Scrubber Waste	DSTs	5,900[a]	1987	100	0	0	100	0	0
7. PUREX Process Condensate	DSTs	4,800[a]	1989	100	0	0	100	0	0
8. Hexone Waste	276-S-141, 142	0.4	1951	0	0	0	0	0	0
9. 183-H Solar Evaporation Basins Waste	183-H Basins	none[c]	1973	20[c]	80[c]	0	100[c]	0	0
10. PUREX Storage Tunnel 2 Waste (mercury)	PUREX Tunnel 2	0.01[d]	1971	100	0	0	100	0	0
11a. PUREX Storage Tunnel 2 Waste (lead)	PUREX Tunnel 1 PUREX Tunnel 2	0.25[d]	1960	0	100	0	100	0	0
11b. PUREX Storage Tunnels 1 and 2 Waste (silver)	PUREX Tunnel 2	0.17[d]	1971	0	100	0	100	0	0
12. PUREX Canyon Deck Storage (lead and cadmium)	PUREX Plant	0.29[d]	1987	0	100	0	100	0	0
13. SWOC Stored Low-Level, TRU, and PCB Wastes	Various	3,287	1988	0	100	0	95	5	0
14. Retrievably Stored Low-Level and TRU Wastes	Various	978	1970	0	100	0	78	22	0

Table 2-5. Stored Waste Characteristics. (sheet 2 of 2)

Waste stream	Facility	Amount in storage (m^3)	Date first waste in storage	Liquid (%)	Solid (%)	Sludge (%)	LLW	TRU/LLW	HLW
15. TRUSAF Stored Waste	224-T Bldg	43	1985	0	100	0	0	100	0
16. 303-K Stored Waste	303-K Bldg	14.7	1943	0	100	0	100	0	0

[a]Inventories for PUREX Ammonia Scrubber Waste and PUREX Process Condensate also are included in the DST Waste inventory. PUREX Aging Waste is not included in the DST Waste inventory. The total DST Waste inventory is 93,938 cubic meters.

[b]Tank waste contains LLW, TRU, and HLW. However, in the interim storage mode, all DST and SST waste is managed as HLW.

[c]Waste from the 183-H Solar Evaporation Basins has been removed and is now stored at the Solid Waste Operations Complex. Other reported valves for 183-H are for the waste when it was at 183-H. Any waste that has leaked from the basins would not be included within the scope of this report.

[d]These are the actual waste volumes. The wastes are in railcars with 600 cubic meters in storage in Tunnel 1 and 1,360 cubic meters in storage in Tunnel 2 (railcars included).

DST = double-shell tank
HLW = high-level waste
LERF = Liquid Effluent Retention Facility
LLW = low-level waste
PCB = polychlorinated biphenyl
PUREX = Plutonium-Uranium Extraction (Facility)
SST = single-shell tank
TRU = transuranic (waste)
TRUSAF = Transuranic Waste Storage and Assay Facility.

Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 1 of 12)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
1. DST Waste Pretreated Complexant Concentrate Waste (transuranic fraction)						
F001	CCW	vitrification	HWVP	33	WIPP	2004
F002	CCW	vitrification	HWVP	33	WIPP	2004
F003	CCW	vitrification	HWVP	33	WIPP	2004
F004	CCW	vitrification	HWVP	33	WIPP	2004
F005	CCW	vitrification	HWVP	33	WIPP	2004
D001	deactivation	vitrification	HWVP	33	WIPP	2004
D002	deactivation	vitrification	HWVP	33	WIPP	2004
D003	deactivation	vitrification	HWVP	33	WIPP	2004
D004	CCWE	vitrification	HWVP	33	WIPP	2004
D005	CCWE	vitrification	HWVP	33	WIPP	2004
D006	CCWE	vitrification	HWVP	33	WIPP	2004
D007	CCWE	vitrification	HWVP	33	WIPP	2004
D008	CCWE	vitrification	HWVP	33	WIPP	2004
D009	CCWE	vitrification	HWVP	33	WIPP	2004
D010	CCWE	vitrification	HWVP	33	WIPP	2004
D011	CCWE	vitrification	HWVP	33	WIPP	2004
WT01	reduction	vitrification	HWVP	33	WIPP	2004
WT02	none	vitrification	HWVP	33	WIPP	2004
WC01	reduction	vitrification	HWVP	33	WIPP	2004
WC02	none	vitrification	HWVP	33	WIPP	2004
WP01	reduction	vitrification	HWVP	33	WIPP	2004
WP02	none	vitrification	HWVP	33	WIPP	2004
Pretreated Complexed Concentrate Waste (low-level fraction)						
F001	CCW	evaporation	242-A	870	none[b]	2001[c]
F002	CCW	evaporation	242-A	870	none[b]	2001[c]
F003	CCW	evaporation	242-A	870	none[b]	2001[c]
F004	CCW	evaporation	242-A	870	none[b]	2001[c]

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Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 2 of 12)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
F005	CCW	evaporation	242-A	870	none[b]	2001[c]
D001	deactivation	grout	GTF	382	GTF	2001[c]
D002	deactivation	grout	GTF	382	GTF	2001[c]
D003	deactivation	grout	GTF	382	GTF	2001[c]
D004	CCWE	grout	GTF	382	GTF	2001[c]
D005	CCWE	grout	GTF	382	GTF	2001[c]
D006	CCWE	grout	GTF	382	GTF	2001[c]
D007	CCWE	grout	GTF	382	GTF	2001[c]
D008	CCWE	grout	GTF	382	GTF	2001[c]
D009	CCWE	grout	GTF	382	GTF	2001[c]
D010	CCWE	grout	GTF	382	GTF	2001[c]
D011	CCWE	grout	GTF	382	GTF	2001[c]
WT01	reduction	grout	GTF	382	GTF	2001[c]
WT02	none	grout	GTF	382	GTF	2001[c]
WC01	reduction	grout	GTF	382	GTF	2001[c]
WC02	none	grout	GTF	382	GTF	2001[c]
WP01	reduction	grout	GTF	382	GTF	2001[c]
WP02	none	grout	GTF	382	GTF	2001[c]
Pretreated Neutralized Cladding Removal Waste (transuranic fraction)						
F001	CCW	vitrification	HWVP	33	WIPP	2002
F002	CCW	vitrification	HWVP	33	WIPP	2002
F003	CCW	vitrification	HWVP	33	WIPP	2002
F004	CCW	vitrification	HWVP	33	WIPP	2002
F005	CCW	vitrification	HWVP	33	WIPP	2002
D001	deactivation	vitrification	HWVP	33	WIPP	2002
D002	deactivation	vitrification	HWVP	33	WIPP	2002
D003	deactivation	vitrification	HWVP	33	WIPP	2002
D004	CCWE	vitrification	HWVP	33	WIPP	2002

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Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 3 of 12)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
D005	CCWE	vitrification	HWVP	33	WIPP	2002
D006	CCWE	vitrification	HWVP	33	WIPP	2002
D007	CCWE	vitrification	HWVP	33	WIPP	2002
D008	CCWE	vitrification	HWVP	33	WIPP	2002
D009	CCWE	vitrification	HWVP	33	WIPP	2002
D010	CCWE	vitrification	HWVP	33	WIPP	2002
D011	CCWE	vitrification	HWVP	33	WIPP	2002
WT01	reduction	vitrification	HWVP	33	WIPP	2002
WT02	none	vitrification	HWVP	33	WIPP	2002
WC01	reduction	vitrification	HWVP	33	WIPP	2002
WC02	none	vitrification	HWVP	33	WIPP	2002
WP01	reduction	vitrification	HWVP	33	WIPP	2002
WP02	none	vitrification	HWVP	33	WIPP	2002
Pretreated Neutralized Cladding Removal Waste (Low-Level Fraction)						
F001	CCW	evaporation	242-A	870	none[b]	1998[c]
F002	CCW	evaporation	242-A	870	none[b]	1998[c]
F003	CCW	evaporation	242-A	870	none[b]	1998[c]
F004	CCW	evaporation	242-A	870	none[b]	1998[c]
F005	CCW	evaporation	242-A	870	none[b]	1998[c]
D001	deactivation	grout	GTF	382	GTF	1998[c]
D002	deactivation	grout	GTF	382	GTF	1998[c]
D003	deactivation	grout	GTF	382	GTF	1998[c]
D004	CCWE	grout	GTF	382	GTF	1998[c]
D005	CCWE	grout	GTF	382	GTF	1998[c]
D006	CCWE	grout	GTF	382	GTF	1998[c]
D007	CCWE	grout	GTF	382	GTF	1998[c]
D008	CCWE	grout	GTF	382	GTF	1998[c]
D009	CCWE	grout	GTF	382	GTF	1998[c]

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Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 4 of 12)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
D010	CCWE	grout	GTF	382	GTF	1998[c]
D011	CCWE	grout	GTF	382	GTF	1998[c]
WT01	CCWE	grout	GTF	382	GTF	1998[c]
WT02	CCWE	grout	GTF	382	GTF	1998[c]
WC01	CCWE	grout	GTF	382	GTF	1998[c]
WC02	CCWE	grout	GTF	382	GTF	1998[c]
WP01	CCWE	grout	GTF	382	GTF	1998[c]
WP02	CCWE	grout	GTF	382	GTF	1998[c]
Double-Shell Slurry Feed And Double-Shell Slurry						
F001	CCW	evaporation	242-A	870	none[b]	1992[c]
F002	CCW	evaporation	242-A	870	none[b]	1992[c]
F003	CCW	evaporation	242-A	870	none[b]	1992[c]
F004	CCW	evaporation	242-A	870	none[b]	1992[c]
F005	CCW	evaporation	242-A	870	none[b]	1992[c]
D001	deactivation	grout	GTF	382	GTF	1992[c]
D002	deactivation	grout	GTF	382	GTF	1992[c]
D004	CCWE	grout	GTF	382	GTF	1992[c]
D005	CCWE	grout	GTF	382	GTF	1992[c]
D006	CCWE	grout	GTF	382	GTF	1992[c]
D007	CCWE	grout	GTF	382	GTF	1992[c]
D008	CCWE	grout	GTF	382	GTF	1992[c]
D009	CCWE	grout	GTF	382	GTF	1992[c]
D010	CCWE	grout	GTF	382	GTF	1992[c]
D011	CCWE	grout	GTF	382	GTF	1992[c]
WT01	CCWE	grout	GTF	382	GTF	1992[c]
WT02	CCWE	grout	GTF	382	GTF	1992[c]
WC01	CCWE	grout	GTF	382	GTF	1992[c]
WC02	CCWE	grout	GTF	382	GTF	1992[c]
WP01	CCWE	grout	GTF	382	GTF	1992[c]

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Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 5 of 12)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
WP02	CCWE	grout	GTF	382	GTF	1992[c]
2. PUREX Aging Waste High-Level Fraction						
D001	deactivation	vitrification	HWVP	33	repository	2000
D002	vitrification	vitrification	HWVP	33	repository	2000
D006	vitrification	vitrification	HWVP	33	repository	2000
D007	vitrification	vitrification	HWVP	33	repository	2000
D008	vitrification	vitrification	HWVP	33	repository	2000
Low-Level Waste						
D001	deactivation	grout	GTF	382	GTF	1995[c]
D002	deactivation	grout	GTF	382	GTF	1995[c]
D006	CCWE	grout	GTF	382	GTF	1995[c]
D007	CCWE	grout	GTF	382	GTF	1995[c]
D008	CCWE	grout	GTF	382	GTF	1995[c]
3. SST Waste Liquid Single-Shell Tank Waste						
F003	CCW	evaporation	242-A	870	none[b]	1992[c]
F005	CCW	evaporation	242-A	870	none[b]	1992[c]
D001	deactivation	grout	GTF	382	GTF	1992[c]
D002	deactivation	grout	GTF	382	GTF	1992[c]
D005	CCWE	grout	GTF	382	GTF	1992[c]
D006	CCWE	grout	GTF	382	GTF	1992[c]
D007	CCWE	grout	GTF	382	GTF	1992[c]
D008	CCWE	grout	GTF	382	GTF	1992[c]
D009	CCWE	grout	GTF	382	GTF	1992[c]
D010	CCWE	grout	GTF	382	GTF	1992[c]
D011	CCWE	grout	GTF	382	GTF	1992[c]
Non-Liquid Single-Shell Tank Waste Treatment						
Treatment not selected.						

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Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 6 of 12)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
4. 242-A Evaporator Process Condensate						
F003	CCW	destruction	ETF	TBD	SALDS	1994
F005	CCW	destruction	ETF	TBD	SALDS	1994
WT01	reduction	removal	ETF	TBD	SALDS	1994
WT02	none	removal	ETF	TBD	SALDS	1994
5. 4843 Sodium Storage Facility Waste						
D001	deactivation	deactivation	TBD	TBD	LLBG	TBD
D002	deactivation	deactivation	TBD	TBD	LLBG	TBD
D003	deactivation	deactivation	TBD	TBD	LLBG	TBD
WT01	reduction	TBD	TBD	TBD	TBD	TBD
WT02	none	TBD	TBD	TBD	TBD	TBD
6. PUREX Ammonia Scrubber Waste						
Included with LLW DST wastes.						
7. PUREX Process Condensate						
Included with LLW DST wastes.						
8. Hexone Waste						
F003	CCW	incineration	Diversified Scientific Services, Kingston, TN	12	None (complete destruc-tion)	1991-1993
WT02	none	incineration	Diversified Scientific Services, Kingston, TN	12	None (complete destruc-tion)	1991-1993
D001	deactivation	incineration	Diversified Scientific Services, Kingston, TN	12	None (complete destruc-tion)	1991-1993
WC02	CCWE	incineration	Diversified Scientific Services, Kingston, TN	12	None (complete destruc-tion)	1991-1993

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Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 7 of 12)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
9. 183-H Solar Evaporation Basins Waste						
U123	incineration[g]	TBD	TBD	TBD	TBD	TBD
P030	CCWE	TBD	WRAP	TBD	TBD	1999[e]
P120	stabilization	TBD	WRAP	TBD	TBD	1999[e]
P029	CCWE	TBD	WRAP	TBD	TBD	1999[e]
P106	CCWE	TBD	WRAP	TBD	TBD	1999[e]
P098	CCWE	TBD	WRAP	TBD	TBD	1999[e]
D007	CCWE	TBD	WRAP	TBD	TBD	1999[e]
WT01	reduction	TBD	WRAP	TBD	TBD	1999[e]
10. PUREX Storage Tunnel 2 Waste (mercury)						
D001	deactivation	TBD	TBD	TBD	TBD	TBD
D009	amalgamation	TBD	TBD	TBD	TBD	TBD
D011	CCWE	TBD	TBD	TBD	TBD	TBD
WT01	reduction	TBD	TBD	TBD	TBD	TBD
11. PUREX Storage Tunnels 1 and 2 Waste (lead and silver)						
D001	deactivation	TBD	TBD	TBD	TBD	TBD
D008	macro-encapsulation	TBD	TBD	TBD	TBD	TBD
D011	CCWE	TBD	TBD	TBD	TBD	TBD
WT01	reduction	TBD	TBD	TBD	TBD	TBD
12. PUREX Canyon Deck Storage (lead and cadmium)						
D006	CCWE	TBD	TBD	TBD	TBD	TBD
D008	macro-encapsulation	TBD	TBD	TBD	TBD	TBD
WT01	reduction	TBD	TBD	TBD	TBD	TBD
13. SWOC Stored Low-Level, Transuranic, and PCB Wastes Low-Level Waste[h]						
F001	CCW	TBD	WRAP	TBD	TBD	1999[e]
F002	CCW	TBD	WRAP	TBD	TBD	1999[e]
F003	CCW	TBD	WRAP	TBD	TBD	1999[e]

9 3 1 2 9 3 7 0 8 6 3

Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 8 of 12)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
F004	CCW	TBD	WRAP	TBD	TBD	1999[e]
F005	CCW	TBD	WRAP	TBD	TBD	1999[e]
D001	deactivation	TBD	WRAP	TBD	TBD	1999[e]
D002	deactivation	TBD	WRAP	TBD	TBD	1999[e]
D003	deactivation	TBD	WRAP	TBD	TBD	1999[e]
D004	CCWE	TBD	WRAP	TBD	TBD	1999[e]
D005	CCWE	TBD	WRAP	TBD	TBD	1999[e]
D006	CCWE	TBD	WRAP	TBD	TBD	1999[e]
D007	CCWE	TBD	WRAP	TBD	TBD	1999[e]
D008	macro-encapsulation	TBD	WRAP	TBD	TBD	1999[e]
D009	amalgamation	TBD	WRAP	TBD	TBD	1999[e]
D010	CCWE	TBD	WRAP	TBD	TBD	1999[e]
D011	CCWE	TBD	WRAP	TBD	TBD	1999[e]
D012	CCWE	TBD	WRAP	TBD	TBD	1999[e]
D016	CCWE	TBD	WRAP	TBD	TBD	1999[e]
WT01	reduction	TBD	WRAP	TBD	TBD	1999[e]
WT02	none	TBD	WRAP	TBD	TBD	1999[e]
WC01	reduction	TBD	WRAP	TBD	TBD	1999[e]
WC02	none	TBD	WRAP	TBD	TBD	1999[e]
WP01	reduction	TBD	WRAP	TBD	TBD	1999[e]
WP02	none	TBD	WRAP	TBD	TBD	1999[e]
WP03	none	TBD	WRAP	TBD	TBD	1999[e]
U080	CCWE	TBD	WRAP	TBD	TBD	1999[e]
U123	incineration[g]	TBD	TBD	TBD	TBD	TBD
U161	CCWE	TBD	WRAP	TBD	TBD	1999[e]
P029	CCWE	TBD	WRAP	TBD	TBD	1999[e]
P030	CCWE	TBD	WRAP	TBD	TBD	1999[e]
P098	CCWE	TBD	WRAP	TBD	TBD	1999[e]

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Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 9 of 12)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
P106	CCWE	TBD	WRAP	TBD	TBD	1999[e]
P120	stabilization	TBD	WRAP	TBD	TBD	1999[e]
PCBs	incineration[g]	TBD	TBD	TBD	TBD	TBD
Transuranic Waste[i]						
F003	CCW	TBD	WRAP	TBD	TBD	1999[e]
F005	CCW	TBD	WRAP	TBD	TBD	1999[e]
D001	deactivation	TBD	WRAP	TBD	TBD	1999[e]
D002	deactivation	TBD	WRAP	TBD	TBD	1999[e]
D006	CCWE	TBD	WRAP	TBD	TBD	1999[e]
D007	CCWE	TBD	WRAP	TBD	TBD	1999[e]
D008	macro-encapsulation	TBD	WRAP	TBD	TBD	1999[e]
D009	amalgamation	TBD	WRAP	TBD	TBD	1999[e]
WT01	reduction	TBD	WRAP	TBD	TBD	1999[e]
WT02	none	TBD	WRAP	TBD	TBD	1999[e]
WC01	reduction	TBD	WRAP	TBD	TBD	1999[e]
WC02	none	TBD	WRAP	TBD	TBD	1999[e]
PCBs	incineration[g]	TBD	TBD	TBD	TBD	TBD
14. Retrievably Stored Low-Level and Transuranic Wastes Low-Level Waste[j]						
F001	CCW	TBD	WRAP	TBD	TBD	1999[e]
F003	CCW	TBD	WRAP	TBD	TBD	1999[e]
F005	CCW	TBD	WRAP	TBD	TBD	1999[e]
D001	deactivation	TBD	WRAP	TBD	TBD	1999[e]
D003	deactivation	TBD	WRAP	TBD	TBD	1999[e]
D005	CCWE	TBD	WRAP	TBD	TBD	1999[e]
D006	CCWE	TBD	WRAP	TBD	TBD	1999[e]
D007	CCWE	TBD	WRAP	TBD	TBD	1999[e]
D008	macro-encapsulation	TBD	WRAP	TBD	TBD	1999[e]

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Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 10 of 12)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
D009	amalgamation	TBD	WRAP	TBD	TBD	1999[e]
D011	CCWE	TBD	WRAP	TBD	TBD	1999[e]
WT01	reduction	TBD	WRAP	TBD	TBD	1999[e]
WT02	none	TBD	WRAP	TBD	TBD	1999[e]
WC01	reduction	TBD	WRAP	TBD	TBD	1999[e]
WC02	none	TBD	WRAP	TBD	TBD	1999[e]
WP01	reduction	TBD	WRAP	TBD	TBD	1999[e]
WP03	none	TBD	WRAP	TBD	TBD	1999[e]
PCBs	incineration[g]	TBD	TBD	TBD	TBD	TBD
Transuranic Waste[k]						
D006	CCWE	TBD	WRAP	TBD	TBD	1999[e]
D008	macro-encapsulation	TBD	WRAP	TBD	TBD	1999[e]
WT01	reduction	TBD	WRAP	TBD	TBD	1999[e]
WT01	reduction	TBD	WRAP	TBD	TBD	1999[e]
WC01	reduction	TBD	WRAP	TBD	TBD	1999[e]
P015	recovery	TBD	WRAP	TBD	TBD	1999[e]
15. TRUSAF Stored Waste						
D002	none[f]	none	--	--	WIPP	--
D005	none[f]	none	--	--	WIPP	--
D006	none[f]	none	--	--	WIPP	--
D007	none[f]	none	--	--	WIPP	--
D008	none[f]	none	--	--	WIPP	--
D009	none[f]	none	--	--	WIPP	--
WC01	none[f]	none	--	--	WIPP	--
WC02	none[f]	none	--	--	WIPP	--
WP01	none[f]	none	--	--	WIPP	--
WT01	none[f]	none	--	--	WIPP	--

9 3 1 2 9 7 0 8 6 6

Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 11 of 12)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
16. 303-K Stored Waste						
F001	CCW	TBD	WRAP	TBD	TBD	1999[e,m]
F003	CCW	TBD	WRAP	TBD	TBD	1999[e,m]
D001	deactivation	TBD	WRAP	TBD	TBD	1999[e]
D006	CCWE	TBD	WRAP	TBD	TBD	1999[e]
D007	CCWE	TBD	WRAP	TBD	TBD	1999[e]
D008	macro-encapsulation	TBD	WRAP	TBD	TBD	1999[e]
D037	none currently promulgated	TBD	WRAP	TBD	TBD	1999[e]
D039	none currently promulgated	TBD	WRAP	TBD	TBD	1999[e]
D040	none currently promulgated	TBD	WRAP	TBD	TBD	1999[e]
WT02	none	TBD	WRAP	TBD	TBD	1999[e]
WC01	reduction	TBD	WRAP	TBD	TBD	1999[e]
WC02	none	TBD	WRAP	TBD	TBD	1999[e]
WP01	reduction	TBD	WRAP	TBD	TBD	1999[e]
WP02	none	TBD	WRAP	TBD	TBD	1999[e]

[a]Treatment required by 40 CFR 268. Nonwastewater category assumed for this table.

[b]Concentrate is recycled for grout disposal.

[c]This waste will be available to treatment after this date and will be treated as soon as possible based on facility operating schedules.

[d]Volume requiring treatment is approximately twice the stored volume as a result of heat loading limits in the grout disposal vaults.

[e]The facility for treating this waste is available on this date. This waste will be treated based on facility operating schedules. For the WRAP, dates given are for Module 2 (preceding submodulization to modules 2A and 2B). However, some wastes may be able to be treated sooner (1996) in Module 1. If the change request for WRAP Facility, Module 2, is approved, some activities will occur after 1999.

[f]The assumption is made that no treatment is required as WIPP is expected to operate under a no-migration petition.

[g]A treatment variance will be applied for; incineration of this waste is not planned.

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Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 12 of 12)

[h]Total volume of this waste type is 1,416 cubic meters. Only a partial list of waste codes is given (see note for this stream in Table 2-3.)
[i]Total volume of this waste type is 111 cubic meters.
[j]Total volume of this waste type is 96.2 cubic meters.
[k]Total volume of this waste type is 234.4 cubic meters.
[l]Total volume of this waste type is 38.85 cubic meters.
[m]These degreaser solvent wastes are to be sent offsite for treatment.

CCW = constituent concentrations in waste
CCWE = constituent concentrations in waste extract
DST = double-shell tank
ETF = Effluent Treatment Facility
GTF = Grout Treatment Facility
HWVP = Hanford Waste Vitrification Plant
LLBG = low-level burial grounds
LLW = low-level waste
PCB = polychlorinated biphenyl
PUREX = Plutonium-Uranium Extraction (Facility)
SALDS = state-approved land disposal structure
SWOC = Solid Waste Operations Complex
TBD = to be determined
TRUSAF = Transuranic Waste Storage and Assay Facility
WIPP = Waste Isolation Pilot Plant
WRAP = Waste Receiving and Processing (Facility).

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Table 2-7. Waste Reduction Activities for Hanford Site Land Disposal Mixed Wastes. (sheet 1 of 2)

Waste	Method to reduce	Schedule for implementing waste reduction procedures	Projected waste reduction
1. DST Waste[a]	• Evaporation • Minimize frequency of flush • Minimize flush volumes	under way	80%
2. PUREX Aging Waste	• Optimum control of the evaporator waste flow concentration overflow rate • Evaporation	under way (Aging waste will no longer be generated.)	TBD 21%
3. SST Waste	• Waste is no longer being added to SSTs	NA	NA
4. 242-A Evaporator Process Condensate	• Effluent Treatment Facility will remove ammonia, aqueous, salts, metal ions, and organics	1993	>99%
5. 4843 Sodium Storage Facility Waste[b]	• Deactivate sodium by converting it to carbonate (or other treatment method)	TBD	>99%
6. PUREX Ammonia Scrubber Waste	NA[c]	--	--
7. PUREX Process Condensate	NA[c]	--	--
8. Hexone Waste	• Distill and incinerate	Distillation complete (1990), incineration completed in 1993	88%
9. 183-H Solar Evaporation Basins Waste	• Evaporate liquid	Complete (1990)	unknown
10. PUREX Storage Tunnel 2 Waste (mercury)	• Segregation from nonhazardous waste	ongoing	variable
11. PUREX Storage Tunnels 1 and 2 Waste (silver and lead)	• Segregation from nonhazardous waste	ongoing	variable

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Table 2-7. Waste Reduction Activities for Hanford Site Land Disposal Mixed Wastes. (sheet 2 of 2)

Waste	Method to reduce	Schedule for implementing waste reduction procedures	Projected waste reduction
12. PUREX Canyon Deck Storage (lead and cadmium)	• Reduce use of lead counterweights	ongoing	variable
13. SWOC, Stored Low-Level, TRU, and PCB Waste	• Compaction • Substitution of nonhazardous materials • Neutralization of corrosive materials • Treatment of waste to remove hazardous constituents	WRAP 2A FY 1999, WRAP 2B TBD[d]	variable
14. Retrievably Stored Low-Level and TRU Wastes	• Waste is no longer being added	NA	NA
15. TRUSAF Stored Waste	• Waste is not generated at TRUSAF	NA	NA
16. 303-K Stored Waste	• Minimal generation expected in 1993 (2 cubic meters). Future generation not anticipated	NA	NA

[a]Waste sent to tanks also is reduced at the generating facilities through pretreatment (e.g., destroying ammonia) and recycling of streams.

[b]Waste sodium also is recycled at the generation point (Fast Flux Test Facility).

[c]Ammonia Scrubber and Process Condensate will remain inactive; PUREX Plant has been officially notified to enter shutdown.

[d]Assumes that the WRAP Facility, Module 2, change request to submodularize is approved.

DST = double-shell tank
NA = not applicable
PCB = polychlorinated biphenyl
PUREX = Plutonium-Uranium Extraction (Facility)
SST = single-shell tank
SWOC = Solid Waste Operations Complex
TBD = to be determined
TRU = transuranic
TRUSAF = Transuranic Waste Storage and Assay Facility.

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Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 1 of 8)

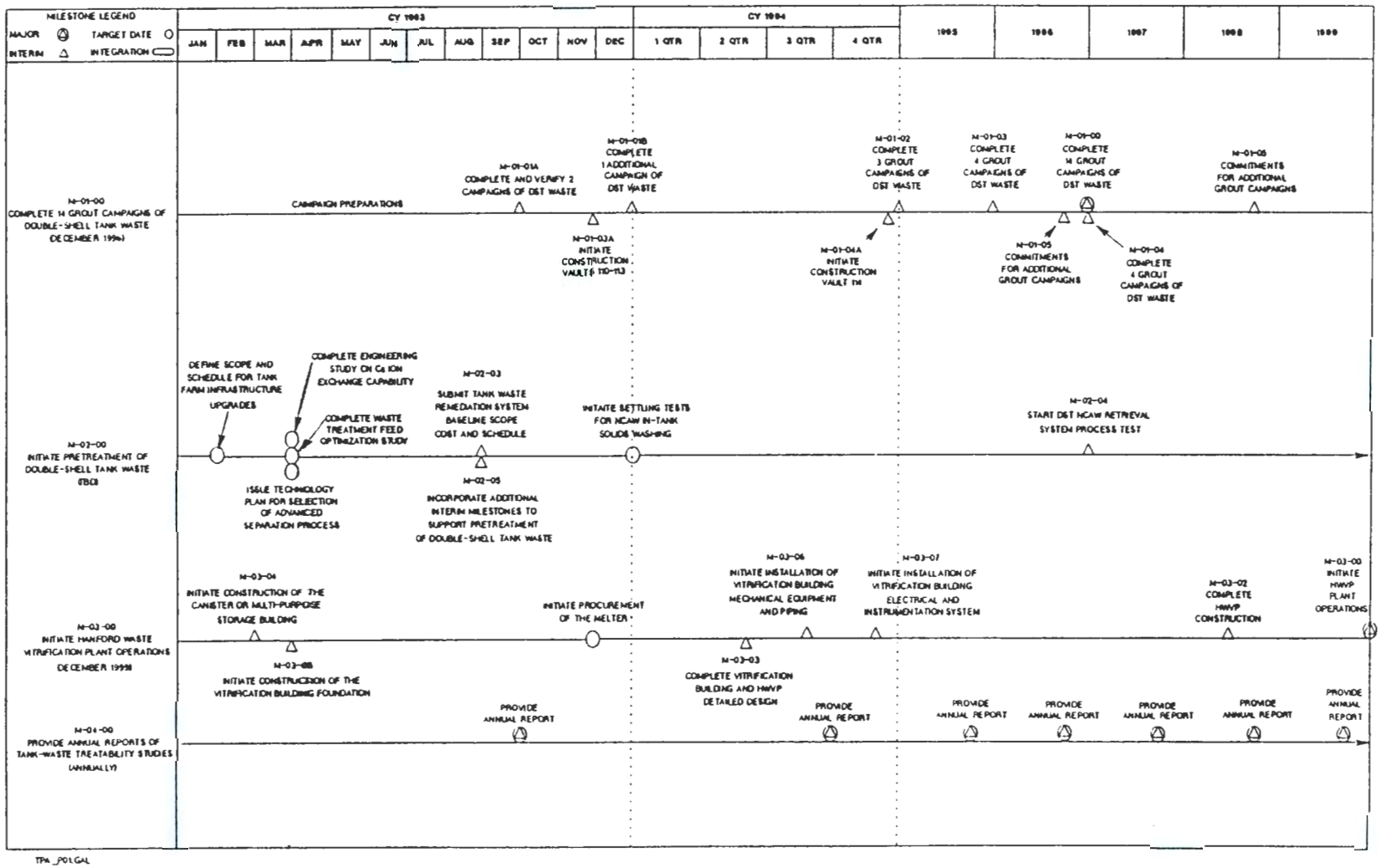


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 2 of 8)

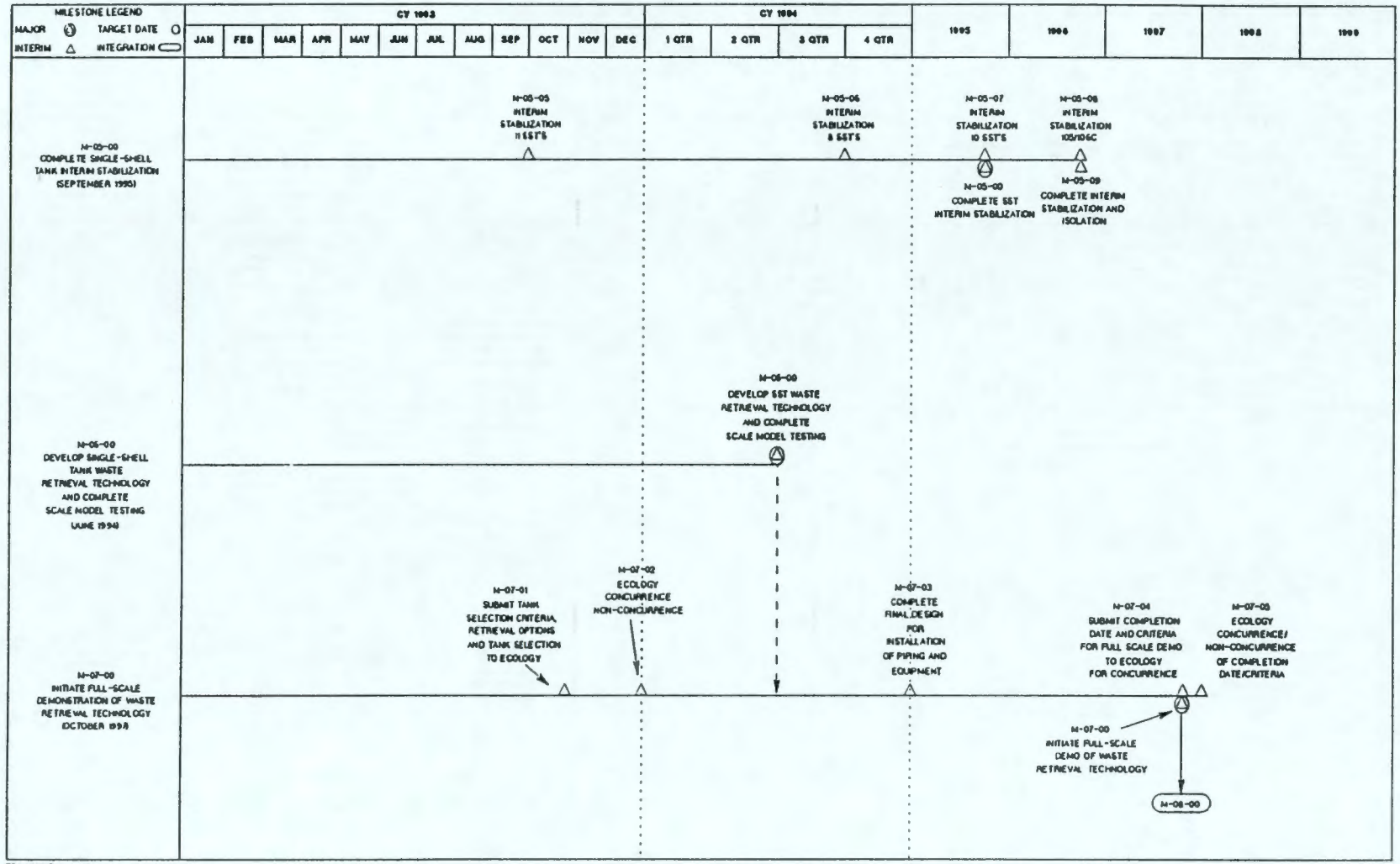
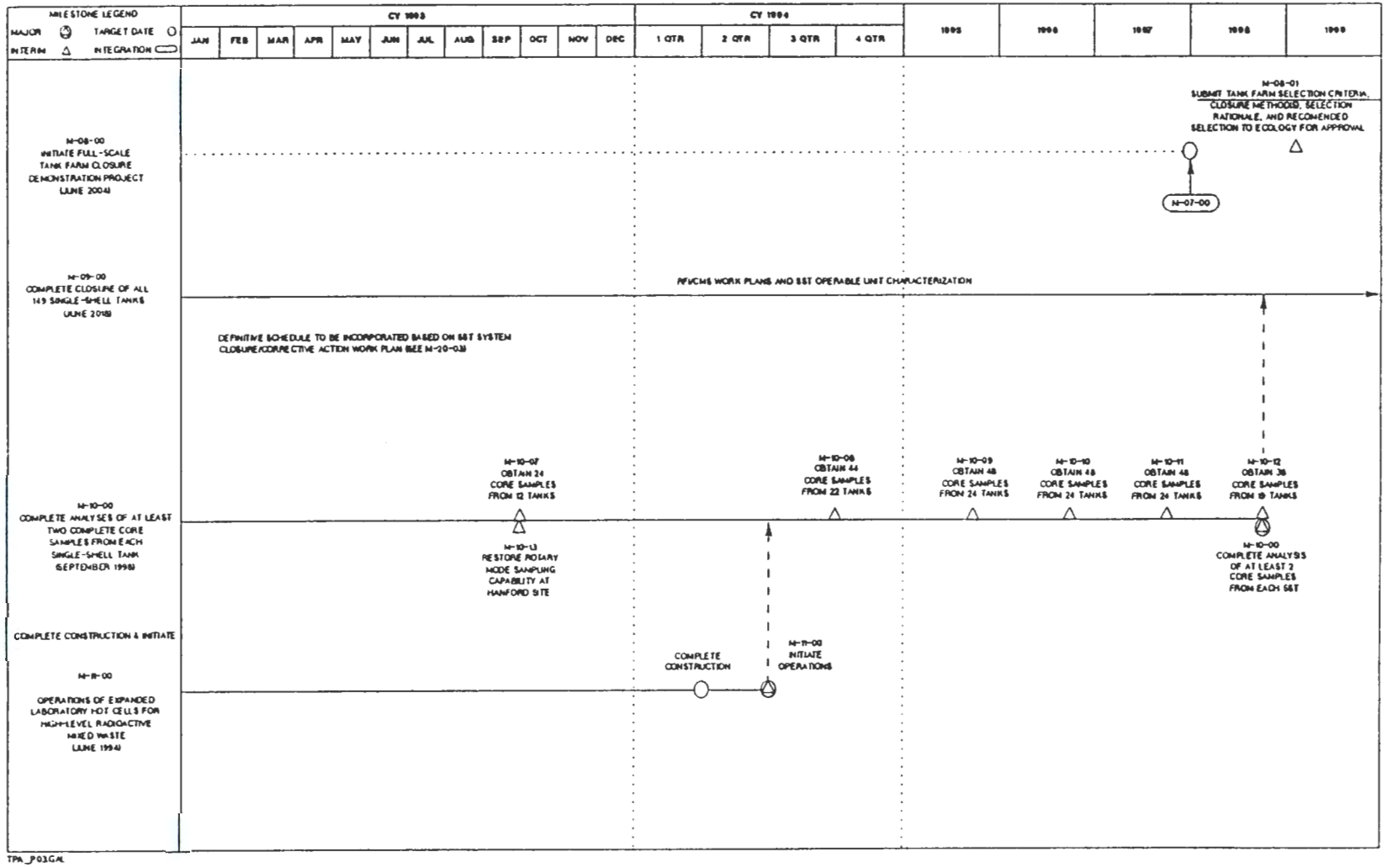


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 3 of 8)



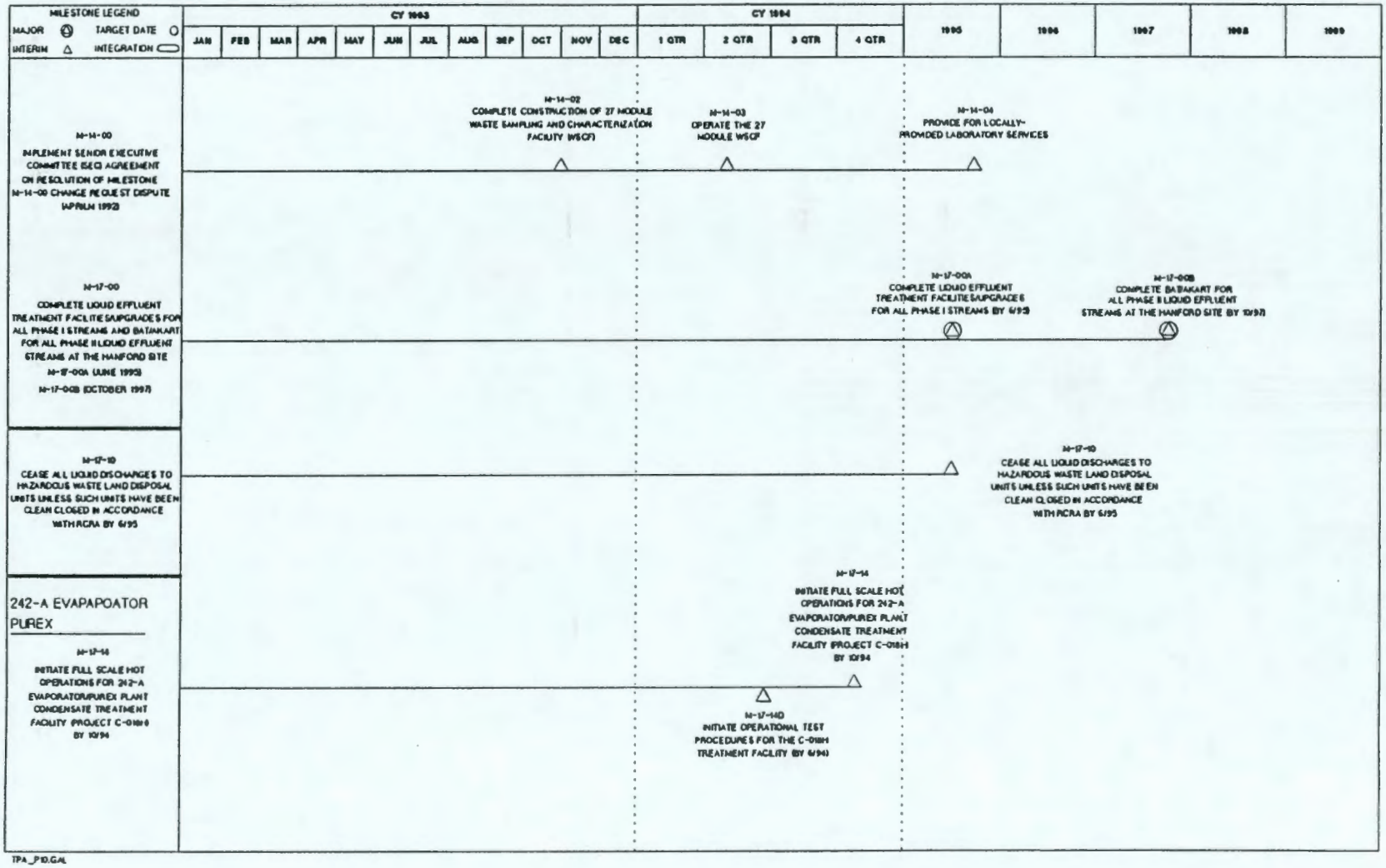


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 4 of 8)

Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 5 of 8)

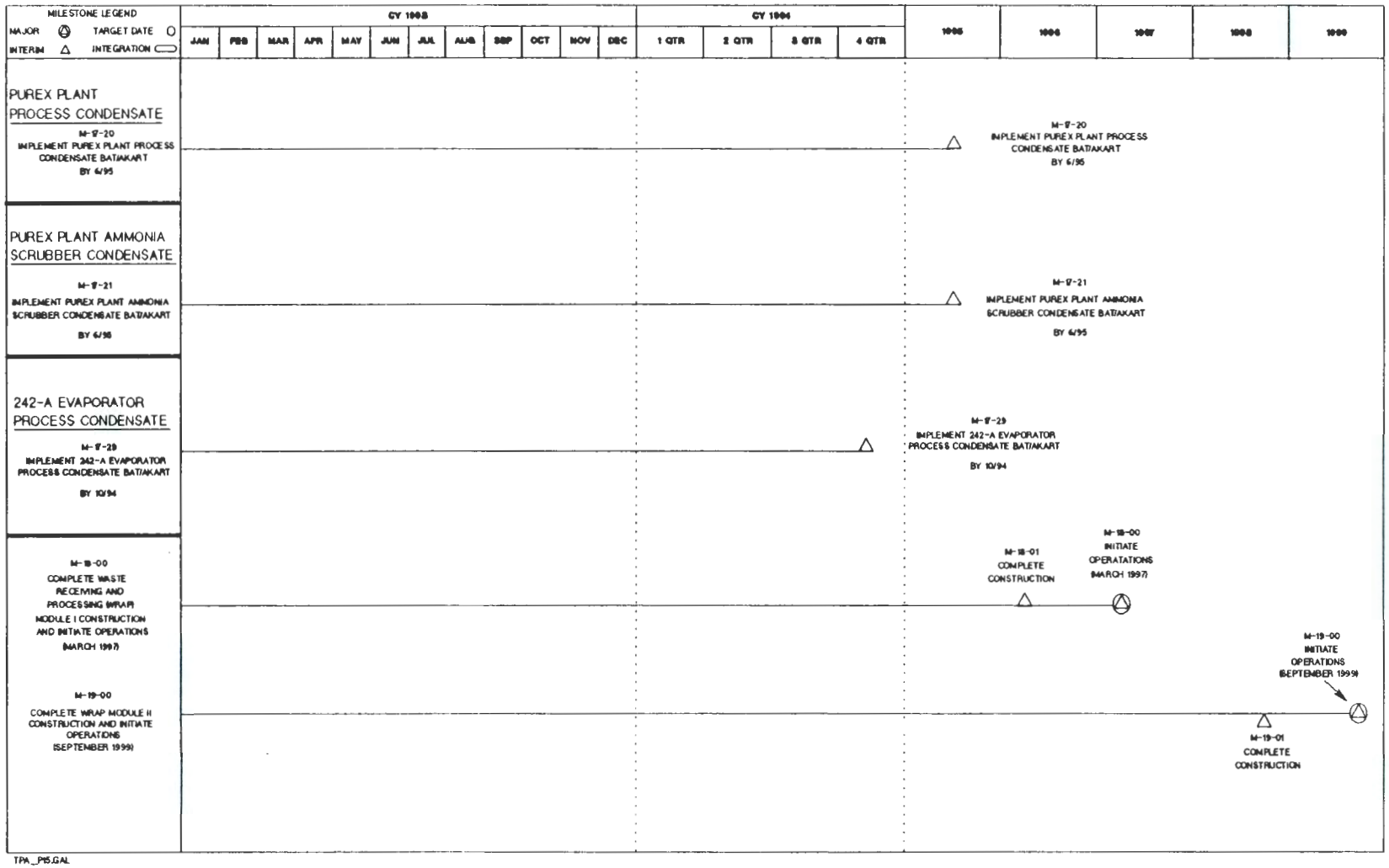


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 6 of 8)

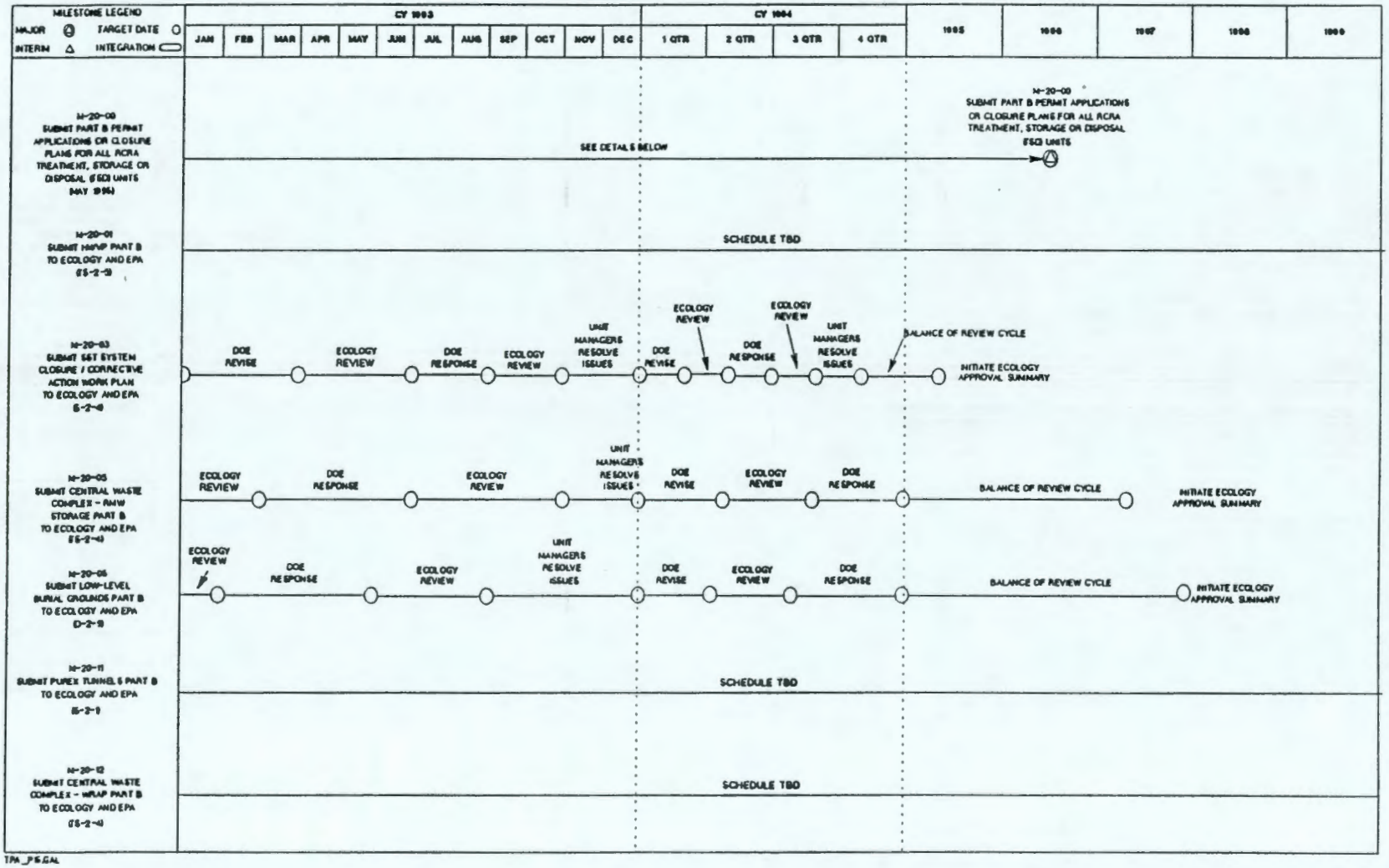


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 7 of 8)

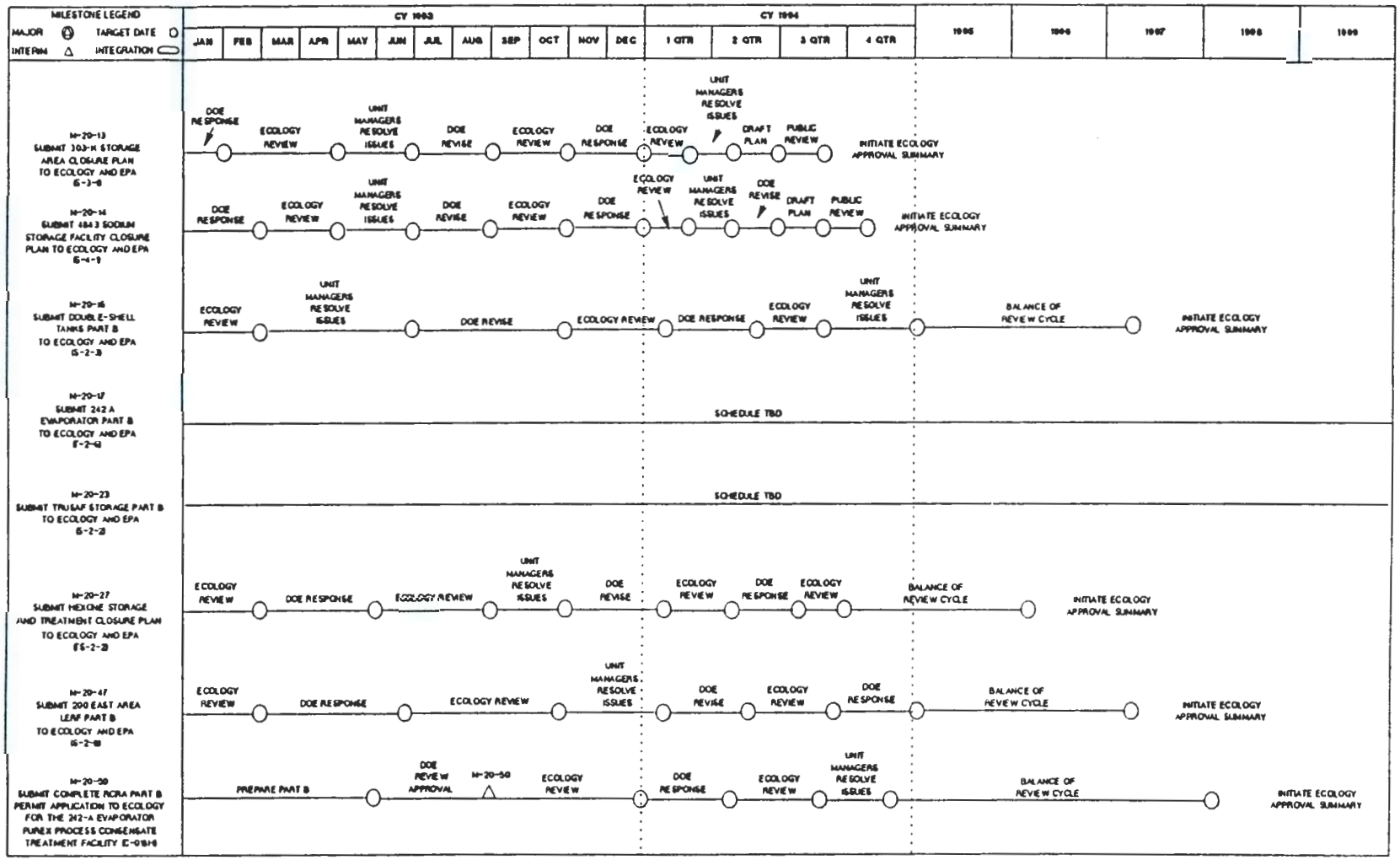


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 8 of 8)

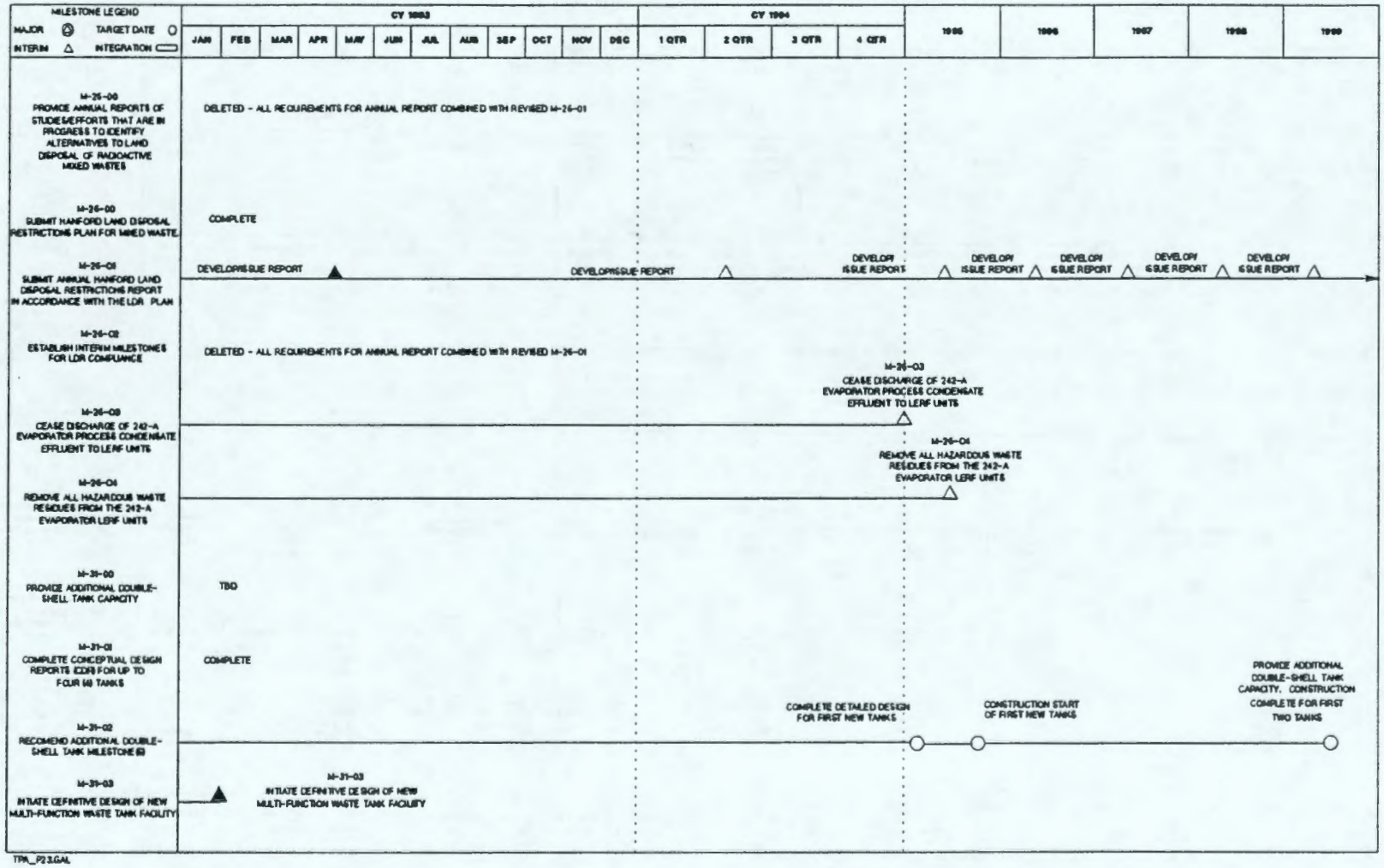
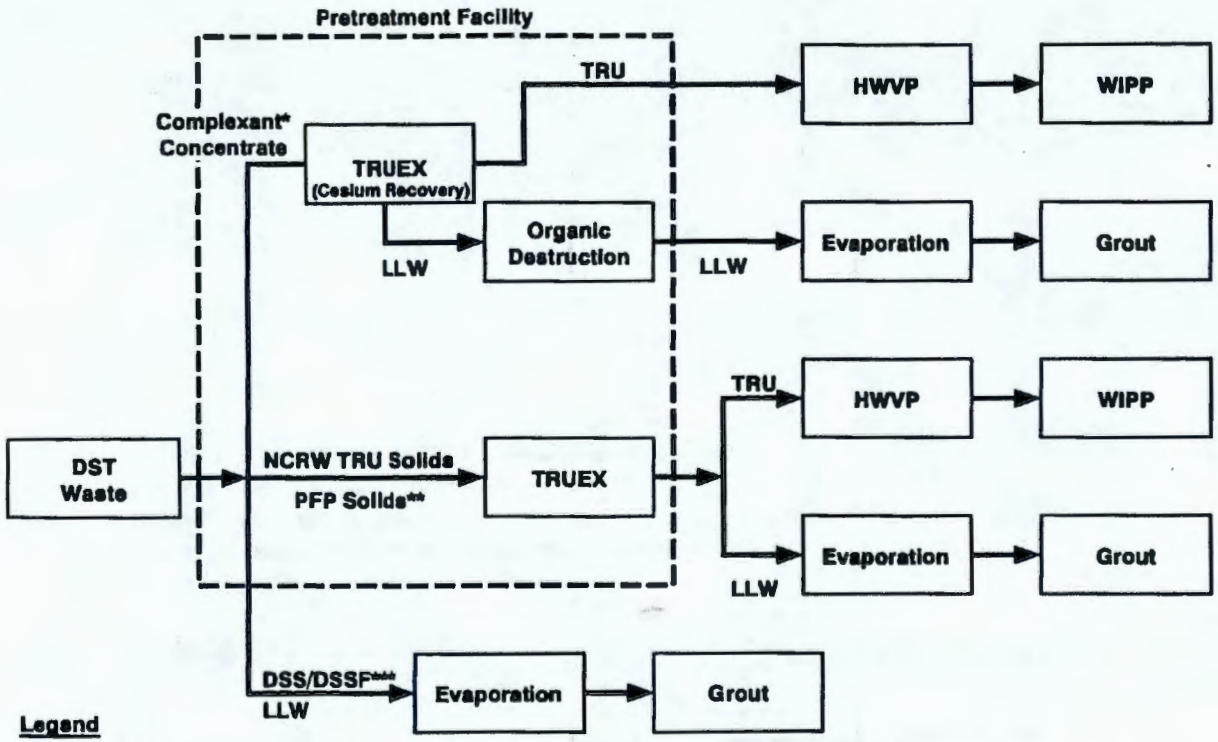


Figure 2-2. Double-Shell Tank Waste Treatment Flow Diagram.



Legend

DSS	double-shell slurry
DST	double-shell tank
DSSF	double-shell slurry feed
HWVP	Hanford Waste Vitrification Plant
LLW	low-level waste
NCRW	neutralized cladding removal waste
TRU	transuranic
TRUEX	transuranic extraction
WIPP	Waste Isolation Pilot Plant

*An alternative under consideration is a molten salt treatment that destroys the organics, nitrates, and nitrites, thus converting the waste into a salt fusion that is subsequently dissolved in water to separate the water-soluble species from the transuranics.

**An alternative under consideration is to selectively leach away major constituents like aluminum and chromium in alkaline solution and forgo the acid dissolution/TRUEX process.

***Removal of cesium before grouting is being investigated.

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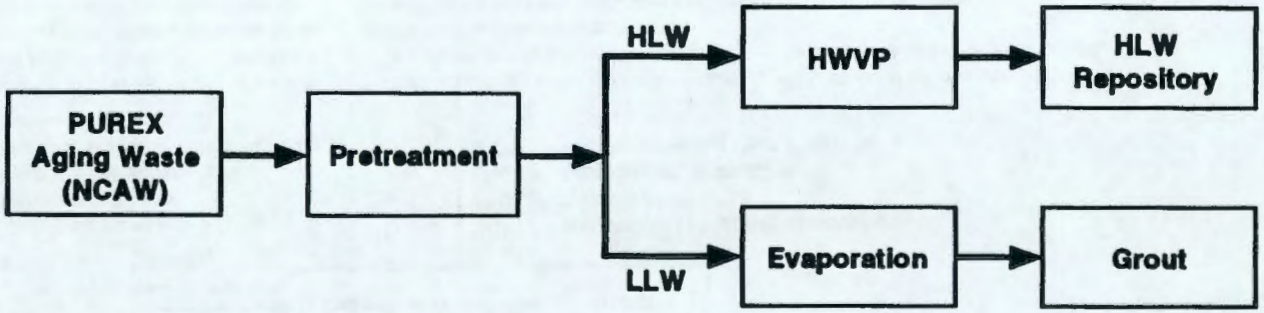

Legend

HLW	high-level waste
HWVP	Hanford Waste Vitrification Plant
LLW	low-level waste
NCAW	neutralized current acid waste
PUREX	Plutonium-Uranium Extraction (Plant)

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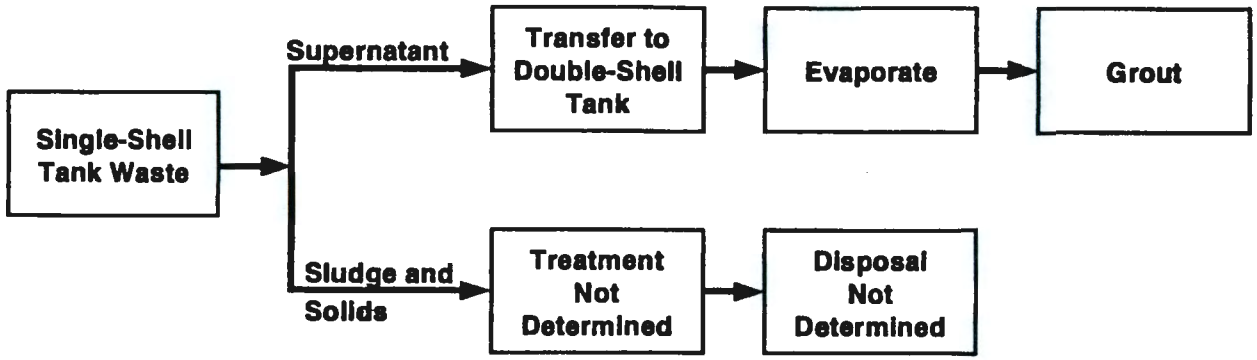
Figure 2-3. Plutonium-Uranium Extraction Aging Waste Treatment Flow Diagram.

Figure 2-4. Single-Shell Tank Waste Treatment Flow Diagram.



Note: Single-shell watch list tanks will be treated to destroy organics and ferrocyanides. Further pretreatment is still not determined.

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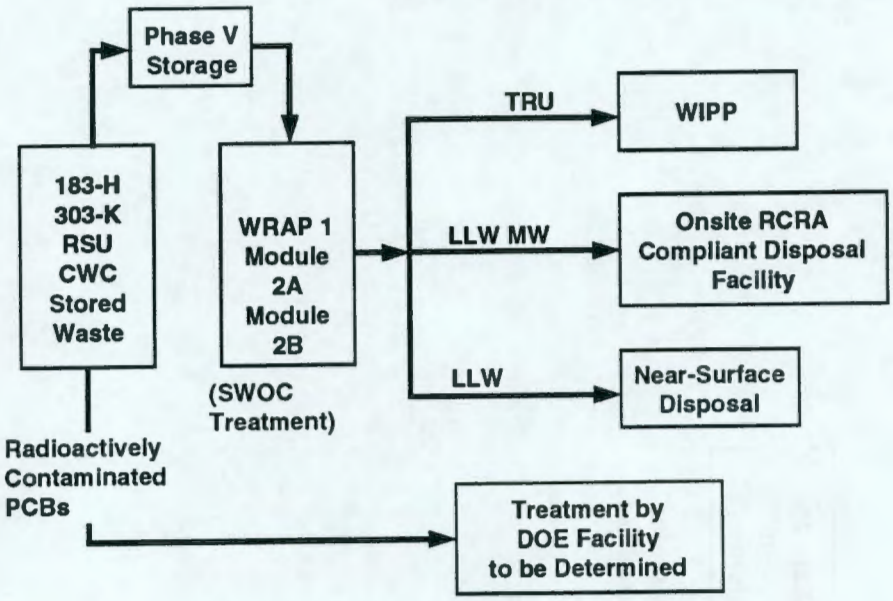
Figure 2-5. Solid Waste Operations Complex Stored Waste, Retrievably Stored Waste, 183-H Solar Basin Waste, and 303-K Waste Treatment Flow Diagram.



Legend

CWC	Central Waste Complex	RSU	retrievable storage units
DOE	U.S. Department of Energy	SWOC	Solid Waste Operations Complex
LLW	low-level waste	TRU	transuranic
MW	mixed waste	TRUSAF	Transuranic Waste Storage and Assay Facility
PCB	polychlorinated biphenyl	WIPP	Waste Isolation Pilot Plant
RCRA	Resource Conservation and Recovery Act	WRAP	Waste Receiving and Processing

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3.0 INDIVIDUAL WASTE STREAM INFORMATION

3.1 DOUBLE-SHELL TANK WASTE

Most DST waste was generated during the past production of nuclear materials. The DST waste is stored as alkaline liquids and solids in double-shell underground storage tanks in the 200 East and 200 West areas of the Hanford Site. Twenty-eight DSTs store 93,938 cubic meters of waste as of December 31, 1992 (WHC 1992b). Two of these DSTs contain PUREX aging waste and are addressed separately in Section 3.2.

The DST waste is (or has been) generated from the PUREX process, B Plant operations, research and development programs, laboratories, and decontamination of plants and equipment. Liquid supernatant, interstitial liquids, and solids from SSTs also are pumped to DSTs for storage.

Treatment plans are to recover the contents of the tanks and immobilize them for disposal. The TRU and high-level fractions will be vitrified for disposal in the WIPP and a high-level geologic repository; the low activity fraction will be converted to grout for disposal in near-surface vaults at the GTF.

Projected generation rates for DST waste fluctuate depending on the operating schedules of the waste generating units. The startup of planned treatment and disposal units will decrease the current and future DST waste volumes.

3.1.1 Generation

The DST waste has been generated by operations in the 100, 200, 300, and 400 areas of the Hanford Site. The first DSTs were constructed in 1970 and the newest DSTs were completed in 1986.

3.1.1.1 **Process.** The tanks contain waste from current operations and waste from past chemical separations processes. The major contributors to the waste stored in DSTs are discussed in the following sections. All waste streams transferred to the DSTs for storage are treated with sodium hydroxide and sodium nitrite to minimize tank corrosion. In addition to newly generated waste, liquid waste stored in SSTs also is transferred to the DSTs. This waste originated from the same sources as that stored in the DSTs. These sources include the PUREX Plant and B Plant chemical processes as well as bismuth phosphate separations, uranium recovery, and reduction-oxidation extraction processes. Descriptions of these processes are included below (DOE 1987).

Liquid waste streams destined for DSTs from current operations can be classified into four waste categories. These categories and examples follow:

1. Safety--Streams that are required to prevent hazards to personnel or equipment. Examples: PUREX criticality drains must be tested to prevent violation of criticality specifications; B Plant railroad tunnel must be washed down to reduce exposure to personnel.

2. Regulatory--Required by a regulatory body. Example: the aging waste ventilation system condensate could exceed regulatory limits for crib discharge and be sent to DSTs.

3. Tri-Party Agreement--Waste streams that are required to support the Tri-Party Agreement. Examples: Remaining SST wastes are to be pumped to DSTs to meet Tri-Party Agreement milestones for SST stabilization; S Plant laboratory wastes are generated from sampling to support Tri-Party Agreement activities.

4. Miscellaneous/Production--Miscellaneous streams in support of Hanford Site program activities. Example: waste generated in cleaning the 400 Area Interim Examination and Maintenance Cell (IEMC) are required to support the fusion program or Argonne National Laboratory.

As a result of the delay in the restart of the 242-A Evaporator and the shortage of DST space, waste minimization limits have been set based on categories 1-3. Category 4 wastes must be reviewed and approved by the Tank Space Management Board for acceptance.

Characterization and waste volume information for both DSTs and SSTs is contained in the document *A History of the 200 Area Tank Farms* (WHC 1990e).

3.1.1.1.1 The PUREX Process. The PUREX process was a solvent extraction process that used a tributyl phosphate in a kerosene-like solvent for recovering uranium and plutonium from nitric acid solutions of irradiated uranium. Laboratory waste and flush water also were sent to the DSTs from the PUREX Plant. The PUREX Plant began operation in 1956 and operated intermittently. It is currently beginning shutdown activities.

3.1.1.1.2 Plutonium Finishing Plant. In 1949 the PFP began converting plutonium in solution to plutonium metal. This historic waste stream was high in metallic nitrates. The process comprises precipitation, solvent exchange, and ion exchange wastes. The current waste stream generated from the PFP is a low-salt stream from operating the building systems and from laboratory operations. High-salt streams are generated along with the low-salt stream during plutonium reclamation. Liquid wastes averaging 4.5 percent solids are sent to DSTs and average about 15 liters per hour. Similar liquid wastes, when the facility is operating, from plutonium reclamation average about 270 liters per hour.

Table 3-1 provides estimated PFP radioactive liquid waste compositions. The stream volumes and concentrations are estimated values based on process knowledge. Two batches of waste have been characterized to date, but complete results are not yet available.

3.1.1.1.3 Bismuth Phosphate Separations. Beginning in the early 1940s, B Plant and T Plant separated plutonium from uranium in irradiated fuel by coprecipitation with bismuth phosphate from a uranyl nitrate solution. The plutonium was further separated from fission products by successive precipitation cycles using bismuth phosphate and lanthanum fluoride. Waste containing uranium, acid, and many of the fission products was neutralized and

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stored in underground SSTs. This separation process was used from 1943 to 1957.

The bismuth phosphate metal wastes were initially stored in separate SSTs; however, the metal waste was reprocessed to recover the uranium and the supernatant was scavenged and disposed to the cribs, leaving very little original metal waste remaining in the SSTs. In addition, through the years waste management operations have created a complex intermingling of the tank wastes.

3.1.1.1.4 Uranium Recovery Process. Uranium in process waste was mined from the SSTs by sluicing, dissolved in nitric acid, and processed through a solvent extraction process using tributyl phosphate in a kerosene-like solvent. The acid waste from the uranium recovery process was made alkaline and returned to SSTs. The recovery process, which operated from 1952 to 1958 in U Plant and from 1956 to 1958 in PUREX Plant, resulted in an increase in the volume of nonradioactive salts and a small increase in waste volume.

The uranium recovery process operated in U Plant and at PUREX Plant were similar in that they used tributyl phosphate as the solvent; however, there were significant differences between the two processes. The wastes produced by the process in U Plant recovered uranium from bismuth phosphate metal wastes and discarded the fission products and residual plutonium. The process in U Plant also produced relatively dilute HLW, approximately 19 liters of waste per kilogram of uranium processed. The PUREX Plant process recovered uranium and plutonium in addition to separating the fission products. The PUREX process produced a much more concentrated high-level waste product than the process in U Plant, approximately 0.2 liters per kilogram of uranium processed, and the waste was more radioactive, because the fuel was irradiated for a longer period of time.

No SSTs received acidic wastes or purely nonradioactive salts from these processes. The wastes were all neutral or alkaline in nature and the nonradioactive materials were ultimately mingled with radioactive materials.

A significant increase in the volume of waste resulted from the uranium recovery process in U Plant. The process efficiently recovered uranium from the bismuth phosphate metal waste; however, it generated about 2 gallons of waste for every gallon of bismuth phosphate metal waste processed. This increase in waste volume was the rationale for the ferrocyanide scavenging campaign. It was necessary to reduce the occupied waste tank volume, and the ferrocyanide scavenging decontaminated the waste sufficiently to enable disposal to the cribs.

3.1.1.1.5 Reduction-Oxidation Process. The reduction-oxidation process used a continuous solvent extraction process to extract plutonium and uranium from dissolved fuel in a hexone solvent. The slightly acidic waste stream contained the fission products and large quantities of aluminum nitrate. This waste was neutralized and stored in SSTs. The 202-S Plant operated between 1951 and 1967.

3.1.1.1.6 Cesium and Strontium Recovery. Past operations in B Plant for recovery of cesium and strontium from waste were a main source of DST waste. This waste is known as complexant concentrate.

3.1.1.1.7 Other Contributors to Double-Shell Tank Waste. Cleaning solutions and other miscellaneous waste are chemically adjusted to minimize tank corrosivity and transferred to DSTs for storage. The waste includes the following:

- Spent cleaning solutions from decontamination and ion exchange regeneration at the 100 Area
- Waste from decontaminating and decommissioning tools and equipment
- Laboratory waste from the 200 Area
- Fuels fabrication waste from the 300 Area
- Miscellaneous waste from the Fast Flux Test Facility (FFTF) operations in the 400 Area.

Additional detail can be found in the DST Part B Permit Application (RL 1991a).

3.1.1.2 Generation. The DSTs do not simply accumulate and store waste; the tanks are a waste-handling system. The inflows to the system include PUREX and other production waste, interstitial liquids pumped from SSTs, and B Plant waste. Outflows include evaporation, grout, and future vitrification processes. Evaporation decreases the DST waste volume; grout and vitrification remove DST waste and solidify it for disposal.

Projected DST waste generation through 1999 is shown in Figure 3-1 in terms of tank space used versus available space. The average generation rate for DST waste is about 16,200 cubic meters per year before evaporation. This generation rate is based on waste generation projections through 1997 (Table 2-1).

3.1.2 Characterization

The wastes in DSTs consist of solids and liquids. Typically the solids fraction has settled out as a sludge layer. The wastes are LLW, TRU waste, and HLW, and designated as ignitable, corrosive, toxic, persistent, and carcinogenic extremely hazardous waste. Because of heavy metals contamination, DST waste also is designated as toxic by the TCLP.

This section summarizes process knowledge and sample analysis for the contents of the DSTs. The assumed waste designations and their bases are described, and schedules for further analysis are given.

3.1.2.1 Process Knowledge. Several processes contribute to DST waste, as described in Section 3.1.1.1. Waste management practices, including evaporation of tank contents, have intermingled the various types of waste. This intermingling precludes a detailed, quantified characterization of the tank contents based strictly on process knowledge. Instead, the DST waste is described qualitatively based on generation data and sample analysis.

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Stratification and segregation have occurred in the tanks as solids have settled out. The consistency of the waste ranges from liquid supernatant to a thick sludge to crusts formed as a top layer.

The major constituents of DST waste are water and sodium salts of aluminate, nitrate, nitrite, phosphate, hydroxide, carbonate, and sulfate. Some calcium and potassium salts also are present. Complexed waste in the DSTs contains sodium salts of the chelating agents ethylenediamine-tetraacetic acid and n-hydroxyethylethylenediamine-tetraacetic acid. There also may be detectable concentrations of halogenated and nonhalogenated organic compounds and heavy metals such as lead, chromium, and cadmium.

3.1.2.2 Sample Analyses. Samples of the DSTs have been analyzed per EPA SW-846 methodology (EPA 1986). Because no one DST constitutes a "representative" tank, the analytical data from these samples are presented in Table 3-2 as ranges of values for tank composition.

3.1.2.3 Waste Designation and Basis. All waste stored in DSTs is designated corrosive dangerous waste (D002) because it has been treated with sodium hydroxide to raise the pH above 12.5 in preparation for tank storage.

The DST waste is assumed to be extremely hazardous waste (WT01) for toxicity based on the concentration of chemicals in the waste. The waste may exhibit the characteristic of ignitability (D001) as identified in WAC 173-303-090 because of the presence of oxidizers such as nitrate and nitrite. The waste has not been tested for ignitability. The D001 code only applies if the combined oxidizers exceed 40 weight percent of the waste stream. This designation currently is being reevaluated. The DST waste also is suspected to contain spent solvents including hexone and acetone (waste codes F003 and F005). The DSTs contain waste that meets TCLP criteria for heavy metals contamination: arsenic (D004), barium (D005), cadmium (D006), chromium (D007), lead (D008), mercury (D009), selenium (D010), and silver (D011). The waste also is carcinogenic (WC01, WC02) and persistent (WP01, WP02).

The DSTs do not contain waste listed on the dangerous waste source list of WAC 173-303-082.

Radioactive constituents include americium-241, carbon-14, cesium-137, cobalt-60, curium-244, iodine-129, neptunium-237, plutonium-239 and -240, ruthenium- and rhodium-106, selenium-79, strontium-90, technetium-99, and tritium.

3.1.2.4 Uncertainty of Waste Designation. The waste codes previously assigned are considered accurate, but have been assigned based on limited analytical data. Additional waste codes may be added or deleted based on the ongoing characterization program.

3.1.2.5 Schedule for Further Characterization. Sampling and analysis of the DST contents is under way and scheduled to continue through 1998 (WHC 1990a, 1991a).

There are two types of samples: cores and bottles-on-a-string. The analytical procedures used by the two onsite laboratories to characterize the

Methods and Evaluation of Solid Waste (SW-846). However, some of these procedures have been modified in terms of sample sizes and preparation techniques to reflect the radioactive nature of the waste samples and the complex constituent matrix. A comprehensive list of the chemical analytes, radionuclides, and physical measurements to be included in the DST characterization effort will be found in the updated Tank Waste Remediation System Waste Characterization Plan. This plan shall also identify the procedures used by both of the onsite laboratories to characterize the waste samples.

3.1.3 Storage

This section describes DST storage and assesses its compliance with existing regulations.

3.1.3.1 Storage Unit and Capacity. There are 28 DSTs, each with a 4,300-cubic-meter capacity. Four of these DSTs are equipped to manage PUREX aging waste and are addressed separately in Section 3.2. The 28 tanks are located in 6 tank farms in the 200 East and 200 West Areas of the Hanford Site.

3.1.3.2 Amount in Storage. As of December 31, 1992, the tanks held 86,806 cubic meters of waste (WHC 1992b). This does not include PUREX aging waste (Chapter 3.0, Section 3.2). Projections indicate that the DSTs could be filled to capacity in 1993 based on current expected generation rates. The construction of up to four new DSTs is proposed to relieve the limitations.

3.1.3.3 Storage Compliance Assessment. The DSTs were reviewed for compliance with interim status dangerous waste regulations in accordance with Tri-Party Agreement (Ecology et al. 1990) Milestone M-21-00. The assessment for compliance with interim status regulations noted the following areas of noncompliance (RL 1991b):

- Inspection plan
- Waste analysis plan
- Waste characterization
- Training plan.

Compliance action schedules for DSTs are being negotiated in the Tri-Party Agreement. Interim status compliance for the items listed is completed. Additional DST actions may be required after December 1990. These actions may include the following:

- Recordkeeping system modifications
- Provision of secondary containment for ancillary equipment

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- Development of additional leak detection systems
- Development of a closure plan.

3.1.4 Treatment

This section discusses current and proposed treatment of DST waste.

3.1.4.1 Current Treatment. The 242-A Evaporator reduces the DST waste volume by evaporative concentration (Chapter 3.0, Section 3.4.1.1). It began operating in 1977 and has evaporated more than 246,000 cubic meters of water from the DST stored waste.

3.1.4.2 Proposed Treatment. The DST waste will be retrieved, pretreated (as required), and solidified for disposal. A pictorial flow diagram and a process flow diagram are shown in Figures 3-2 and 3-3 (WHC 1990a). The TRU fraction of the tank waste will be vitrified and disposed of in a geologic repository. High-level DST waste (aging waste) is addressed separately in Section 3.2. The low-level fraction will be converted to cementitious grout for disposal in near-surface vaults. Grout disposal is being conducted under an interim RCRA permit (RL 1990a) and in compliance with applicable DOE orders. The grout facility will dispose of organic waste, below LDR concentrations only, in addition to inorganic wastes. (Organic wastes require best-demonstrated-available technology per the regulations; inorganic wastes do not. The grout facility has not been determined as best-demonstrated available technology. Therefore, only organic wastes meeting LDR restrictions can be disposed of as grout.)

Four waste types have been identified as feed to the vitrification plant after pretreatment (WHC 1992a):

- NCAW (PUREX aging waste)
- Complexant concentrate
- PFP waste
- NCAW.

Pretreatment consists of resolving tank safety issues by destroying the constituents that are the source of the safety issue, and separating the waste into a low-volume, TRU fraction and a low-volume, low-activity waste fraction. Pretreatment for other DST waste to remove fission products before disposing of the waste to grout is being investigated, but no decision has been made on taking this additional pretreatment action.

3.1.4.2.1 Definition and Treatment of Double-Shell Slurry Feed and Double-Shell Slurry Waste. Double-shell slurry feed is generated by concentrating the dilute waste streams generated by the operating plants to conserve storage space. Double-shell slurry is generated by further concentration of double-shell slurry feed.

Double-shell slurry feed and double-shell slurry are concentrated waste types generated by the evaporation of dilute noncomplexed waste streams to conserve tank space. The double-shell slurry feed waste type has been evaporated up to, but not beyond the sodium aluminate phase boundary; therefore, it contains no aluminate solids. Double-shell slurry is a more concentrated waste form that is produced by further evaporation of double-shell slurry feed past the aluminate boundary. Double-shell slurry contains aluminate solids and has a much higher viscosity which makes retrieval from tanks more difficult and costly.

There are currently 3604 cubic meters of double-shell slurry and 15,675 cubic meters of double-shell slurry feed.

Double-shell slurry feed and double-shell slurry are to be retrieved from the DSTs and treated for disposal at the GTF (RL 1990a). The treatment of these waste types at the GTF is scheduled to begin in 1993 (Milestone M-01-00, Ecology et al. 1990). Approximately 7,500 cubic meters are expected to be treated through 1993.

3.1.4.2.2 Definition and Treatment of Neutralized Current Acid Waste. The NCAW is also known as PUREX aging waste. Further discussion of NCAW is contained in Section 3.2.

3.1.4.2.3 Definition and Treatment of Neutralized Cladding Removal Solids Waste. Cladding removal waste results from dissolving the zircaloy cladding of irradiated nuclear fuel from N Reactor. Neutralizing the waste precipitates most of the zirconium and creates a slurry. The resulting stream is called NCRW.

An interim Tri-Party Agreement Interim Milestone (M-02-03) to submit Tank Waste Remediation System baseline scope, cost, and schedule information by August 1993 has been established. This information will include the reevaluation of pretreatment options. There is also an interim Tri-Party Agreement milestone to incorporate additional Tri-Party Agreement milestones for pretreatment in August 1993. Specific pretreatment milestones will be established at that time.

A status report on the pretreatment of NCRW is available (DOE-RL 1992a). The new recommended flowsheet calls for water washing the solids to remove soluble metals and fluoride. The sludge is dissolved in nitric acid/hydrofluoric acid under ambient conditions and at a carefully controlled fluoride-to-metal ratio to promote solution stability. Before solvent extraction, the fluoride-to-metal ratio is adjusted to prevent interfacial crud formation. A reductant is also added to hold plutonium in the +3 valence. A uranium extraction cycle has been added to this flowsheet to prevent problems that were being caused by the presence of uranium in the TRUEX process. The uranium cycle prevents uranium from entering the glass plant feed stream and allows stripping of TRU with a nonphosphorus based stripping agent that is more compatible with glass.

3.1.4.2.4 Definition and Treatment of Plutonium Finishing Plant Waste. The PFP waste originates from the conversion of plutonium nitrate to oxide or metal and includes TRU laboratory waste and high-salt solvent extraction waste. Projected generation of this waste through 1995 is 1,150 cubic meters.

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Current inventory in storage is estimated at 390 to 503 cubic meters. This is stored in Tank 241-SY-102 where it is blended with other 200 West Area wastes.

A report on progress in pretreating 241-SY-102 waste is available (RL 1992b). Two approaches to 241-SY-102 sludges are being considered. The first approach focuses on the selective leach of chromium from the sludge using chemical oxidants, thereby making the residual sludge more compatible with glass. The second approach is similar to the NCRW process, i.e., sludge washing to remove water-soluble constituents followed by dissolution in acid and separation of the TRUs from solution. The TRUEX process is still being considered. Los Alamos National Laboratory is working also on an ion exchange process that might be applicable for this application.

3.1.4.2.5 Definition and Treatment of Complexant Concentrate Waste. The complexant concentrate results from the concentration of waste containing large amounts of organic complexing agents. The organic complexing compounds were introduced to the waste during strontium recovery at B Plant. No future generation of this waste is planned.

Treatment of the complexant concentrate will begin with acidifying the stream to dissolve as many of the solids as possible. The liquid will be separated from the undissolved solids and used as feed to the TRUEX process. The TRUEX process will separate a low-volume TRU concentrate waste stream from a low-level waste stream containing organics and possibly cesium. The low-level waste stream will be treated to destroy organics and the cesium will be removed. The resulting low-level waste stream will then go to grout treatment. The pretreated waste would go through an evaporator on an as-needed basis if excess water were in the waste stream. The TRU concentrate stream will be added to the undissolved solids and eventually vitrified.

3.1.4.3 Treatment Alternatives and Accelerated Treatment. Alternative treatments are discussed where applicable in Section 3.1.4.2. In addition, a tank waste technical options report has been issued (WHC 1992c) that presents a number of alternatives for remediating DSTs. Alternative pretreatment technologies are discussed further in WHC (1993a).

Treatment of DST waste is on a schedule based primarily upon Tri-Party Agreement milestones M-01-00 (grout) M-02-00 (pretreatment) and M-03-00 (HWVP). (Refer to Figure 2-1 for details.) Due to budget limitations, accelerating treatment beyond these milestone dates is not realistic.

3.1.5 Waste Reduction

Currently 11 major plants or programs generate DST waste. Annual waste generation for 1990 through 1992 is listed in Table 3-3. Total waste generation has been reduced by 60 percent from 1990 to 1991 and another 21 percent from 1991 to 1992. The caption labeled "SST to DST Pumping" refers to pumping liquid waste from SSTs and was scheduled to be increased to meet a Tri-Party Agreement milestone requiring all SSTs to be stabilized by the end of FY 1995. Waste reduction activities (current and planned) are outlined for each unit in the *Annual Report of Tank Waste Treatability* (WHC 1992a). The four activities include minimizing flush volumes and frequency, pretreating waste (e.g., destroying ammonia), modifying processes, and recycling streams.

Dilute waste received at the DSTs will be concentrated by the 242-A Evaporator, further reducing the waste volume by 30 percent to 95 percent. In an average year, projected volumes of dilute waste will be reduced by approximately 71 percent (Section 3.1.1.2).

3.1.6 Variances, Exemptions, Time Extensions

The DST waste consists of LLW, TRU Waste, and HLW containing dangerous waste constituents. The DST waste is restricted from land disposal because it contains solvent waste (40 CFR 268.30) and California list waste (40 CFR 268.32). It also contains waste covered by the Third-Third Promulgation (55 FR 22520).

The national capacity variance for Third-Third Waste (55 FR 22520) provided for a 2-year national capacity variance from the LDR for third-third mixed waste expiring on May 8, 1992. This variance allowed continued storage of these wastes. A Federal Register notice dated May 26, 1992, stated that EPA could not grant a case-by-case extension for Third-Third mixed waste due to questions regarding the DOE's demonstration that they have entered into binding contractual commitments to construct or otherwise provide treatment capability. A final decision has yet to be made. This extension would allow DOE to store LDR mixed wastes until May 8, 1993, and this date could be extended for up to an additional year. The Tri-Party Agreement will allow continued storage of these wastes in accordance with the schedules in the Tri-Party Agreement. The Federal Facility Compliance Act of 1992 also allows DOE facilities to store their wastes for 3 years if compliance with the Act's provisions for providing waste inventory and treatment plans are met.

The Tri-Party Agreement provides for continued storage of California list (40 CFR 268.32) and solvent waste (40 CFR 268.30) until treatment capacity is developed for these wastes. The agreement requires treatment and disposal capacity for these wastes to be developed on the following schedule:

- **Low-Level Waste**--Disposal of treated waste in grout as soon as sufficient quantities are available to facilitate proper treatment and disposal, in accordance with the grout schedule defined in the Tri-Party Agreement that requires 14 grout campaigns by December 1996.

- **Transuranic Waste**--Treatment schedules for TRU waste stored in the DSTs (complexed concentrate, NCRW, solids, and PFP solids) currently are being negotiated and will be incorporated into the Tri-Party Agreement when they are approved by all three parties to the agreement.

- **High-Level Waste**--Treatment of waste will begin as soon as the HWVP is on-line (currently scheduled for 1999 per the Tri-Party Agreement). Disposal is intended for a national HLW geologic repository, with an uncertain startup date.

If additional variances, exemptions, or time extensions are required as a result of delays in the development of treatment, storage, or disposal

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capacity, they will be applied for in accordance with the procedures detailed in the Tri-Party Agreement or regulations.

3.2 PUREX AGING WASTE

The aging waste storage unit comprises four DSTs in the 241-AY (Tanks 241-AY-101 and -102) and 241-AZ (Tanks 241-AZ-101 and -102) tank farms in the 200 East Area of the Hanford Site. Two latter DSTs, 241-AZ-101 and -102, presently hold a mixture of solids and supernate aging high-level waste (from the PUREX Plant).

Aging waste from the PUREX Plant comes from the first decontamination solvent extraction column in the PUREX solvent extraction process. The feed to the extraction column is irradiated fuel elements dissolved in nitric acid. The extraction column separates the uranium and TRU products from the majority of the fission products. The fission products are contained in the aqueous nitric acid phase from the extraction column. The aqueous phase is concentrated to recover nitric acid and reduce volumes, and the concentrated stream is sampled. If it is determined to be a waste, based on sample analysis, it is treated with sugar to destroy the majority of the nitric acid. Sodium hydroxide is added to meet storage tank specifications and the waste is transferred to the aging DSTs for storage. As of December 31, 1992, a total of 7,132 cubic meters of PUREX aging waste was in storage.

The waste stream is considered corrosive and toxic and has designated EPA waste codes of D002, D006, D007, and D008. The waste stream will be treated at B Plant for separation of the HLW from the LLW. The low-level fraction will be transferred to the GTF for disposal and the high-level fraction will be vitrified at the HWVP and disposed of in a repository.

3.2.1 Generation

This section describes the waste generation process. The PUREX Plant received official notification to begin shutdown. Aging waste will not be generated in the future.

The PUREX Plant received irradiated zirconium clad fuel from N Reactor, removed the cladding from the fuel, and dissolved the fuel in nitric acid. The dissolved fuel was processed through several solvent extraction steps to separate the plutonium, uranium, and neptunium from the fission products contained in the fuel. The aging waste contains the majority of the fission products from the fuel and is generated from the aqueous stream from the first extraction column.

3.2.2 Characterization

This section discusses the available waste characterization information. Information based on process knowledge and sample analysis is provided along with the waste designations and their bases, the uncertainty related to the designation, and the schedule for further analysis.

3.2.2.1 Process Knowledge. The aging waste comprises water, aluminum hydroxide, sodium nitrate, sodium hydroxide, sodium fluoride, cadmium nitrate, sodium nitrite, corrosion products, and the majority of radionuclides from N Reactor fuel. Past practice (before 1989) was to recycle process samples analyzed in the laboratory back to the process system, which may have resulted in some of the chemicals added to the samples entering the aging waste. The presence of these chemicals in the aging waste never has been confirmed by sample analysis.

3.2.2.2 Sample Analyses. The composition of PUREX Plant NCAW is given in Table 3-4. The results of sample analyses per EPA SW-846 methodology (EPA 1986) of the PUREX aging waste stored in the DSTs are given in Table 3-5.

3.2.2.3 Waste Designation and Basis. The NCAW stream contains excess amounts of sodium hydroxide (0.8 M) making the waste corrosive dangerous waste (D002) and LDR (52 FR 22520). Based on equivalent concentration calculations, there are sufficient concentrations of sodium nitrate and sodium hydroxide to make the aging waste toxic dangerous waste (WT01). In addition, there are sufficient quantities of heavy metals to designate the NCAW as a toxic, as determined by the TCLP, for cadmium (D006), chromium (D007), and possibly lead (D008).

3.2.2.4 Uncertainty of Waste Designation. Based on sample data from tanks 241-AZ-101 and -102 (Table 3-5), the waste designation is correct.

3.2.2.5 Schedule for Further Characterization. Three core samples have been taken and characterized to date; two additional samples are planned for fiscal year 1993, for a total of five.

3.2.3 Storage

This section provides the volume currently in storage and assesses the compliance status of the storage unit.

3.2.3.1 Storage Unit and Capacity. The aging waste storage unit comprises four DSTs in the 241-AY and 241-AZ tank farms. Only the 241-AZ tank farm currently contains aging waste. The AY and AZ aging waste tanks each have a maximum fill volume of 3,800 cubic meters. The use of air-lift circulators limits the working volumes to 3,700 cubic meters for these tanks. These circulators keep the supernate agitated and aid in heat removal from the tanks. The tanks also are equipped with steam coils to boil away water in the waste and a ventilation system that can handle large amounts of steam.

3.2.3.2 Amount in Storage. Tanks 241-AZ-101 and -102 contain approximately equal volumes totaling 7,132 cubic meters. The waste in these tanks is NCAW.

3.2.3.3 Storage Compliance Assessment. The PUREX aging waste is stored in the DSTs. The DSTs were reviewed for compliance with interim status dangerous waste regulations in accordance with Tri-Party Agreement (Ecology et al. 1990) Milestone M-21-00. The results of the compliance assessment are provided in Chapter 3.0, Section 3.1.3.3.

3.2.4 Treatment

This section discusses the current and proposed waste treatment processes.

3.2.4.1 Current Treatment. Currently the aging waste is being stored pending pretreatment and vitrification.

3.2.4.2 Proposed Treatment. The NCAW will be pretreated in preparation for disposal. The GTF converts the liquid low-activity waste from the pretreatment process into cement-like grout. The HWVP will incorporate TRU Waste and HLW into a glass matrix for disposal.

The major unit operations in the NCAW pretreatment process are solid-liquid separation and washing, polishing filtration, cesium removal by ion exchange, and concentration of the cesium and LLW streams (WHC 1990a). This process is illustrated in Figure 3-4 (WHC 1992a).

B Plant was scheduled to initiate pretreatment of NCAW at a date to be determined (Tri-Party Agreement Milestone M-02-01) (Ecology et al. 1990). This facility will not be used for this purpose. A study to reevaluate pretreatment options is in progress. Treatment milestones will be established after this study is complete.

3.2.4.3 Treatment Alternatives. Any applicable treatment alternatives are discussed in Section 3.1.4.

3.2.4.4 Accelerated Treatment. Treatment of aging waste is on a schedule based primarily on Tri-Party Agreement Milestones M-01-00 (grout), M-02-00 (pretreatment), and M-03-00 (HWVP). (Refer to Figure 2-1 for details.) Due to budget limitations, accelerating treatment beyond these milestone dates is not realistic.

3.2.5 Waste Reduction

The production of HLW by the PUREX Plant was reduced from 9,800 kilograms per day of operation in 1985 to 4,900 kilograms per day of operation in 1988. Minimization of aging waste was accomplished through increased process control of the aqueous stream concentration, better control of aluminum nitrate addition, and better control of sodium hydroxide addition to adjust waste stream pH to tank specifications. The minimization is graphically illustrated in Figure 3-5.

The following process improvements were implemented.

- Optimum control of the evaporator waste concentration overflow rate
- Reduction of the aluminum-to-fluoride ratio in the aluminum nitrate nonahydrate addition to the dissolvers during fuel processing.

On December 21, 1992, PUREX received official notification for shutdown and to proceed with terminal cleanout activities. Aging waste is no longer generated by the PUREX Plant.

3.2.6 Variances, Exemptions, Time Extensions

The PUREX aging waste consists of HLW mixed with dangerous waste constituents. The PUREX aging waste is a LDR waste because of both the Third-Third Promulgation (55 FR 22520) and the presence of California list constituents. The Tri-Party Agreement (Ecology et al. 1990) provides for continued storage of LDR waste until treatment capacity is developed for this waste. The agreement requires treatment and disposal capacity for this waste to be developed on the following schedule:

- Demonstrate pretreatment at a date to be determined
- Initiate vitrification operations by December 1999
- Dispose of vitrified waste when repository opens.

The national capacity variance for Third-Third Waste (55 FR 22520) provided for a 2-year national capacity variance from the LDR for third-third mixed waste expiring on May 8, 1992. This variance allowed continued storage of these wastes. A Federal Register notice dated May 26, 1992, stated that EPA could not grant a case-by-case extension for Third-Third mixed waste due to questions regarding the DOE's demonstration that they have entered into binding contractual commitments to construct or otherwise provide treatment capability. A final decision has yet to be made. This extension would allow DOE to store LDR mixed wastes until May 8, 1993, and this date could be extended for up to an additional year. The Tri-Party Agreement will allow continued storage of these wastes in accordance with the schedules in the Tri-Party Agreement. The Federal Facility Compliance Act of 1992 also allows DOE facilities to store their wastes for 3 years if compliance with the Act's provisions for providing waste inventory and treatment plans are met.

If additional variances, exemptions, or time extensions are required as a result of delays in the development of treatment, storage, or disposal capacity, they will be applied for in accordance with the procedures detailed in the Tri-Party Agreement or regulations.

3.3 SINGLE-SHELL TANK WASTE

The SST waste currently in storage is not a LDR waste because it was placed in storage before the effective date of the LDRs for mixed waste (November 27, 1987). Information on the SSTs is included only because when the waste is retrieved or transferred, it then becomes a LDR waste and this information will be required to identify treatment and disposal capacity requirements.

The SSTs are underground, reinforced-concrete, steel-lined tanks used for waste storage. These tanks have held chemically hazardous and radioactive waste generated as a byproduct of processing spent nuclear fuel for the recovery of plutonium, uranium, and neptunium beginning in 1944; additional tanks were constructed as required.

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Liquid waste collection and storage in the SSTs continued until November 1980. The only material added to the SSTs since 1980 has been water, which was added to two tanks for evaporative cooling purposes. An interim stabilization program was initiated in 1968 to remove pumpable interstitial liquid and supernatant from the SSTs and transfer it to the DSTs. This program primarily is intended to reduce the leak potential of the SSTs and will be completed in 1996 (WHC 1990h).

The SSTs consist of 149 tanks containing approximately 139,500 cubic meters of waste. These tanks are located in 12 tank farms with 4 to 18 tanks each in the 200 East and 200 West Areas. The amount of waste contained in the tanks varies from 5 percent to 95 percent of each tank's capacity and varies in consistency from pumpable liquid to sludge to hard salt cake.

3.3.1 Generation

This section describes the waste generation process. Also refer to Section 3.1.1.1 for additional information.

The waste has been generated through a variety of analytical, decladding, and separation processes and various associated sitewide operations. The SSTs received this waste from various Hanford Site activities before 1980.

Waste currently stored in the SSTs was produced by four major chemical processing operations that were conducted from 1944 to 1980:

- The bismuth phosphate process
- The reduction-oxidation process
- The PUREX process
- The tributyl phosphate process.

The bismuth phosphate, reduction-oxidation, and PUREX Plant processes were specifically designed for plutonium recovery. The initial bismuth phosphate chemical separations process produced large volumes of dilute, low-heat waste. The tributyl phosphate solvent extraction process was designed for the recovery of relatively large amounts of uranium that remained in the bismuth phosphate process waste. The bismuth phosphate process was superseded by the reduction-oxidation process, which was superseded by the PUREX process.

The reduction-oxidation and PUREX processes recovered the uranium and neptunium as well as the plutonium from the irradiated reactor fuel. The PUREX process used solvent extraction with tributyl phosphate to separate uranium and plutonium. Chemical removal of the fuel cladding before extraction produced decladding waste with high concentrations of aluminum and zirconium. High-heat-producing isotopes in the waste were separated from the fuel-reprocessing waste by a modified B Plant waste fractionation process. The strontium was separated by an extraction process using complexing agents (e.g., ethylene-diaminetetraacetic acid, n-hydroxyethylethylenediamine-tetraacetic acid, citrate) to prevent transition metal extraction. The cesium was purified by ion exchange. These isotopes (cesium and strontium) were

converted to fluoride and chloride salts and encapsulated in the Waste Encapsulation and Storage Facility. Sodium hydroxide or sodium carbonate was added to the waste before transfer to the SSTs to create an alkaline solution and to minimize tank corrosion (RL 1989b). The processing of irradiated fuels produced waste that included most of the fission products and comparatively small quantities of uranium, plutonium, and other actinides (WHC 1990h).

Smaller volumes of waste also were added to the SSTs from research and development programs, facility and equipment decontamination, laboratory activities, and the PFP (RL 1989b).

Waste components in the SSTs have settled, stratified, and segregated. The tanks contain a mixture of nonradioactive and radioactive chemicals produced during the various chemical processes. Therefore, the determination of the actual composition of each tank of waste is complex.

Addition of new waste into the SSTs was terminated in November 1980. Water occasionally is added to certain tanks if necessary for evaporative cooling purposes. This water evaporates and does not add to the waste volume.

3.3.2 Characterization

The SSTs contain radioactive mixed waste that is solid, liquid, and sludge.

This section discusses the available waste characterization information. Information based on process knowledge and sample analysis is provided along with the waste designations and their bases, the uncertainty related to the designation, and the schedule for further analysis.

3.3.2.1 Process Knowledge. The SSTs contain irradiated fuel reprocessing waste from separation plants. The tanks received waste from five chemical process activities: the bismuth phosphate, reduction-oxidation, PUREX, and tributyl phosphate processes, and B Plant waste fractionation.

The SSTs contain approximately 139,500 cubic meters of waste as radionuclides and dangerous nonradioactive chemicals. The distribution of the three waste forms (sludge, salt cake, and supernatant) in these tanks is illustrated in Figure 3-6 (WHC 1992b). The salt cake and sludge contain interstitial liquid. The bulk of this liquid, approximately 19,000 cubic meters, is contained in salt cake and is being pumped to the DSTs.

The sludge consists of the solids (hydrous metal oxides, iron, and aluminum) precipitated from the neutralization of acid waste before transfer to the SSTs. Sludges vary greatly in their physical properties. Salt cake contains various salts, primarily sodium nitrate, formed by the evaporation of the water from the waste. Damp salt cake is a jelly-like material; dried salt cake is a hard, abrasive, brittle material that may have formed as large single crystals. The salt cake porosity ranges from 10 to 50 percent. The liquid exists as supernate and interstitial fluid (WHC 1990h).

Additional equipment components also are found in the tanks with the process waste. These include metal measuring tapes, level instrumentation,

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other contaminated scrap, pump heads and shafts, and diatamaceous earth. Other nonrecorded items are likely to be contained in the tanks.

3.3.2.2 Sample Analyses. Sample analyses are used to evaluate the chemical, physical, and radiological properties of the SST waste and soils that have been contaminated by spills and leaks. This determination will be used to select a disposal alternative that can be executed safely in compliance with RCRA, the *Washington State Hazardous Waste Management Act*, the *National Environmental Policy Act* (NEPA), and the *Atomic Energy Act* regulatory requirements. The waste is extremely varied with respect to radionuclide content and chemical and physical characteristics. This variation among tanks results from the different nuclear fuel processes and the blending, evaporation, and admixture schemes used since 1944.

A remotely operated method for obtaining samples was developed and implemented for sampling of the liquid and soft, solid tank waste. One to four core samples were removed from each of 15 SSTs in FY 1985 and 1986. Core samples were analyzed by the individual segment removed or as a homogenized sample of all segments retrieved from each core. The detailed waste analysis results are reported in Weiss (1986) and Adams et al. (1986).

The SST waste primarily is comprised of sodium hydroxide; sodium salts of nitrate, nitrite, carbonate, aluminate, and phosphate; and hydrous oxides of iron and aluminum. A relatively small amount of solvents was added to the SST waste during fuel reprocessing as well as water-soluble complexing agents and carboxylic acids from the B Plant waste fractionation process (RL 1989b). Initial estimates of inventories of nonradioactive chemicals are given in Table 3-6 (WHC 1990c).

Twenty-two of the SSTs contain cyanides, introduced as ferrocyanides in a process to precipitate cesium. Approximately 90 percent of the ferrocyanide is in 10 of the tanks. Mixtures of ferrocyanide with sodium nitrate or sodium nitrite may undergo explosive reactions when heated to temperatures significantly above current tank storage temperatures. The buildup of hydrogen under the salt cake in 17 of the SSTs has been a concern. The potential for forming flammable or explosive gas mixtures in the tank vapor space or in gas pockets trapped below the surface of the waste must be considered in retrieval operations (RHO 1985). A large effort currently is under way to resolve these concerns.

A complete, long-term program to characterize SST waste is being conducted by the DOE. This program is detailed in Sasaki (1990). Characterization of all 149 SSTs is scheduled to be completed by September 1998 according to Tri-Party Agreement (Ecology et al. 1990) Milestone M-10-00. The concentration of chemical and radionuclide species of leaked or spilled materials will require future characterization. Recent characterization data for SSTs have been published (WHC 1993b, WHC 1993c) for two tanks.

3.3.2.3 Waste Designation and Basis. The waste in the SSTs is considered ignitable (due to the presence of nitrate), corrosive, and TCLP toxic. The waste currently is assigned waste codes D001 (ignitable), D002 (corrosive), D005 (TCLP toxic barium), D006 (TCLP toxic cadmium), D007 (TCLP toxic chromium), D008 (TCLP toxic lead), D009 (TCLP toxic mercury), D010 (TCLP toxic

selenium), D011 (TCLP toxic silver), F003 (acetone and hexone) and F005 (nonspent solvents). These designations are based on process knowledge and limited sample analyses and may change subject to the results of the analysis and characterization of the waste. The waste designations will be reexamined and revised as necessary as the tanks are characterized.

3.3.2.4 Uncertainty of Waste Designation. The confidence in the current waste code designations is low. The confidence will increase once necessary sampling and analysis work is completed.

3.3.2.5 Schedule for Further Characterization. Characterization of the SST waste is scheduled to be completed in 1998, based on the current waste characterization plan (Sasaki 1990; WHC 1991d, WHC 1991e). This plan includes analysis for inorganic and organic materials, hazardous waste characteristics and criteria (WAC 173-303), as well as extensive physical and radiological properties.

3.3.3 Storage

This section describes the storage unit, provides the volume currently in storage and projected to be added, and assesses the compliance state of the storage unit.

3.3.3.1 Storage Unit and Capacity. Eighty-three of the SSTs are located in the 200 West Area and 66 are in the 200 East Area. The tanks are arranged in 12 tank farms. One hundred thirty-three of the tanks are 22.9 meters in diameter with nominal capacities between 2,000 and 3,800 cubic meters. Sixteen tanks are 6.1 meters in diameter with capacities of 210 cubic meters (WHC 1990c).

3.3.3.2 Amount in Storage. The SST waste consists of 139,500 cubic meters of solids including 25,000 cubic meters of interstitial liquid and supernatant. The volume of waste in each tank farm is shown in Figure 3-7 (WHC 1992b). No waste has been added to the tanks since November 1980 or will be added in the future.

3.3.3.3 Storage Compliance Assessment. The SSTs have released liquid to the soil column. Table 3-7 details the current estimates of releases.

The SSTs will be closed in accordance with schedules negotiated in the Tri-Party Agreement (Ecology et al. 1990). The SSTs were reviewed for compliance with interim status dangerous waste regulations in accordance with Milestone M-21-00. Compliance action schedules and actions for limited compliance with the interim status requirements during the closure are being negotiated.

Currently the following planned interim status compliance actions have been completed:

- Develop waste analysis plans
- Develop contingency plans

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- Develop inspection plans
- Develop training plan
- Maintain inspection results in the operating record
- Determine if annual fire inspections are required.

An SST system closure/corrective action work plan was submitted in September 1989 (RL 1989b). Additionally, a supplemental EIS will be prepared addressing SST closure before beginning final closure activities. Closure steps to be taken include removal of pumpable liquid from the tanks by September 1996.

3.3.4 Treatment

This section discusses the current and proposed waste treatment processes.

3.3.4.1 Current Treatment. Ninety-nine of the SSTs have undergone interim stabilization by removal of pumpable liquid. The remaining tanks will undergo interim stabilization operations before disposal. An interim groundwater monitoring program has been established to comply with the interim status dangerous waste requirements found in WAC 173-303 and 40 CFR 265.

Sixty of the 22.9-meter-diameter SSTs and seven of the 6.1-meter-diameter SSTs (WHC 1990c) are assumed to be past leakers. Unique requirements for waste retrieval from these SSTs have not been identified.

3.3.4.2 Proposed and Alternative Treatment. The waste in the SSTs will undergo retrieval and disposal per the latest planning base. The selection of the specific alternative will be documented through the NEPA process. A comprehensive tank waste remediation system supplemental environmental impact statement is planned to be prepared. A study was completed in 1991 on retrieval options, entitled "Systems Engineering Study for the Closure of the Single-Shell Tanks" (Boomer et al. 1991).

Waste treated in or retrieved from the SSTs will remain subject to the LDRs unless the following criteria are met:

- Hazardous waste listings applicable to the waste must be identified, and the waste must be delisted in accordance with regulatory requirements
- The treated waste must not exhibit a hazardous waste characteristic (corrosivity, ignitability, reactivity, or TCLP toxicity)
- Treated waste must meet the treatment standards specified by 40 CFR 268.

Waste that meets these requirements would still be subject to the state RCRA program unless the waste does not exhibit any of the dangerous waste criteria for toxicity, persistence, or carcinogenicity of WAC 173-303-101 through -103.

A Tank Waste Technical Options Report was completed in 1992 (WHC 1992c) that presents a number of alternatives for remediating the SSTs and DSTs at Hanford.

3.3.4.3 Accelerated Treatment. Treatment of SST waste is on a schedule based primarily upon Tri-Party Agreement Milestones M-05-00 (interim stabilization), M-06-00 (retrieval technology and testing), M-07-00 and M-08-00 (retrieval demonstration), and M-09-00 (complete closure by June 2018). (Refer to Figure 2-1 for details.) Due to budget limitations, accelerating treatment beyond these milestone dates is not realistic.

3.3.5 Waste Reduction

A waste evaporation program was initiated in 1965 to reduce the volume of liquid waste that potentially could leak and contaminate the soil surrounding the tanks. The supernatant liquids were extracted from the SSTs, evaporated to a slurry, and replaced in the tanks for storage. In 1974 two evaporators were installed and used to evaporate approximately 510,000 cubic meters of water to date.

3.3.6 Variances, Exemptions, Time Extensions

The SST waste consists of radioactive waste mixed with dangerous waste constituents. The SST waste is not subject to LDRs until it is removed from the tanks because it was all generated and placed in storage before promulgation of LDR regulations.

The Tri-Party Agreement (Ecology et al. 1990) provides for development of treatment and disposal units for the SST waste as follows:

- Complete SST interim stabilization by September 1996
- Develop SST waste retrieval technology and complete scale-model testing by June 1994
- Initiate full-scale tank demonstration of SST waste retrieval technology by October 1997
- Initiate full-scale farm closure demonstration project by June 2004
- Complete closure of all 149 SSTs by June 2018.

If additional variances, exemptions, or time extensions are required as a result of delays in the development of treatment, storage, or disposal capacity, they will be applied for in accordance with the procedures detailed in the Tri-Party Agreement or regulations.

Information on SST waste is provided because of the applicability of LDRs to the waste upon retrieval and because of the need to consider SST waste in establishing treatment capacity requirements for tank waste.

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3.4 242-A EVAPORATOR PROCESS CONDENSATE

The 242-A Evaporator concentrates the low-level liquid waste that is stored and treated in underground DSTs. The tanks store low-heat-generating waste that contains relatively small amounts of fission products.

The 242-A Evaporator concentrates liquid waste by evaporation. This process reduces the tank waste volume and, hence, the number of DSTs required for storage. The 242-A Evaporator started operating in September 1977; ongoing upgrades will extend its useful life through the year 2000.

In the past (before 1989), the process condensate was routed to retention basins, analyzed for radionuclides and ammonia, and discharged to a crib. In April 1989, dangerous waste and high concentrations of ammonia were detected in the process condensate and discharge to the crib was discontinued. The 242-A Evaporator currently is not operating and is expected to restart in early calendar year 1993. At this time, the process condensate will be discharged to the LERF and ultimately treated for disposal at the Effluent Treatment Facility.

3.4.1 Generation

The 242-A Evaporator concentrates liquid LLW by evaporation. The evaporation process also separates the organic constituents and water from the inorganic constituents and radionuclides.

The 242-A Evaporator receives a mixture of waste from DST 241-AW-102 (the evaporator feed tank). This feed tank receives dilute wastes from other DSTs after the waste has been characterized to determine the suitability of the waste for evaporation. A simplified schematic of 242-A Evaporator process operations is shown in Figure 3-8.

The 242-A Evaporator heats the feed, at reduced pressure, and evaporates off some of the water and volatile organic constituents from the slurry. The vapor fraction and slurry fraction are then processed separately. The vapor fraction is condensed, filtered, and discharged to the LERF as process condensate. If the process condensate does not meet discharge limits, it is pumped back to the 242-A Evaporator feed tank for processing. The remaining supersaturated slurry is recirculated. When the slurry is sufficiently concentrated, it is pumped to underground storage in DSTs.

Upon restart, the 242-A Evaporator will generate up to 4.5 million liters of process condensate per month until the LERF (Section 3.4.3) is full. The 242-A Evaporator will then be shut down for a short time. The 242-A Evaporator will restart when the 242-A Evaporator/PUREX Condensate Treatment Facility becomes operational.

3.4.2 Characterization

The process condensate is a liquid LLW consisting of the condensed vapor fraction from the evaporation process and raw water. The process condensate is designated a dangerous waste because of toxicity (WT02) and the presence of

spent nonhalogenated solvents such as acetone and methyl isobutyl ketone (hexone) (F003).

3.4.2.1 Process Knowledge. The 242-A Evaporator receives liquid waste from DSTs that originated from most of the Hanford Site waste generators and processes. This waste is processed through the 242-A Evaporator in different batches according to their classification by total organic carbon content, TRU content, and effects on the evaporator process.

Dilute complexed waste is received from processing operations at B Plant. This waste contains high amounts of total organics and complexing agents.

Dilute noncomplexed waste is a mixture of T Plant and S Plant waste, PFP supernate, salt well liquids, 300 and 400 Area waste (including fuel fabrication waste), PUREX Plant neutralized decladding waste supernate, salt well liquids (Section 3.3), and ammonia scrubber waste (Section 3.6) (WHC 1990j).

3.4.2.2 Sample Analyses. Process condensate was sampled for characterization from August 1985 to March 1989 during the processing of a variety of evaporator feeds. The average concentration of each analyte detected is shown in Table 3-8 (WHC 1990j).

3.4.2.3 Waste Designation and Basis. The process condensate is designated a dangerous waste because of toxicity (WT01 and WT02). Forty-seven substances potentially present in the process condensate were determined to have toxic categories associated with them. The contribution of each substance to the percent equivalent concentration was calculated in accordance with WAC 173-303-101. The resulting equivalent concentration sum is 10 percent higher than the limit of 0.001 percent; therefore, the process condensate is a toxic dangerous waste. The dominant contributor to the equivalent concentration sum is ammonia.

Additionally, the process condensate is designated a dangerous waste because it is derived from waste that contains the spent nonhalogenated solvents acetone, hexone, and 1-butanol (F003) as well as methyl ethyl ketone and 2-butanone (F005) (WHC 1990j).

3.4.2.4 Uncertainty of Waste Designation. The current designations are considered accurate.

3.4.2.5 Schedule for Further Characterization. The process condensate will be characterized after treatment (Section 3.4.4) to confirm that it is no longer designated dangerous (waste codes no longer applicable).

3.4.3 Storage

The 242-A Evaporator currently is not operating and is being modernized. Process condensate, therefore, is not being generated and no process condensate currently is in storage. On restart of the 242-A Evaporator, process condensate will be stored at the LERF until a treatment system is operational. The LERF can hold about 49 million liters of process condensate,

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which is the volume projected to be generated between December 1991 and October 1992.

The LERF consists of surface impoundment storage units that will comply with interim status design and operation requirements. A Part B permit application was prepared and submitted in accordance with Tri-Party Agreement (Ecology et al. 1990) Milestone M-20-47 detailing the compliance of the LERF with RCRA final status design and operation standards. All dangerous waste will be removed from the LERF by June 1995 in accordance with Tri-Party Agreement Milestone M-26-04.

3.4.4 Treatment

3.4.4.1 Planned Treatment. Planned treatment of the process condensate stored at the LERF is as follows. The 242-A Evaporator/PUREX Plant Condensate Treatment Facility will treat process condensate and prepare the waste for disposal. The current draft process flow diagram is as described below.

- The first step is to adjust the pH of the waste stream with sulfuric acid to a pH of about 6 within a 100,000-gallon surge tank using a recirculation pump.
- Next, suspended particles are filtered by a roughing filter.
- Then an organic destruction unit uses hydrogen peroxide and/or ozone with ultraviolet light to degrade organic compounds into carbon dioxide and water.
- The pH of the waste stream is then lowered to 4 by the addition of sulfuric acid. This adjustment insures all ammonia is converted into its ammonium salt, thereby conditioning the ammonia (as a salt) to be removed by reverse osmosis in a subsequent treatment step. Adjustment of the pH to 4 also converts carbonate and bicarbonate to carbon dioxide for removal by a degasser in a subsequent step.
- Next, a filtration step removes residual particulates down to about 0.5 μm.
- Following that degasification removes the carbon dioxide generated in previous treatment steps.
- Then reverse osmosis removes aqueous salts (including metal ions, radionuclides, and ammonium sulfate) producing a secondary waste stream that will be further concentrated by an evaporation process in subsequent steps.
- The stream is next treated by ion exchange to remove residual aqueous salts not removed by reverse osmosis.
- The treated stream is neutralized as necessary and sent to verification tanks. A system of three verification tanks hold the treated effluent for sampling before discharge (current plans call for discharge to a state-approved land disposal structure). A

recycle loop is provided should verification analyses show that a rework is required to meet permit conditions.

- Secondary waste (primarily produced from the reverse osmosis step, regeneration wastes from the ion exchange step, and blow-down from the two filtration steps) is sent to an evaporation process consisting of a mechanical vapor recompression evaporator and a thin-film dryer. Feed to the evaporation process will be routinely analyzed to determine the nature of the dry secondary waste product. If the dried secondary waste product is a hazardous or dangerous waste, it will be sent to the SWOC and treated at the WRAP Facility. If it is not hazardous or dangerous, the drums will be disposed of at the low-level burial grounds.

The treatment facility is scheduled to begin operations in October 1994 in accordance with Tri-Party Agreement Milestone M-17-14.

3.4.4.2 Treatment Alternatives and Accelerated Treatment. The treatment method for 242-A Process Condensate has been established. Startup of the effluent treatment facility is a priority and accelerating treatment is not realistic.

3.4.5 Waste Reduction

Planned treatment of the process condensate will result in a nondangerous liquid stream acceptable for discharge to the ground and a solid waste form acceptable for land disposal.

The treatment unit will reduce each 245 cubic meters of process condensate to one 0.21-cubic-meter drum of solid waste; this is a waste reduction factor of 1,200. This reduction is based on two assumptions: the average concentration of ammonium in process condensate is 410 ppm and the waste product in the drums is 100% ammonium sulfate.

3.4.6 Variances, Exemptions, Time Extensions

The 242-A Evaporator process condensate is a LLW mixed waste that is LDR because it contains solvent list (40 CFR 268.30) constituents. Currently process condensate is not generated because the 242-A Evaporator is shut down for modifications. Additional process condensate will be generated when the 242-A Evaporator is restarted.

The national capacity variance for Third-Third Waste (55 FR 22520) provided for a 2-year national capacity variance from the LDR for third-third mixed waste expiring on May 8, 1992. This variance allowed continued storage of these wastes. A Federal Register notice dated May 26, 1992, stated that EPA could not grant a case-by-case extension for Third-Third mixed waste due to questions regarding the DOE's demonstration that they have entered into binding contractual commitments to construct or otherwise provide treatment capability. A final decision has yet to be made. This extension would allow DOE to store LDR mixed wastes until May 8, 1993, and this date could be extended for up to an additional year. The Tri-Party Agreement will allow

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continued storage of these wastes in accordance with the schedules in the Tri-Party Agreement. The Federal Facility Compliance Act of 1992 also allows DOE facilities to store their wastes for 3 years if compliance with the Act's provisions for providing waste inventory and treatment plans are met.

The Tri-Party agreement requires treatment and disposal capacity for this waste to be developed on the following schedule:

- Cessation of discharge of process condensate to the LERF by December 1994
- Removal of all dangerous waste residues from the LERF by June 1995.

Future process condensate generated will be discharged to and stored in the LERF until the Effluent Treatment Facility is constructed and operational. The Effluent Treatment Facility will treat process condensate to meet the LDRs. Additionally, a petition is being prepared to delist the effluent from the Effluent Treatment Facility to allow land disposal of the treatment residues.

Part B permit applications will or have been submitted for the 242-A Evaporator (completed June 1991), the LERF (completed June 1991), and the Effluent Treatment Facility (due in August 1993). The delisting petition for the Effluent Treatment Facility was submitted in October 1992.

If additional variances, exemptions, or time extensions are required because of delays in the development of treatment, storage, or disposal capacity, they will be applied for in accordance with the procedures detailed in the Tri-Party Agreement or regulations.

3.5 4843 SODIUM STORAGE FACILITY WASTE

The 4843 Sodium Storage Facility received radioactive and nonradioactive alkali metal waste from Hanford Site generators. The predominant generator of alkali metal waste was the FFTF.

Most of the waste received at the 4843 Sodium Storage Facility consisted of alkali metals and retired equipment from liquid sodium processes. The bulk of material presently in storage is sodium derived from normal FFTF operations and a pump leak at the FFTF.

The waste stored in the 4843 Sodium Storage Facility currently is untreated. The nonradioactive material will be sent offsite for treatment while the radioactive portions would be treated and disposed of onsite with methods to be determined. This facility is scheduled for closure and a closure plan has been prepared. Waste in storage now will be transferred to the SWOC where it will be stored until future processing and disposal facilities are made available.

3.5.1 Generation

The FFTF is an experimental reactor that uses liquid sodium in the primary coolant loop. One cubic meter of sodium and 0.5 cubic meter of structural and other equipment were generated by a pump leak at the FFTF.

Seven drums of waste radioactive sodium have been generated at the FFTF as a result of normal operations during the past 10 years. The rate of future waste production is anticipated to decrease because of a modification in the FFTF procedures that permits recycling of some of this material. The FFTF facility may be shut down as a result of product need and political considerations. This would eliminate waste generated due to facility operation.

The 4843 Sodium Storage Facility became operational in September 1987 to receive radioactive and nonradioactive alkali metal waste from Hanford Site generators. Most of the waste received at the 4843 Sodium Storage Facility consists of spill residue and retired equipment from liquid sodium processes at the FFTF. The 4843 Sodium Storage Facility no longer receives waste for storage.

3.5.2 Characterization

This section discusses the available waste characterization information. Information based on process knowledge and sample analysis is provided along with the waste designation and basis. The uncertainty related to the designation and the schedule for further analysis also are discussed.

3.5.2.1 Process Knowledge. All material in the 4843 Sodium Storage Facility is solid, nonradioactive, or radioactive LLW. All of the waste sodium in the storage unit has been generated at the FFTF from normal operations, a pump leak, and miscellaneous experimental apparatus.

3.5.2.2 Sample Analyses. The waste in the 4843 Sodium Storage Facility is characterized based on process knowledge. No further analysis has been considered at this time.

3.5.2.3 Waste Designation and Basis. The alkali metal waste received for storage at the 4843 Sodium Storage Facility is characterized as ignitable (D001), corrosive (D002), reactive (D003), and toxic (WT01 and WT02).

3.5.2.4 Uncertainty of Waste Designation. The waste characterization certainty is considered high, based on derivation of the waste from sodium cooling loops and experimental apparatus.

3.5.2.5 Schedule for Further Characterization. No further characterization of the waste stored in the 4843 Sodium Storage Facility is anticipated. During future treatment the residues will be analyzed chemically to verify completeness of treatment and to designate the waste for proper disposal.

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3.5.3 Storage

This section describes the storage unit, provides the amount in storage, and assesses the compliance status of the unit.

3.5.3.1 Description of Storage Unit and Capacity. The 4843 Sodium Storage Facility waste storage unit is located in the northwest corner of the 400 Area of the Hanford Site. There are no other buildings in the immediate vicinity of the 4843 Sodium Storage Facility. The gravel area surrounding the building is clear of combustibles for several hundred meters. The building is 12 meters long, 12 meters wide, and 6 meters high. The building has an all-steel structural frame and sides and a gable roof, all of which are insulated with fiberglass batting. The floor is a concrete slab. Building access is through two large rollup doors in the east and west ends and through personnel doors in the southeast and northwest corners.

The 4843 Sodium Storage Facility is used to store radioactive and nonradioactive alkali metal waste, including sodium, lithium, and a sodium/potassium mixture, which has been generated at the FFTF and other operations at the Hanford Site that use alkali metals. (Waste has become radioactive through use in the sodium-cooled reactor.) Waste is segregated within the building depending on whether the alkali metal is radioactive or nonradioactive. Radioactive alkali metal waste is stored in 0.21-cubic meter drums, various piping sections, and "hot-traps." Nonradioactive alkali metal waste is stored in the southern half of the building. The radioactive and nonradioactive storage areas are separated by a radiation boundary rope divider.

The 4843 Sodium Storage Facility only accepted solid alkali metal waste properly packaged in U.S. Department of Transportation-specified containers. To keep the reactive alkali metal waste stable, these containers are flushed with inert gas (argon) and sealed to provide a nonreactive atmosphere.

The estimated capacity of the 4843 Sodium Storage Facility is 84,000 kilograms of alkali metal (RL 1989a).

3.5.3.2 Amount in Storage. The current inventory of the 4843 Sodium Storage Facility includes 8.5 cubic meters of radioactive waste contaminated with 872 kilograms of sodium, and 0.02 cubic meters of nonradioactive waste contaminated with 0.05 kilograms of lithium.

3.5.3.3 Storage Compliance Assessment. The 4843 Sodium Storage Facility was reviewed for compliance with interim status dangerous waste regulations in accordance with Tri-Party Agreement (Ecology et al. 1990) Milestone M-21-00. No areas of noncompliance with interim status requirements were noted other than the since-completed development of a waste analysis plan and a contingency plan. The facility is now scheduled for closure. The closure plan has been prepared and it is anticipated that closure will be completed in FY 1993.

3.5.4 Treatment

This section discusses the current and proposed waste treatment.

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3.5.4.1 Current Treatment. The 4843 Sodium Storage Facility is a storage unit. The waste stored in this unit currently is not being treated.

3.5.4.2 Proposed Treatment. Original plans called for this facility to be fully permitted as a RCRA storage unit. A Part B permit application was prepared and submitted for internal review in March 1991. Subsequently a decision was made to close the 4843 Sodium Storage Facility. The closure plan has been prepared and transmitted to Ecology in June 1991. According to the provision of these plans, the nonradioactive alkali metal waste will be sent offsite to an approved facility for treatment and disposal while the radioactive alkali waste will be transported to the SWOC for storage until appropriate treatment and disposal systems are available. All but one container of nonradioactive waste already has been shipped offsite. It is anticipated that the closure will be completed during FY 1993. A considered method for treatment involves the conversion of sodium to sodium hydroxide and then to sodium carbonate. The sodium carbonate would be designated and disposed of in accordance with applicable regulations. Further planning for treatment alternatives or accelerated treatment will be handled as with other SWOC Waste (Section 3.13).

3.5.5 Waste Reduction

The 4843 Sodium Storage Facility is a storage unit that received alkali metal waste generated on the Hanford Site. Waste generated at the 4843 Sodium Storage Facility is managed to ensure that the quantity and toxicity are minimized. No waste is anticipated to be generated after 1993.

The 4843 Sodium Storage Facility has an operating procedure for the disposal of waste generated at the 4843 Sodium Storage Facility Waste that includes proper responses for cleanup after dangerous waste spills. The response to dangerous waste spills is aimed at minimizing liquid and material used during cleanup. Conversion to carbonate, if this is the chosen treatment method, would remove the entire inventory of elemental sodium waste (see Section 3.5.4.2).

3.5.6 Variances, Exemptions, Time Extensions

The national capacity variance for Third-Third Waste (55 FR 22520) provided for a 2-year national capacity variance from the LDR for third-third mixed waste expiring on May 8, 1992. This variance allowed continued storage of these wastes. A Federal Register notice dated May 26, 1992, stated that EPA could not grant a case-by-case extension for Third-Third mixed waste due to questions regarding the DOE's demonstration that they have entered into binding contractual commitments to construct or otherwise provide treatment capability. A final decision has yet to be made. This extension would allow DOE to store LDR mixed wastes until May 8, 1993, and this date could be extended for up to an additional year. The Tri-Party Agreement will allow continued storage of these wastes in accordance with the schedules in the Tri-Party Agreement. The Federal Facility Compliance Act of 1992 also allows DOE facilities to store their wastes for 3 years if compliance with the Act's provisions for providing waste inventory and treatment plans are met.

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3.6 PUREX AMMONIA SCRUBBER WASTE

The ammonia scrubber waste is a mixed LLW liquid effluent that was generated by the PUREX Plant. During PUREX Plant operations, approximately 7,600 cubic meters of ammonia scrubber feed were generated per year. The ammonia scrubber feed is designated as toxic (WT01) due to the concentration of ammonia in some operating modes. The most recent fraction of ammonia scrubber feed was treated with sodium hydroxide in preparation for tank storage. The treated ammonia scrubber waste is designated as corrosive (D002) as well as toxic (WT01) and is a LDR waste. No additional ammonia scrubber waste has been generated since December 1989 and none will be generated in the future.

3.6.1 Generation

The PUREX Plant received irradiated zirconium clad fuel from N Reactor, removed the cladding from the fuel, and dissolved the fuel in nitric acid. The dissolved fuel was processed through several solvent extraction steps to separate the plutonium, uranium, and neptunium from the fission products contained in the fuel. The PUREX ammonia scrubber feed was generated when water was sprayed to adsorb ammonia gas generated by the decladding and metathesis reactions from the dissolver offgas stream.

In the past, the ammonia scrubber feed was boiled in a concentrator to separate the bulk of the water from the entrained fission products. The condensed water vapors were disposed of to a crib. The remaining ammonia scrubber waste was treated to comply with DST storage specifications and transferred to DSTs as shown in Figure 3-9.

In late 1987, it was determined that the ammonium hydroxide concentration in the ammonia scrubber condensate sometimes exceeded 1 percent, making it a dangerous (toxic) waste as designated by state regulations; therefore it is not appropriate for discharge to the crib. An interim process was established in which ammonia scrubber feed no longer was concentrated for discharge, but was treated for tank storage and transferred as ammonia scrubber waste to underground storage tanks. The treatment consisted of adding sodium hydroxide to adjust the pH to greater than 12 and adding sodium nitrite to minimize tank corrosion.

Approximately 15 cubic meters of ammonia scrubber feed was generated per metric ton of uranium processed. The amount of ammonia scrubber waste generated by month for 1988 is shown in Figure 3-10. No ammonia scrubber waste has been generated since December 1989 and none will be generated in the future.

3.6.2 Characterization

This section discusses the available waste characterization information. Information based on process knowledge and sample analyses is provided along with the waste designation and its basis, the uncertainty related to the designation, and the schedule for further analysis.

3.6.2.1 Process Knowledge. The ammonia scrubber feed waste stream comprises water, ammonium hydroxide, dissolved ammonia, trace amounts of radionuclides, and fluoride and nitrate ions from the ammonium fluoride-ammonium nitrate solution used in the dissolver. The pH of the ammonia scrubber feed stream before treatment for tank storage is between 8 and 10. In the past, the ammonia scrubber waste was similar in composition to the ammonia scrubber feed except that 99 percent of the ammonia present in the ammonia scrubber feed was removed by volatilization during waste concentration and was discarded into the ammonia offgas system or with the ammonia scrubber condensate waste stream.

3.6.2.2 Sample Analyses. The management of the PUREX ammonia scrubber waste can be divided as follows:

- The ammonia scrubber feed produced before late 1987, most of which was evaporated, condensed, and discharged to cribs as ammonia scrubber discharge (Figure 3-9)

- The total ammonia scrubber feed generated after crib closure in 1987, which was then treated and sent as ammonia scrubber waste to DSTs for storage.

The ammonia scrubber discharge was sampled randomly four times over a 23-month period during routine operation, once in 1985 and three times in 1987. The number of chemical analytes detected was 12, although not every analyte was detected at each sampling time. Table 3-9 summarizes the analytical results (WHC 1990f).

The ammonia scrubber feed stored in the DSTs is treated with sodium hydroxide and sodium nitrite. Available analytical data for this stream are shown in Table 3-10.

3.6.2.3 Waste Designation and Basis. Both the historical and PUREX ammonia scrubber waste streams are toxic liquid, noncombustible LLWs classified as wastewaters.

The ammonia scrubber feed stream treated and sent to tank storage is toxic because of the concentration of ammonia. Pursuant to WAC 173-303-070, its designation is WT01. Treating the ammonia scrubber feed with sodium hydroxide, to raise the pH above 12, occasionally renders the resulting ammonia scrubber waste corrosive (D002) as well and creates land disposal restricted waste (WHC 1990f).

3.6.2.4 Uncertainty of Waste Designation. Waste designations for the ammonia scrubber waste recently sent to tank storage are based on sample analyses. Actual sample results show that the ammonia concentration exceeds 1 weight percent during the first few hours of the decladding reaction. The dangerous waste designation due to ammonia for these streams is only a result of exceeding the 1 weight percent limit for a few hours during each decladding reaction. The average concentration for ammonia in this waste is less than 0.1 M as shown in Table 3-9.

Based on the chemicals added to the ammonia scrubber waste that was sent to DSTs and on sample analyses, the ammonia scrubber waste is a toxic (WT01) and may be a corrosive (D002) LDR waste.

3.6.2.5 Schedule for Further Characterization. The ammonia scrubber waste currently stored in tanks will be characterized before planned treatment and disposal of the tank contents. The tank contents will be concentrated at the 242-A Evaporator to reduce the volume of waste requiring grout disposal. The streams ultimately will be disposed of by grout processing. The identification of additional waste characterization tasks will be negotiated among Ecology, EPA, and DOE (WHC 1990f).

3.6.3 Storage

This section provides the volume currently in storage and assesses the compliance state of the storage unit.

3.6.3.1 Storage Unit and Capacity. The PUREX ammonia scrubber waste is stored in underground DSTs in the 200 East Area of the Hanford Site. The tank farms have twenty-eight 4,300 cubic meters tanks, 26 of which are used to store nonaging waste. The total contents of the DSTs are addressed as a single waste stream in Section 3.1.

3.6.3.2 Amount in Storage. The amount of DST waste in storage contributed by ammonia scrubber waste is 5,900 cubic meters. The volume of waste requiring disposal as grout will decrease when the waste is evaporated before grout disposal. The capacity of the tank farms for continued waste storage is discussed in Section 3.1.

3.6.3.3 Storage Compliance Assessment. The PUREX ammonia scrubber waste is stored in the DSTs. The DSTs were reviewed for compliance with interim status dangerous waste regulations in accordance with Tri-Party Agreement (Ecology et al. 1990) Milestone M-21-00. The results of the compliance assessment are provided in Section 3.1.3.3.

3.6.4 Treatment

The ammonia scrubber waste has been treated for storage by adding sodium hydroxide and sodium nitrite to control tank corrosivity. The stream in the DSTs will be concentrated at the 242-A Evaporator and disposed of at the GTF.

3.6.5 Waste Reduction

Change in operational status has eliminated the ammonia scrubber waste; therefore, waste reduction is not applicable.

3.6.6 Variances, Exemptions, Time Extensions

The national capacity variance for Third-Third Waste (55 FR 22520) provided for a 2-year national capacity variance from the LDR for third-third

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mixed waste expiring on May 8, 1992. This variance allowed continued storage of these wastes. A Federal Register notice dated May 26, 1992, stated that EPA could not grant a case-by-case extension for Third-Third mixed waste due to questions regarding the DOE's demonstration that they have entered into binding contractual commitments to construct or otherwise provide treatment capability. A final decision has yet to be made. This extension would allow DOE to store LDR mixed wastes until May 8, 1993, and this date could be extended for up to an additional year. The Tri-Party Agreement will allow continued storage of these wastes in accordance with the schedules in the Tri-Party Agreement. The Federal Facility Compliance Act of 1992 also allows DOE facilities to store their wastes for 3 years if compliance with the Act's provisions for providing waste inventory and treatment plans are met.

If additional variances, exemptions, or extensions of time are required as a result of delays in the development of treatment, storage, or disposal capacity, they will be applied for in accordance with the procedures detailed in the Tri-Party Agreement or regulations.

3.7 PUREX PROCESS CONDENSATE

The PUREX process condensate was a mixed LLW liquid effluent generated by the PUREX Plant. As of April 1, 1990, approximately 4,800 cubic meters of PUREX process condensate have been generated and are stored in DSTs. No additional PUREX process condensate has been generated since March 1990 and none is expected to be generated in the future.

The PUREX process condensate is distilled water with a nitric acid content that can exceed 0.01 M (pH 2). Additionally, the stream contains traces of various radionuclides. Until 1987, the PUREX process condensate stream was discharged directly to a crib. After closure of the crib and to prevent corrosive (pH <2) waste from being discharged into the new crib, potassium hydroxide was added and the stream was routed through a tank with calcium carbonate (limestone) before being discharged. In early 1989 the stream was temporarily rerouted to DSTs during a reevaluation of its dangerous waste designation. The PUREX process condensate transferred to DSTs was designated corrosive (D002).

3.7.1 Generation

The PUREX Plant received irradiated zirconium clad fuel from N Reactor, removed the cladding from the fuel, and dissolved the fuel in nitric acid. The dissolved fuel was processed through several solvent extraction steps to separate the plutonium, uranium, and neptunium from the fission products contained in the fuel.

The PUREX process condensate stream was generated by condensing vapors from uranium/nitric acid concentration and recycle processes within PUREX. This condensate contains trace quantities of nitric acid. Before 1987, the condensate was monitored for radioactivity and discharged to a crib. In 1987, the PUREX process condensate system was upgraded to include a potassium hydroxide neutralization system and a calcium carbonate neutralization bed to

neutralize the traces of nitric acid in the PUREX process condensate before discharge to a second crib (Figure 3-11).

In 1989, during a reevaluation of the designation of the PUREX process condensate stream to ensure that no improperly designated waste was being discharged to the environment, the PUREX process condensate waste stream was treated to meet tank storage specifications and to be transferred to the DSTs. Since March 1990, no PUREX process condensate has been generated.

Approximately 44 cubic meters of PUREX process condensate was generated per metric ton of uranium processed.

3.7.2 Characterization

This section discusses the available waste characterization information. The information is gathered from process knowledge and sample analyses data. Preliminary waste designation and basis, the uncertainty related to the designation, and the schedule for further analysis is provided.

3.7.2.1 Process Knowledge. Before 1986, the traces of nitric acid that distilled over with the PUREX process condensate were not neutralized before discharging that stream to a crib. After 1986, a neutralization system was installed that included controlled addition of potassium hydroxide to the PUREX process condensate, a pH polishing tank containing calcium carbonate (crushed limestone), and pH monitoring instrumentation (Figure 3-11) (WHC 1990g).

3.7.2.2 Sample Analysis. During PUREX operations, PUREX process condensate is sampled as indicated below.

- Pre-1989--PUREX process condensate was sampled with a weekly composite sampler system. Samples were collected in a tank over a 1-week time period and analyzed for key radionuclides, pH, organics, and uranium.

- 1989-1990 Stabilization Run--PUREX process condensate was batch sampled for pH, NO_2, and uranium and sent to DSTs.

Before 1989, samples of the PUREX process condensate stream going to the crib were analyzed. The PUREX process condensate was randomly sampled eight times over a 24-month period during routine operations, once in 1985, twice in 1986, and five times in 1987. The number of chemical constituents detected was 46, although not every constituent was detected in each sample. Table 3-11 summarizes the analytical results (WHC 1990i).

3.7.2.3 Waste Designation and Basis. Before 1987, the PUREX process condensate waste stream occasionally was corrosive (pH less than 2) due to the nitric acid present in the PUREX process condensate. Under these conditions, the occasionally corrosive stream would have been designated as a corrosive (D002). After the neutralization system was installed in 1987, the PUREX process condensate stream was nondangerous. During a reassessment of the designation of the PUREX process condensate waste stream to ensure that no discharge to the environment of improperly designated waste was occurring, the

PUREX process condensate was rerouted to DSTs in early 1989. The PUREX process condensate waste stream sent to the DSTs was treated with sodium hydroxide (to adjust pH to above 12) and sodium nitrite (to control tank corrosivity). This treated waste was designated corrosive D002.

3.7.2.4 Uncertainty of Waste Designation. The PUREX process condensate stream designation is based on process knowledge and sample analyses that are representative of the normal process. There are potential upset conditions and unusual occurrences that could create a corrosive dangerous waste. However, no unusual or abnormal events have occurred that would change the waste designation for the waste sent to DSTs.

3.7.2.5 Schedule for Further Characterization. No future characterization of PUREX process condensate is planned except as part of the treatment process for DST contents (similar to ammonia scrubber waste, Section 3.6.2.5).

3.7.3 Storage

This section discusses the PUREX process condensate waste storage and capacity, identifies stored quantities, and assesses the compliance status of the storage unit.

3.7.3.1 Storage Unit and Capacity. The PUREX process condensate waste is stored in underground DSTs in the 200 East Area of the Hanford Site. These tanks are discussed in Section 3.1.

3.7.3.2 Amount in Storage. As of April 1, 1990, approximately 4,800 cubic meters of PUREX process condensate waste were in storage in the DSTs.

3.7.3.3 Storage Compliance Assessment. The previously generated PUREX process condensate is stored in the DSTs. The DSTs were reviewed for compliance with interim status dangerous waste regulations in accordance with Tri-Party Agreement (Ecology et al. 1990) Milestone M-21-00. The results of the compliance assessment are provided in Section 3.1.3.3.

3.7.4 Treatment

The PUREX process condensate has been treated for storage by adding sodium hydroxide and sodium nitrite to control tank corrosivity. Refer to DST treatment plans for future treatment information.

3.7.5 Waste Reduction

Waste reduction is not applicable at this time. The PUREX Plant will not be restarted.

3.7.6 Variances, Exemptions, Time Extensions

Previously generated PUREX process condensate waste was restricted from land disposal by the Third-Third Promulgation (55 FR 22520). As a component

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of the DST contents, PUREX process condensate will be treated and disposed of in accordance with the plans for DST LLW discussed in Chapter 3.0, Section 3.1.6.

The national capacity variance for Third-Third Waste (55 FR 22520) provided for a 2-year national capacity variance from the LDR for third-third mixed waste expiring on May 8, 1992. This variance allowed continued storage of these wastes. A Federal Register notice dated May 26, 1992, stated that EPA could not grant a case-by-case extension for Third-Third mixed waste due to questions regarding the DOE's demonstration that they have entered into binding contractual commitments to construct or otherwise provide treatment capability. A final decision has yet to be made. This extension would allow DOE to store LDR mixed wastes until May 8, 1993, and this date could be extended for up to an additional year. The Tri-Party Agreement will allow continued storage of these wastes in accordance with the schedules in the Tri-Party Agreement. The Federal Facility Compliance Act of 1992 also allows DOE facilities to store their wastes for 3 years if compliance with the Act's provisions for providing waste inventory and treatment plans are met.

If additional variances, exemptions, or extensions of time are required as a result of delays in the development of treatment, storage, or disposal capacity, they will be applied for in accordance with the procedures detailed in the Tri-Party Agreement or regulations.

3.8 HEXONE WASTE

One hundred thirty-six cubic meters of liquid mixed LLW, primarily hexone, formerly were stored in two underground tanks near the 202-S Plant in the 200 West Area. The waste was distilled to remove radionuclides and is being incinerated to destroy the hexone. Hexone waste no longer is being generated.

3.8.1 Generation

The 202-S Plant used solvent extraction with hexone to separate uranium and plutonium from reactor fuel. The 202-S Plant operated from 1951 to 1967 (DOE 1987).

The hexone was stored in two underground tanks. Tank 276-S-141 contained 76 cubic meters of hexone that was distilled before storage. Tank 276-S-142 contained 53 cubic meters of mixed solvents and 8 cubic meters of water. The mixed solvents were 65 percent hexone, 25 percent N-alkanes (normal paraffin hydrocarbon), and 9 percent tributyl phosphate that were added to the tank as spent solvent from a one-time americium extraction campaign at the 202-S Plant. Tank 276-S-142 also contained 8 cubic meters of water, most of which was added to the tank to flush transfer piping. The tanks also contained about 0.4 cubic meter of sludge, primarily tank corrosion products.

The hexone waste no longer is being generated.

3.8.2 Characterization

The hexone (methyl isobutyl ketone) waste is a dangerous liquid LLW. The dangerous waste codes for this material are F003 (hexone), WT02 (toxic dangerous waste), WC02 (carcinogenic), and D001 (ignitable). The result of a chemical analysis for each tank (before distillation as well as the residual after distillation) is shown in Table 3-12.

After distillation, there were 16,691 gallons of pure hexone in two tank cars and 12,198 gallons of a mixture of hexone, kerosene, and small amounts of tributyl phosphate (less than 1 percent) in two other tank cars. Also in the latter two tank cars were 4,171 gallons of water stored with hexone (1 to 2 percent). Between the four cars, there was 0.71 curie of tritium. All of the distilled material was trucked to the Diversified Scientific Services, Inc. incinerator in Kingston, Tennessee, and all of it has been burned except for 900 gallons of solvent-saturated water that is scheduled for incineration in March/April 1993.

The distillation tars have a volume of 250 gallons and contain essentially all of the nonvolatile radionuclides. The tar has been analyzed and found to be non-TRU mixed waste.

3.8.3 Storage

The waste remaining in the two original storage tanks will be handled and disposed of as part of the tank closure process.

3.8.4 Treatment

During 1990, the waste was treated by distillation to remove radionuclides to allow disposal of the bulk of the waste by incineration. The next treatment step was offsite incineration to destroy the hexone. This treatment was nearly complete as this was written and is expected to be finished by April 1993. The last of the hexone was shipped off the Hanford Site in June 1992. A flowsheet summarizing the treatment and disposal of hexone waste is shown in Figure 3-12.

Distillation of the liquid waste produced three primary product streams: the "clean" distillate, the tar-like bottoms in the distillation vessel, and the offgases of the distillation. There also remains in Tanks 261-S-141 and -142 a liquid level of under 50 gallons and small amounts of sludge.

The tar-like bottoms will remain in the distillation vessels, and the vessels will be sealed for disposal. The vessels are 0.9 meter in diameter and 1.9 meters long, with an approximate weight of 860 kilograms. The spent vessels are non-TRU and will be stored at the SWOC for further treatment by the WRAP Facility. Waste minimization was achieved by minimizing the number of vessel changeouts.

The offgasses were vented back through the underground tanks to maximize condensation (minimizing gaseous effluents and the amount of activated charcoal required for treatment) and treated by high-efficiency filtration and

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charcoal adsorption and filtration. The charcoal adsorbent becomes a mixed waste. Approximately 270 kilograms of charcoal (three or four 0.21-cubic meter drums) were used.

The waste remaining in the two original storage tanks will be handled and disposed of as part of the tank closure process.

As with the distillation phase, the treatment by incineration is itself a waste reduction effort because it will eliminate a dangerous waste (the incineration process will reduce the organic distillate to nondangerous carbon dioxide and water).

Accelerated treatment of the bulk of the hexone waste is not applicable; it has already been treated. Any accelerated treatment of the bottoms in the distillation vessels would be provided by the WRAP Facility (Section 3.13.4). The tank closure process will dispose of the waste in the two original storage tanks. Similarly, alternative treatments would be considered as part of the design and operation of the WRAP Facility.

3.8.5 Waste Reduction

Distillation has reduced the volume of mixed waste from 136 cubic meters of hexone waste to less than 1.6 cubic meters of tar-filled vessels and 1 cubic meter of charcoal adsorbent. Additional reduction information is located in Section 3.8.4. No true waste minimization efforts are in effect for hexone waste since it is no longer being generated.

3.8.6 Variances, Exemptions, Time Extensions

Hexone is a mixed LLW that is restricted from land disposal because it contains solvent list (40 CFR 268.30) constituents.

If additional variances, exemptions, or time extensions are required as a result of delays in the development of treatment, storage, or disposal capacity, they will be applied for in accordance with the procedures detailed in the Tri-Party Agreement.

3.9 183-H SOLAR EVAPORATION BASINS WASTE

The 183-H Solar Evaporation Basins are being closed under RCRA Regulations, WAC 173-303, and Tri-Party Agreement sitewide permit conditions.

The 183-H Solar Evaporation Basins are four concrete basins located in the 100-H Area. The 183-H Basins were constructed in 1949. Originally there were 16 flocculation and sedimentation basins that were a part of the 183-H Filter Plant. The filter plant provided water treatment, filtering units, and reservoir capacity for the 100-H Reactor process water system. In the spring of 1974, after decontamination, demolition of the 183-H Filter Plant was initiated. The 183-H headhouse, 12 of the flocculation and sedimentation basins, the filter building, and the clearwell pump room were demolished to groundlevel and the underground portions were backfilled to

groundlevel. The remaining four basins were used from 1973 to 1985 to store and treat liquid chemical waste from 300 Area fuel fabrication plants. The purpose of the 183-H Basins was to provide a means of waste reduction by natural solar evaporation.

The waste stored in the 183-H Basins has undergone solar evaporation. The waste precipitates and the residual liquids have been treated by solidification; sludges have been removed; everything has been packaged in lined 0.21-cubic meter drums, and shipped to the SWOC for storage and future processing at the WRAP Facility.

3.9.1 Generation

The 183-H Basins were a storage and treatment (evaporation) unit for the liquid chemical waste generated at the 300 Area nuclear fuel fabrication plants. The basins received waste from 1973 through 1985 (RL 1991c).

During the operating life of the 183-H Basins a total of 9,623 cubic meters of routine waste was added to the basins. Table 3-13 presents the quantity of chemical constituents discharged to the basins.

In addition to the routine waste, nonroutine waste periodically was discharged into the 183-H Basins. Nonroutine waste consisted of unused chemicals and spent solutions from miscellaneous processes, development tests, and laboratories. Nonroutine waste fell into three categories: listed waste, nonlisted waste that was added directly to the 183-H Basins, and nonlisted waste that was mixed with the routine waste stream before being transported to the 183-H Basins. Only a small amount of listed nonroutine waste was discharged to the basins. The listed waste quantities were estimated to be 2 kilograms of solid materials and 9 liters of solution. Nonlisted, nonroutine waste discharged directly into the 183-H Basins totaled approximately 50 kilograms of apparently dangerous solid materials, less than 5.8 cubic meters of apparently dangerous liquid waste, and 39 cubic meters of nondesignated waste. Internal "chemical waste disposal permit" records indicate that about 44.30 cubic meters of liquid waste and 700 kilograms of solid waste was mixed with routine waste before being discharged into the 183-H Basins (RL 1991c).

The quantity of waste removed from the basins and now stored at the SWOC totals 2,627 cubic meters. An estimated 8,300 cubic meters of liquid have been "removed" through evaporation and solidification. This comprises all of the wastes that were in the basins.

3.9.2 Characterization

This section discusses the available waste characterization information. Information based on process knowledge and sample analyses is provided along with the waste designations and their bases, the uncertainty of the designations, and the schedule for further analysis.

3.9.2.1 Process Knowledge. The 183-H Basins received both routine and nonroutine waste. The routine waste stream consisted of spent acid etch

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solutions (primarily nitric, sulfuric, hydrofluoric, and chromic acids) generated by the nuclear fuel fabrication process. Typically, these acidic solutions were neutralized with excess sodium hydroxide before being transported to the 183-H Basins. Metal constituents in the waste included copper, silicon, zirconium, aluminum, chromium, manganese, nickel, and uranium. Following reaction with sodium hydroxide, these metals were present primarily in the form of precipitates. The resultant slurry of liquid and metal precipitates was transported and discharged into the 183-H Basins.

Nonroutine waste also was discharged to the 183-H Basins during its period of operation. Before each addition, a review was performed to determine whether undesirable chemical reactions would take place. A "chemical waste disposal permit" system was developed for acceptance of waste into the 183-H Basins. The permit system was for internal use only and should not be considered in the same context as a state or EPA permitted system. These internal chemical waste disposal permits have left a historical record which has been used to determine waste designations for the waste of the 183-H Basins.

Nonroutine waste consisted of unused chemicals and spent solutions from miscellaneous processes, development tests, and laboratories. Nonroutine waste falls into three categories: listed waste, nonlisted waste that was added directly to the 183-H Basins, and nonlisted waste that was mixed with the routine waste stream before being transported to the 183-H Basins.

The chemical waste disposal permits have shown that six different listed nonroutine wastes were discharged into the 183-H Basins. Twelve chemical waste disposal permits were for the discharge of nonlisted, nonroutine waste directly into the 183-H Basins. This waste included sodium arsenate acid; ammonium phosphate; nickel oxide; mixed nickel, copper, and iron oxides; solutions of sodium nitrate, sodium sulfate (anhydrous), sodium chloride, and sodium carbonate (corrosive); sodium carbonate sludge; used boiler cleaning solution containing ethylene-diaminetetraacetic acid, ammonium persulfate, aqua ammonia, ethylene-diamine, hydrazine, and thiourea.

A common practice for disposal of nonroutine waste was to mix the materials with the routine waste stream before the waste was transported to the 183-H Basins. The chemical waste disposal permits indicate that about 44 cubic meters of liquid waste and 1,545 kilograms of solid waste were discharged to the 183-H Basins in this manner.

Additional information is contained in the 183-H Solar Evaporation Basins Closure Plan (RL 1991c).

3.9.2.2 Sample Analyses. During the operating life of the 183-H Basins, systematic chemical analyses were not performed for the routine waste discharges. In October 1984, the waste in Basin 1 was sampled. The waste contained three strata: a wet sludge, a liquid phase, and a relatively dry white stratum. In January 1986, the waste in Basin 2 was sampled. The waste consisted of a wet sludge and a liquid phase. During March 1987, the wet sludge and relatively dry crystalline strata in Basins 3 and 4 were sampled. At the same time, the consolidated liquid (from Basins 1, 2, 3, and 4) in Basin 2 was also sampled (RL 1991c).

The waste in the inner portion of Basin 1 consisted primarily of sludge intermixed with a residual liquid. The cleanout effort involved pumping as much liquid as possible into Basin 2; therefore, the results for the Basin 1 liquid are not discussed. The Basin 1 characterization was addressed by the analysis of the liquid in Basin 2. The outer basin waste was a relatively dry waste that was visibly different than the inner basin waste; consequently, samples taken from this stratum were analyzed separately. During removal of waste from Basin 1, no attempt was made to segregate the different stratum. As a consequence, the most conservative designation resulting from the separate analyses was assigned to all waste from Basin 1.

The results of inorganic chemical analyses for major constituents showed that the waste consisted largely of sodium sulfate, along with water held as moisture and as water of hydration. Nitrate and fluoride ions also were present in high concentrations. Copper constituted about 12 percent of the waste. The uranium concentration ranged from 390 to 530 parts per million (ppm).

Before removing sludge from Basin 2, samples of the liquid and sludge phases were analyzed for chemical constituents. The major constituents in the sludge were copper (13 percent), sodium ion (9.7 percent), and nitrate ion (13.5 percent). Moisture content in the sludge averaged 53 percent. Uranium was present in the sludge in concentrations up to 2,500 ppm.

The solid waste in Basins 3 and 4 was sampled concurrently, and the analytical results are similar enough to be treated in a single discussion. There were two visibly distinct waste strata in each of the basins. These consisted of a moist sludge (inner basin) and a relatively dry, white, crystalline stratum (outer basin) near the walls. Samples of the two strata were analyzed separately and each basin was sampled separately.

The sludge stratum in both basins consisted primarily of sodium, nitrate, and copper ions. Moisture content in this stratum averaged greater than 40 percent in each basin. The crystalline stratum contained high average concentrations of sodium and sulfate ions. A major difference between the basins was that the nitrate ion concentration in the crystalline stratum in Basin 4 ranged from 7 percent to 70 percent, while in Basin 3 the levels were all less than 1 percent. The uranium concentration ranged from 7 to 1,560 picocuries per gram dry weight.

Volatile organic analysis in accordance with Ecology and RCRA SW-846 methods was performed on 10 samples of wet sludge from Basins 3 and 4. The primary reason for doing this analysis was to determine if tetrachloroethane and 1,1,1-trichloroethane (solvents routinely used in the nuclear fuels fabrication process) had reached the 183-H Basins via carryover into the routine waste stream. The analysis showed that neither solvent was present in detectable concentrations of 50 milligram per kilogram.

Five samples of the consolidated liquid in Basin 2 were taken. The major constituents found were sodium and nitrate ions (14 percent and 38 percent, respectively). Moisture content averaged 57 percent. Uranium content for the liquid averaged 82,400 picocuries per liter.

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3.9.2.3 Waste Designation and Basis. The following are the bases for the waste designations:

- Pure chemical products identified on the internal chemical waste disposal permits
- Results of analyses conducted for characterizations of the waste for each basin.

The uranium content of the sludges and liquid is sufficient to classify them as non-TRU radioactive LLW.

Six listed wastes were discharged into the 183-H Basins. Five of these materials were extremely hazardous waste. All the listed wastes were initially added to Basin 1. However, because of subsequent transfers of the liquids among the 183-H Basins, all of the 183-H Basins have been designated as having contained these listed materials. As a consequence, waste codes applicable to all basin waste are U123 (formic acid), P030 (soluble cyanide salts), P120 (vanadium pentoxide), P029 (copper cyanides), P106 (sodium cyanide), and P098 (potassium cyanide).

Additional waste designations for waste of each of the 183-H Basins are as follows:

- Basin 1 (solid): WT01 (fluoride ion concentration)
- Basin 2 (sludge): WT01 (fluoride ion concentration); D007 (TCLP chromium)
- Basin 3 and 4: WT01 (fluoride ion concentration)
- Basin 2 (liquid): WT01 (fluoride concentration); D007 (TCLP chromium).

3.9.2.4 Uncertainty of Waste Designation. The designations of the 183-H Basin waste are considered accurate.

3.9.2.5 Schedule for Further Characterization. No further analyses are planned.

3.9.3 Storage

All solid and liquid wastes in the 183-H Basins have been removed and are being stored in the SWOC; other wastes expected to be generated during closure, decontamination, and demolition also will be stored in the SWOC. Concrete rubble and contaminated soil are expected to be generated. Small concentrations of arsenic and lead have been found in the soil. A TCLP analysis on the berm soil has been completed and results show below regulatory levels for lead and arsenic. Therefore, this soil is not regulated as a dangerous waste.

It is DOE's intent to operate the SWOC in compliance with all applicable federal and state requirements related to mixed waste storage. Further

details on this facility are provided in Chapter 3.0, Section 3.13. The storage unit compliance status of the SWOC is discussed in Section 3.13.3.3.

3.9.4 Treatment

Treatment involved solidifying the liquids, packaging the solidified liquids and solid 183-H Basin waste for temporary storage, and moving it to the SWOC.

All dangerous waste from the 183-H Basins will be retrieved for processing in the SWOC's WRAP Facility, a multipurpose waste processing facility that is scheduled to start operation in 1996. The WRAP Facility as well as plans for treatment are described in Section 3.13.4.2.

3.9.5 Waste Reduction

The quantity of 183-H Basin waste requiring disposal has been reduced by solar evaporation. To minimize the waste generated when solidifying the remaining saturated, unevaporated liquid, 13 different liquid waste solidification agents were studied for packaging efficiency. The solidifying agent chosen provided a high-packaging efficiency, allowing 0.15 cubic meter of liquid to be solidified and packaged into 0.21 cubic meter rather than 0.45 cubic meter as was the case with the older solidification agent.

3.9.6 Variances, Exemptions, Time Extensions

The 183-H Basins will undergo closure in accordance with an approved closure plan (RL 1991c). The facility either will be clean closed or closed as a landfill. The choice of closure method currently is being evaluated. The dangerous waste and waste residues have been placed in containers and transported to the SWOC for storage. This waste is managed with other waste stored at the SWOC.

The 183-H Basins waste consists of LLW containing dangerous waste constituents. The 183-H Basin waste is restricted from land disposal because it contains miscellaneous listed chemical waste (40 CFR 268.30) and California list waste (40 CFR 268.32). It also contains waste covered by the Third-Third Promulgation (55 FR 22520).

The national capacity variance for Third-Third Waste (55 FR 22520) provided for a 2-year national capacity variance from the LDR for third-third mixed waste expiring on May 8, 1992. This variance allowed continued storage of these wastes. A Federal Register notice dated May 26, 1992, stated that EPA could not grant a case-by-case extension for Third-Third mixed waste due to questions regarding the DOE's demonstration that they have entered into binding contractual commitments to construct or otherwise provide treatment capability. A final decision has yet to be made. This extension would allow DOE to store LDR mixed wastes until May 8, 1993, and this date could be extended for up to an additional year. The Tri-Party Agreement will allow continued storage of these wastes in accordance with the schedules in the Tri-Party Agreement. The Federal Facility Compliance Act of 1992 also allows DOE

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facilities to store their wastes for 3 years if compliance with the Act's provisions for providing waste inventory and treatment plans are met.

The 183-H Basins' closure waste will be stored at the SWOC until treatment by the WRAP Facility and subsequent disposal at appropriate disposal unit.

An additional variance also may be required to allow alternative treatment of waste code U123 (formic acid), for which the required treatment is incineration or fuel substitution. Currently, there is no incineration capacity planned for mixed waste at the Hanford Site.

If additional variances, exemptions, or extensions of time are required as a result of delays in the development of treatment, storage, or disposal capacity, they will be applied for in accordance with the procedures detailed in the Tri-Party Agreement or regulations.

3.10 PUREX STORAGE TUNNEL 2 WASTE (Mercury)

This liquid LLW is contained in discarded dissolvers for irradiated fuel. The elemental mercury is sealed inside thermowells that are an integral part of the irradiated fuel dissolvers.

As of December 1992, 0.01 cubic meter of elemental mercury is stored in PUREX Storage Tunnel 2. The mercury is designated D009 (TCLP-mercury) and WT01 (toxic) (RL 1990b).

3.10.1 Generation

Elemental mercury waste is generated when dissolvers in the PUREX process fail or are deemed to be obsolete (hereafter referred to as being discarded). The mercury becomes a waste because its removal from the discarded dissolver is not practical.

The elemental mercury is sealed inside thermowells, which are an integral part of reactor fuel dissolvers used at the PUREX Plant. There are two thermowells per dissolver. Each thermowell consists of a 2.9-meter length of stainless steel pipe with an extension welded to the downside end. The lower end butts against the outer surface of the internal slotted bar screen that separates the undissolved fuel elements from the outer solution chamber of the annular dissolver. The mercury serves to transfer heat from the dissolver interior to the temperature sensor mounted within the thermowell. This mercury remains in the thermowells of discarded dissolvers. In preparation for storage, the thermowell is sealed with a stainless steel nozzle plug. In storage, the discarded dissolver rests in an inclined position in a cradle on a railcar. Secondary containment is provided by the dissolver vessel itself.

As of March 1992, three dissolvers have been discarded: one in 1971, a second in 1972, and a third in 1986. The first two dissolvers each contain 45 kilograms of elemental mercury, while the third one contains 38 kilograms. All three dissolvers are stored on railcars in PUREX Storage Tunnel 2 (DOE-RL 1990b).

3.10.2 Characterization

This section discusses the available waste characterization information. Information based on process knowledge and sample analyses is provided along with the waste designations and their bases, the uncertainty of the designations, and the schedule for further analysis.

3.10.2.1 Process Knowledge. Characterization of the mercury waste relies on fabrication and installation specifications. The quantity of mercury present in each dissolver is documented on the fabrication drawings. None of the mercury will evaporate because each thermowell is sealed.

3.10.2.2 Sample Analyses. Sampling and chemical analysis is not performed on mercury associated with the dissolvers. The need for sample analyses will be evaluated during planning for closure of the PUREX Plant including the PUREX Storage Tunnels.

3.10.2.3 Waste Designation and Basis. The basis for the designation of mercury waste is process knowledge, and the fabrication and installation specifications.

Elemental mercury exhibits the characteristic of toxicity as determined by the TCLP and is designated D009. The quantity of mercury present, if exposed to a leachate, could produce an extract greater than 20 milligrams per liter. This dictates that the mixed waste be managed as extremely hazardous waste and is further designated as toxic (WT01) (DOE-RL 1990b). The waste is also designated as ignitable (D001) and D011 (silver nitrate).

3.10.2.4 Uncertainty of Waste Designation. The designation of the PUREX Storage Tunnels mercury waste is considered accurate.

3.10.2.5 Schedule for Further Characterization. The need for additional waste characterization will be evaluated during planning for closing the PUREX Storage Tunnels.

3.10.3 Storage

This section discusses the PUREX Storage Tunnels, provides their storage capacity and the amount of waste stored, and assesses the compliance status of the storage unit.

3.10.3.1 Storage Unit and Capacity. The PUREX Storage Tunnels are a mixed waste storage unit. The two tunnels are connected by rail to the PUREX Plant and combine to provide storage space for 48 railroad cars (railcars). The PUREX Storage Tunnels provide long-term storage for process equipment removed from the PUREX Plant. Equipment transfers into the PUREX Storage Tunnels are made on an as-needed basis. Radioactively contaminated equipment is loaded on railcars and remotely transferred by rail into the PUREX Storage Tunnels. Railcars act as both a transport means and a storage platform for equipment placed into the tunnels.

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The tunnels are weather-tight structures covered by 2.4 meters of earth. This design serves to protect the stored equipment from exposure to natural elements, provides external radiation shielding from the radioactive equipment stored inside the tunnels, and provides for the protection of the environment.

Tunnel 1 (218-E-14) was completed in 1956 as part of the PUREX Plant construction project and provides storage for eight railcars. Tunnel 1 was filled to capacity (approximately 600 cubic meters of waste) in 1965 and subsequently was secured. There is no elemental mercury waste stored in Tunnel 1.

Tunnel 2 (218-E-15) was an expansion project constructed in 1964. This tunnel is different in design and is considerably longer than Tunnel 1, providing storage space for a total of 40 railcars. A more complete description of the PUREX Storage Tunnels may be found in *PUREX Storage Tunnels Dangerous Waste Permit Application*, Rev. 1 (RL 1990b).

PUREX Storage Tunnel 2 has a maximum storage capacity of 40 railcars. Each railcar will hold 77 cubic meters of waste. To date, 43 percent of the storage area is filled, as 17 railcars holding 1,300 cubic meters of discarded equipment and associated waste have been placed in the tunnel. Sufficient storage capacity exists for all future waste projected to be generated.

3.10.3.2 Amount In Storage. The amount of elemental mercury currently being stored in PUREX Storage Tunnel 2 is 0.01 cubic meter (128 kilograms).

3.10.3.3 Storage Compliance Assessment. Elemental mercury waste is stored in PUREX Storage Tunnel 2, a mixed waste storage unit. The PUREX Storage Tunnels do not have secondary containment structures; however, the mercury waste stored is contained in the thermowells of the dissolver vessels, and the outer shell of the dissolver provides secondary containment. Personnel entry (to inspect the waste storage area) is not practical because of the high levels of radiation present inside the tunnel, which would not meet the requirements of the *Atomic Energy Act* to maintain radiation exposure as low as reasonably achievable. The PUREX Storage Tunnels Dangerous Waste Permit Application was submitted to Ecology in September 1990 in accordance with the Tri-Party Agreement (Ecology et al. 1990). No additional compliance actions have been identified for the PUREX Tunnels.

3.10.4 Treatment

3.10.4.1 Planned and Alternative Treatments. Planned treatment of the elemental mercury waste stored in PUREX Tunnel 2 is detailed in the Part B Dangerous Waste permit application (RL 1990b). The EPA required treatment technology for elemental mercury is amalgamation (52 FR 22520). Therefore, the treatment of choice is the current approach of adding zinc powder to create an amalgam. An alternative treatment being considered is to mineralize the elemental mercury (creating elemental mercury sulfide). After treatment, waste still classified as mixed waste will be placed in approved transport packaging and stored in an authorized Hanford Site storage unit or sent to a permitted mixed waste disposal unit.

3.10.4.2 Accelerated Treatment. A schedule for treatment of this waste has not been established. The material stored in the tunnels will be addressed as a part of PUREX Plant closure.

3.10.5 Waste Reduction

The elemental mercury in PUREX Storage Tunnel 2 will be separated from other waste categories to reduce the hazard of waste requiring processing and disposal as mixed waste.

3.10.6 Variances, Exemptions, Time Extensions

Elemental mercury waste was placed in the PUREX storage tunnels before November 1987 (the effective date of the LDRs for mixed waste) and, therefore, is not subject to LDRs until the waste is removed from the tunnels. Removal of elemental mercury waste is planned as part of the closure of the PUREX Plant. At that time waste will be removed from the PUREX storage tunnels, treated to comply with LDR treatment standards, and disposed of at a permitted disposal unit.

If variances, exemptions, or time extensions are required as a result of delays in the development of treatment, storage, or disposal capacity, they will be applied for in accordance with the procedures detailed in the Tri-Party Agreement or regulations.

3.11 PUREX STORAGE TUNNELS 1 AND 2 WASTE (LEAD AND SILVER)

The PUREX Storage Tunnels 1 and 2 contain 0.26 cubic meter of elemental lead and PUREX Storage Tunnel 2 contains 0.17 cubic meter of silver (mostly as silver nitrate). The estimated volume of equipment associated with the elemental lead is 120 cubic meters. The estimated volume of equipment associated with the silver nitrate is 15 cubic meters (RL 1990b, Appendix A). The lead is in jumper counterweights and equipment weights, and the silver is in discarded silver reactors.

The elemental lead waste is TCLP toxic for lead (D008) and also is designated toxic (WT01). The silver nitrate waste is classified as TCLP toxic for silver (D011) and ignitable (D001) because of the presence of nitrates.

3.11.1 Generation

Elemental lead waste is generated in the PUREX process as an integral part of equipment, such as process pipe jumpers, jumper alignment tools, and shielding equipment. Historically, elemental lead was used as weight, counterweight, and radiation shielding in the fabrication of process equipment used in the PUREX Plant; generally, the lead was encased in steel (carbon or stainless) to facilitate its attachment to process equipment. Counterweights are used to facilitate remote installation of in-cell process and service piping (jumpers). A jumper alignment tool may have contained as much as

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680 kilograms of lead. This tool is used as a weight to pull down the free end of a jumper so the connecting parts align vertically and the connection can be made.

Silver in the form of silver salts deposited on unglazed ceramic packing is contained within the discarded silver reactors stored in Tunnel 2. Three silver reactors were used to remove radioactive iodine from the offgas streams of the irradiated reactor fuel dissolvers in the PUREX process. The silver reactor vessel contains two beds of packing. The packing is coated initially with 114 kilograms of silver nitrate used for iodine retention. Nozzles on the top of the reactor are provided to allow flushing and/or regeneration of the packing with silver nitrate solution as the need arises.

Experience has shown that after extended use, the silver reactors lose efficiency. This loss in efficiency normally occurs when about one-half the silver nitrate on the packing has been converted to silver iodide. Other competing reactions such as reduction of silver nitrate to metallic silver and formation of silver chloride also occur and affect silver reactor efficiency. Therefore, regeneration of the silver reactor with fresh silver nitrate is performed periodically. Thus, the packing of the discarded silver reactor contains a mixture of silver nitrate, silver halides, and silver fines.

During PUREX shutdown, elemental lead and silver nitrate waste may be generated by plant maintenance activities.

3.11.2 Characterization

This section discusses the available waste characterization information. Information based on process knowledge and sample analyses is provided along with the waste designations and their bases, the uncertainty of the designations, and the schedule for further analysis.

3.11.2.1 Process Knowledge. The quantity of lead generated is determined from a review of fabrication and design drawings for each piece of equipment placed in storage if the lead weight, counterweight, or shielding is specifically detailed. The silver salts quantity is estimated from the knowledge of the amount of silver nitrate placed on the bedding and the regeneration history of the silver reactors. For accountability purposes, the total silver content is considered to be silver nitrate, the salt that exhibits the characteristics of both ignitability and TCLP toxicity.

3.11.2.2 Sample Analyses. Sampling and chemical analysis is not performed on lead or silver salts associated with the radioactive discarded equipment placed in the PUREX Storage Tunnels. The quantity of lead in storage is determined from process knowledge. Provisions for taking samples of the bedding were not provided in the design of the silver reactor vessels. Therefore, sampling and chemical analysis are not performed for silver salts before placing a silver reactor in storage.

3.11.2.3 Waste Designation and Basis. Elemental lead exhibits the characteristic of toxicity as determined by the TCLP and is designated D008. The form of lead present could produce an extract greater that 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. However, because the bulk of the lead is encased in steel on railcars that isolate the lead from other materials stored within the tunnel, the potential for exposure of lead to a leachate is considered to be negligible.

Silver salts exhibit the characteristics of toxicity as determined by the TCLP and are designated D011 as well as D001 due to their oxidizer characteristics. The form of silver present could produce an extract having greater than 500 milligrams of silver 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. Although nitrate is an oxidizer is designated D001 silver (ignitable), the dispersion of a nitrate salt on unglazed ceramic packing contained within a stainless steel vessel and isolated from other materials stored within the storage tunnel results in a probability for ignition to be considered negligible.

3.11.2.4 Uncertainty of Waste Designation. The designated waste codes for the lead and silver waste are considered accurate.

3.11.2.5 Schedule for Further Characterization. The need for additional waste characterization will be evaluated during planning for closing the PUREX Storage Tunnels.

3.11.3 Storage

The PUREX Storage Tunnels, their storage capacity, and the compliance status of the storage unit are discussed in Section 3.10.3.

As of December 1992, 0.26 cubic meter of elemental lead is stored in PUREX Storage Tunnels 1 and 2, and 0.17 cubic meter of silver nitrate is stored in Storage Tunnel 2. The estimated volume of equipment associated with the elemental lead is 120 cubic meters. The estimated volume of equipment associated with the silver nitrate is 15 cubic meters (RL 1990b).

The amounts of lead and silver placed in the storage tunnels are given in Table 3-14. The estimated quantity of lead listed in Table 3-14 accounts only for the lead in alignment tool 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 estimated quantity of lead in storage.

The quantity of silver salts listed in Table 3-14 is a function of time of reactor use, the regeneration history, and the impurities in the process chemicals that may have reacted with the silver nitrate. Sample analyses have not been conducted to verify the predicted quantities present.

3.11.4 Treatment

3.11.4.1 Planned Treatment. Planned treatment of the elemental lead and the silver salts associated with the process equipment stored in the storage tunnels is presented in RL (1990b). The elemental lead will be removed, where feasible, from the process equipment to reduce the volume to be treated. The

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elemental lead, as well as the silver salts located in the silver reactors, are planned to be treated by encapsulating the material in a cementitious grout that immobilizes the lead and silver.

3.11.4.2 Treatment Alternatives. Alternatives to the process above have not been studied. As necessary, this will be done as part of the plant closure process.

3.11.4.3 Accelerated Treatment. A schedule for treatment of this waste has not been established. The material stored in the tunnels will be addressed as part of PUREX Plant closure.

3.11.5 Waste Reduction

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

The silver and elemental lead in the PUREX Storage Tunnels will be separated from other waste categories to reduce the hazard of waste requiring processing and disposal as mixed waste.

3.11.6 Variances, Exemptions, Time Extensions

Elemental lead waste, silver nitrates, silver salts, and silver fines (mixed LLW) were placed in the PUREX storage tunnels before November 1987 and are, therefore, not subject to LDRs until the waste is removed from the tunnels. Removal of elemental lead waste and silver nitrates, silver fines, and silver salts is planned as part of the PUREX Plant closure. At that time waste will be removed from the PUREX Storage Tunnels, treated to comply with LDR treatment standards, and disposed of at a RCRA-compliant disposal facility.

If variances, exemptions, or time extensions are required as a result of delays in the development of treatment, storage, or disposal capacity, they will be applied for in accordance with the procedures detailed in the Tri-Party Agreement or regulations.

3.12 PUREX CANYON DECK STORAGE (CADMIUM AND LEAD)

Discarded process equipment removed from service in the PUREX Plant and known to have shielding, weights, and/or counterweights containing elemental cadmium or lead are stored on the canyon deck of the 202-A PUREX Building. A change in storage designation from a "waste pile" to "containment building" was made on November 24, 1992. The addition of waste cadmium storage to the canyon deck was also made on this date.

Segregation of lead in this way began in December 1987. The current inventory (as of December 1992) is approximately 0.29 cubic meters (approximately 3,226 kilograms) of radioactively contaminated lead (mixed waste). The cadmium and lead stored on the PUREX Canyon deck currently is

untreated. Of this 0.29 cubic meters, approximately 0.25 cubic meters also contain 6 kilograms of metallic cadmium. The preferred disposal option is microencapsulation.

3.12.1 Generation

The PUREX Plant is located in the 200 East Area of the Hanford Site. It processed irradiated nuclear fuel by separating usable actinides from fission products. The PUREX Plant was constructed in 1955 and had operated intermittently as needed since then.

The lead on the PUREX canyon deck consists of material that had been used for shielding, weights, or counterweights in the PUREX Plant. In most cases, the lead is totally enclosed in steel. However, some of the lead sheeting used in shielding is unclad. Since early 1987, the use of lead in the design and fabrication of new or replacement equipment for the PUREX Plant has been discontinued wherever feasible.

The cadmium on the PUREX canyon deck was used as neutron shielding and is totally enclosed in steel along with approximately 1,300 kilograms of lead.

Specific equipment items that use protective radiation shielding include certain diaphragm-operated valves and neutron monitors used for process control. The amount of lead required for such purposes varies from about 270 kilograms for the shielding around a small diaphragm-operated valve to as much as 1,300 kilograms of lead for a single neutron monitor.

Massive lead weights, up to 680 kilograms, are used as jumper alignment tools in the remote installation of some jumpers. Such tools assist in the vertical alignment so connection can be made. Jumpers are rigid lengths of pipe used to connect lines providing solution transfer to and from process equipment. Counterweights are attached to some of the jumpers to provide proper balancing for remote installation by the overhead maintenance cranes. A typical jumper counterweight consists of appropriately sized steel pipe filled with lead shot (approximately 45 kilograms) and welded shut on both ends.

If the PUREX Plant were to be restarted, lead and cadmium waste generation would be evaluated as part of restart planning. Lead waste may be generated during standby of the PUREX Plant, but data are not available to estimate this generation rate.

3.12.2 Characterization

This section discusses the waste characterization and the basis for the waste characterization. The waste designation, the uncertainty of the designation, and the schedule for further characterization also are provided.

3.12.2.1 Process Knowledge. The waste comes from discarded radioactive process equipment with lead shielding, weights, or counterweights. The waste is characterized as cadmium or lead based on knowledge of the amount and material used to manufacture a specific equipment component as determined from

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review of the fabrication and design drawings for each piece of discarded equipment.

3.12.2.2 Sample Analyses. No chemical analysis of the waste has been performed and is not required because the waste is accurately characterized based on process knowledge.

3.12.2.3 Waste Designation and Basis. The waste (elemental cadmium and lead) is designated TCLP toxic for lead (D008), cadmium (D006), and toxic (WT01). The material is a solid, noncombustible metal.

3.12.2.4 Uncertainty of Waste Designation. The waste designation is accurately known, based on process knowledge.

3.12.2.5 Schedule for Further Characterization. No further characterization of this waste is scheduled.

3.12.3 Storage

This section describes the storage unit and assesses its compliance status.

3.12.3.1 Description of Storage Unit and Capacity. The PUREX canyon is a portion of the plant with a thick concrete floor, walls, and ceiling (up to 1.8 meters thick). Work in the canyon is generally performed remotely due to high radiation levels.

Discarded process equipment with cadmium and/or lead attachments are stored on the south side of the canyon. Periodically, lead-containing components are cut from the equipment and placed in a metal box suitable for transfer by railcar into the PUREX Storage Tunnels. The remaining nonlead-containing equipment components are disposed of as LLW.

Because the waste on the canyon deck is located inside the 202-A Building, the waste is protected from external environmental forces such as wind, rain, and run-on flooding. A system of drains and sumps ensures that any liquids from the waste are routed to appropriate waste storage tanks.

3.12.3.2 Amount in Storage. The combined quantity of lead and cadmium waste in storage is 0.29 cubic meters (3,226 kilograms of lead and 6 kilograms of cadmium). No additional lead has been added to storage since October 1990.

3.12.3.3 Storage Compliance Assessment. Containment building storage of mixed waste on the canyon deck of the 202-A Building as containment building storage is addressed in revisions of the Part A permit application for the PUREX Plant. The PUREX Plant waste management unit was reviewed for compliance with interim status dangerous waste regulations in accordance with Tri-Party Agreement (Ecology et al. 1990) Milestone M-21-00. No interim status compliance deficiencies were noted.

Submittal of a Part B permit application or closure plan for the PUREX Plant has been deferred until July 1995, per Tri-Party Agreement Milestone M-20-24.

3.12.4 Treatment

3.12.4.1 Planned and Alternative Treatments. Although treatment units could be built to separate the contained lead and/or cadmium from its encasement and possibly refine the metal to remove radioactive contamination, it is doubtful if unrestricted release of the refined lead could be achieved. Therefore, the preferred treatment alternative currently is identified as microencapsulation (55 FR 22520). Other alternatives have not been studied at this time.

3.12.4.2 Accelerated Treatment. A schedule for treatment of this waste has not been established. The material stored in the tunnels will be addressed as a part of the PUREX Plant closure.

3.12.5 Waste Reduction

Since early 1987, the use of lead counterweights in the design and fabrication of new or replacement equipment for use in the PUREX Plant has been discontinued wherever feasible. Nondangerous materials such as carbon or stainless steel are substituted for lead counterweights wherever practical.

3.12.6 Variances, Exemptions, Time Extensions

The national capacity variance for Third-Third Waste (55 FR 22520) provided for a 2-year national capacity variance from the LDR for third-third mixed waste expiring on May 8, 1992. This variance allowed continued storage of these wastes. A Federal Register notice dated May 26, 1992, stated that EPA could not grant a case-by-case extension for Third-Third mixed waste due to questions regarding the DOE's demonstration that they have entered into binding contractual commitments to construct or otherwise provide treatment capability. A final decision has yet to be made. This extension would allow DOE to store LDR mixed wastes until May 8, 1993, and this date could be extended for up to an additional year. The Tri-Party Agreement will allow continued storage of these wastes in accordance with the schedules in the Tri-Party Agreement. The Federal Facility Compliance Act of 1992 also allows DOE facilities to store their wastes for 3 years if compliance with the Act's provisions for providing waste inventory and treatment plans are met.

Removal of the mixed waste stored on the canyon deck will be addressed as part of the PUREX Plant closure. At that time, waste will be removed from the PUREX canyon deck, treated to comply with LDR treatment standards, and disposed of at a permitted disposal facility.

If variances, exemptions, or time extensions are required as a result of delays in the development of treatment, storage, or disposal capacity, they will be applied for in accordance with the procedures detailed in the Tri-Party Agreement or regulations.

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3.13 SOLID WASTE OPERATIONS COMPLEX STORED LOW-LEVEL, TRANSURANIC, AND POLYCHLORINATED BIPHENYL WASTE

The SWOC receives radioactive solid waste and provides temporary storage until treatment at the Hanford Site.

Waste is received at the SWOC from all radioactive waste generators at the Hanford Site and any offsite generators that are authorized by the DOE to ship waste to the Hanford Site for treatment and disposal. The waste received at the SWOC is generated by ongoing Site operations (e.g., PFP operation, waste management) and research and development activities conducted at the site (e.g., SST waste sampling and analysis). Offsite waste has been primarily from DOE research facilities and other DOE sites. The characteristics of the waste received at the SWOC vary greatly from waste that is nondangerous LLW to TRU dangerous waste. The SWOC currently stores, as of December 31, 1992, approximately 2,616 cubic meters of mixed LLW subject to LDRs and 122 cubic meters of TRU mixed waste subject to LDRs. Other dangerous waste that is not restricted from land disposal is stored at the SWOC and is not included in these figures.

No treatment units currently exist for TRU or LLW contaminated with PCBs. Therefore, this waste is being held in storage at the SWOC until treatment capability exists. The Hanford Site PCBs inventory includes contaminated liquids (PCB-contaminated hydraulic fluid), contaminated combustible solids, and contaminated equipment (transformers, capacitors, and fluorescent light ballasts). There currently are 179 cubic meters of PCB-contaminated LLW and 78 cubic meters of PCB-contaminated TRU waste (as of 12/31/92).

3.13.1 Generation

This section describes the generation of RMW and radioactive PCB waste shipped to the SWOC.

3.13.1.1 Mixed Waste Generation. The majority of the waste shipped to the SWOC is generated in small quantities by routine plant operation and maintenance activities. Specifying generation rates and types of waste generated by each plant is difficult because this waste is not generated as a direct result of process operations. The overall volumes of mixed waste projected to be generated are given in Table 3-15. No data are available on the fraction of this waste that will be subject to LDRs, but the majority of this newly generated mixed waste probably will be subject to the LDRs. The dangerous waste designation of each container of waste is determined at its point of generation based on knowledge of the waste placed in the container. The major plants that generate mixed waste that is LDR and the general type of waste they generate are discussed below.

In the past the PUREX Plant, located in the 200 East Area, was used to process irradiated nuclear fuel from N Reactor. The PUREX process uses a nitric acid solution to dissolve the fuel and a solvent extraction process to separate the various fission products from the uranium, plutonium, and neptunium product streams. Radioactive solid waste is generated in all parts of the PUREX Plant from routine laboratory operations to equipment maintenance. Typically, the mixed solid waste generated at the PUREX Plant

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includes lead shielding, decontamination solvents, mercury-filled light tubes, and other nonroutinely generated radioactive solid waste.

The PFP, located in the 200 West Area, has been used to process plutonium nitrate solutions from the PUREX Plant, plutonium oxide, and plutonium scrap into metal. The plant consists of several facilities including the Plutonium Reclamation Facility, the Remote Mechanical 'C' Line (RMC), and the Product Handling Facility. Several radioactive mixed waste streams including lead, PCBs, and laboratory wastes are routinely generated at the PFP and shipped to the SWOC.

The Uranium Oxide Plant, located in the 200 West Area, converts uranyl nitrate solution generated from the reprocessing of N Reactor fuel to uranium oxide solids which are shipped offsite for reuse. The primary source of mixed waste at the Uranium Oxide Plant is solvents and mineral acids (HNO_3 and H_2SO_4) used for decontamination or equipment maintenance in radiation areas. Other sources of LDR mixed waste at the Uranium Oxide Plant include contaminated fluorescent tubes and failed equipment.

The 222-S laboratories, located in the 200 West Area, are used to analyze radioactive samples in support of waste management operations and tank characterization. These operations generate both solid and liquid mixed LLW. The solid waste generated by this laboratory includes the following:

- Radioactively contaminated lead
- Outdated chemicals and reagents
- Equipment and absorbent materials contaminated with radioactive waste.

The liquid mixed LLW is generated when using organic solvents to analyze radioisotopes.

A new pretreatment facility for HLW has been planned. It was formerly proposed to modify B Plant for this purpose. Maintenance activities in B Plant generate small quantities of solid waste such as lead shielding, equipment decontamination agents, paint and painting supplies, and fluorescent light ballasts. This contact handled and remote handled waste is generated on an as-needed basis because of plant maintenance and upgrading.

T Plant, located in the 200 West Area, is used to decontaminate failed equipment to facilitate repair, reuse, or disposal as nondangerous LLW. The solid waste generated as a result of these operations includes spent solvents, failed equipment, lead shielding, paint and painting supplies, and metallic vapor lights.

N Reactor, located in the 100 N Area, is shut down in deactivated status. There are numerous sources of mixed LLW in the 100-N Area that generate waste oils, solvents, and decontamination solutions that in the past have been determined to be dangerous waste. In addition, the 100-H Area is the location of the 183-H Solar Evaporation Basins (Section 3.9), which was the source of a large quantity of waste (approximately 460 cubic meters).

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The 300 Area Fuels Manufacturing Operations generates several mixed LLW streams. These operations have been shut down since December 1986, and the only waste generated from these operations is from decontaminating and closing these operations. A detailed description of the waste is provided in Section 3.16. The waste is being transferred to the SWOC, or offsite if determined nonradioactive, as part of the closure activities for the 303-K Facility.

The FFTF, in the 400 Area, and associated research and development activities generate several waste streams that are mixed LLW. This waste includes waste sodium, which is discussed in Section 3.5, spent ethyl alcohol waste, listed solvent residual waste, contaminated lead residual waste, and decontamination waste. Spent ethyl alcohol waste is generated by cleaning of Materials Open Test Assembly specimens to remove residual sodium. This waste exhibits the characteristic of ignitability (D001) and corrosivity (D002). Listed solvent residual waste is generated by the use of listed solvents in plant maintenance activities, such as manipulator repair and painting. Contaminated lead residual waste is generated from the removal of lead shielding for repair and replacement. Decontamination waste is generated while decontaminating stainless steel components such as shipping casks, hot cells, or other equipment in the conduct of Fuels Material Examination Facility operations. The waste contains listed solvents and may contain sufficient concentrations of chromium, nickel, and silver to be designated TCLP toxic.

The research and development activities conducted by PNL in the 300 and 3000 Areas generate numerous small-volume mixed waste streams that are land disposal restricted. This waste is generated in the 303-C, 320, 324, 325, 326, 327, 331, and 3720 Buildings. The laboratory waste may contain materials that are designated TCLP toxic (D003-D011) or that are designated as ignitable (D001) or corrosive (D002). The waste designated as TCLP toxic is generated from the analysis of samples containing toxic metals and the disposal of contaminated equipment and lead shielding. The waste designated as corrosive or ignitable is generated by the use of scintillation cocktails containing ignitable solvents for the analysis of radionuclides.

The operation and maintenance of the SST and DST tank farms located in the 200 East and 200 West Areas generates several types of mixed waste. The waste includes equipment used for tank sampling and characterization, failed equipment and instrumentation, and small quantities of tank waste absorbed on clothing or rags. These waste streams may be designated by some or all of the waste codes applicable to DSTs. These codes include corrosivity (D002); TCLP toxicity for arsenic (D004), barium (D005), cadmium (D006), chromium (D007), lead (D008), mercury (D009), selenium (D010), and silver (D011); spent halogenated solvents (F001); spent nonhalogenated solvents (F003); methyl ethyl ketone (F005); and toxicity (WT01 and WT02); carcinogenic (WC01 and WC02), and persistent (WP01 and WP02).

3.13.1.2 Polychlorinated Biphenyl Waste Generation. The PCB-contaminated TRU and LLW is generated by maintenance and periodic flushing of PCB hydraulic systems, failure of transformers and capacitors, and removal of PCB ballasts from light fixtures located in radioactive contaminated areas. The waste is packaged and shipped as solid waste to the SWOC for storage.

The best available generation information is maintained in the computerized Solid Waste Information and Tracking System database. The Solid Waste Information and Tracking System contains only information provided by the waste generator. In the past, exhaustive waste descriptions that could be used to accurately classify a waste were not required, and data entries such as "contaminated debris" and "mixed fission products" were common. Data from the database indicates that 78 cubic meters of PCB-contaminated LLW and 136 cubic meters of PCB-contaminated TRU waste were generated between 1970 and December 1992.

Future generation of PCB-contaminated waste is expected to be variable. The generation of this waste stream is correlated with the failure rate of PCB transformers, capacitors, and fluorescent light ballasts. Additional generation may be related to general Hanford Site cleanup and decontamination/decommissioning activities. Sitewide cleanup efforts may identify soil-contaminated areas that will require cleanup and packaging.

3.13.2 Characterization

This section discusses waste characterization based on process knowledge and sample analysis, identifies known designations, and addresses any further characterization required or planned.

Before acceptance of any waste at the SWOC, it is characterized and packaged as described in *Hanford Site Solid Waste Acceptance Criteria* (WHC 1991b). These criteria require that the generator of the waste characterize each individual container of waste with sufficient accuracy to permit proper segregation, treatment, certification, shipment, and storage.

3.13.2.1 Process Knowledge. The waste characteristics are determined by the waste generator based on documented knowledge of the process generating the waste or sampling, as appropriate. The generators of all waste shipped to the SWOC are periodically audited to ensure that waste is being managed in accordance with *Hanford Site Solid Waste Acceptance Criteria*.

Process knowledge has been used to characterize PCB-contaminated TRU waste and LLW currently in storage. Equipment containing PCBs such as hydraulic systems, transformers, capacitors, and fluorescent light ballasts have been identified clearly. These systems are managed in accordance with 40 CFR 761 and waste are immediately handled and packaged as PCB TRU waste or LLW material.

3.13.2.2 Sample Analyses. The waste characteristics are determined by the waste generator based on documented knowledge of sample analyses of the generated waste. The generators of all waste shipped to the SWOC are audited periodically to ensure that waste is being properly characterized.

Hydraulic systems and transformers have been sampled to determine PCB concentrations. Any waste resulting from the management of these systems is designated based on the concentration of PCBs in the source system. Light ballasts are designated based on data from the manufacturers.

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Additional sampling is planned when this waste is processed through the WRAP Facility.

3.13.2.3 Waste Designation and Basis. Waste at the SWOC is designated based on the information provided by the generator, performed by the waste analysis organization as part of a waste acceptance evaluation in accordance with *Hanford Site Solid Waste Acceptance Criteria* (WHC 1991b), and recorded in the Solid Waste Information Tracking System database. This database includes Washington State and RCRA waste codes resulting from designations based on process knowledge and sample analysis. Waste codes have been entered into the database since 1988. When the waste codes were not found in database reports, waste designation tables were used to assign codes to containers placed in storage before 1988.

3.13.2.4 Uncertainty of Waste Designation. The designation of the waste stored in the SWOC is considered accurate.

3.13.2.5 Schedule for Further Characterization. No further characterization is required to accurately designate the present waste for storage. For some of the waste, additional characterization will need to be performed to determine proper treatment and disposal options. This characterization will be performed during processing at the WRAP Facility. Further characterization may be necessary for newly generated waste and/or as a result of changed regulations.

3.13.3 Storage

This section describes the storage units associated with the SWOC and details the amount and characterization of the waste stored in these units.

3.13.3.1 Description of Storage Units and Capacity. The storage units described below are included in the SWOC.

- Flammable Mixed-Waste Storage Modules--Eight modules are operational to store flammable LLW, TRU waste, mixed LLW, and TRU-mixed waste with flashpoints below 38 degrees celsius. The total capacity is 246 0.21-cubic meter drums. The modules are small preengineered buildings with 16.3 square meters of floor space each.

- Mixed-Waste Storage Buildings--Thirteen mixed-waste-storage buildings are operational to store all categories of mixed waste (including TRU). The floor space of each building is 372 square meters. Each will have a 1,000-drum equivalent capacity.

- Large Mixed-Waste Storage Facility--The large mixed-waste storage facility will be operational in five phases, from third quarter FY 1991 for Phase I through FY 1998 for Phase V. The large mixed-waste storage unit will store all categories of mixed LLW with an 11,000-drum capacity each for the Phases I, III, and IV buildings; 18,000 drums for Phase II; and 27,000-drum equivalents (both drum and box waste) for Phase V.

- Waste Unloading and Staging Area--This pad is 9,000 square feet in area and can hold approximately 2,500 drums stacked two high. This pad is not intended for long-term storage.

- Mixed-Waste Storage Pad--The mixed-waste storage pad is located adjacent to the radioactive mixed waste storage buildings and is used as interim storage area.

A plan view of the future and existing SWOC units is shown in Figure 3-13.

The planned capacity of the SWOC to store LLW and TRU mixed waste is 14,450 cubic meters. This capacity is adequate to store the current projected volumes of mixed waste to be generated through the year 1999, assuming no treatment of the stored waste. Current plans call for treatment of the mixed waste to begin in 1999, which will reduce the amount of waste in storage and make storage room available for newly generated mixed waste. The capacity of the SWOC to store mixed waste is continually evaluated and additional storage buildings will be constructed if necessary to meet forecast capacity shortfalls.

3.13.3.2 Amount in Storage. The amount of dangerous waste restricted from land disposal currently in storage at the SWOC as of December 1992 is 3,287 cubic meters. This includes 2,627 cubic meters of waste from the 183-H Solar Evaporation Basins (see Section 3.9).

As of December 1992, 136 cubic meters of PCB TRU waste has been placed in the SWOC for storage. Existing storage capacity is judged to be adequate for any future generation.

As of December 1992, 78 cubic meters of PCB LLW has been placed in the 2401-W Building for storage. Existing storage capacity is judged to be adequate for any future generation.

3.13.3.3 Storage Compliance Assessment. The SWOC was reviewed for compliance with interim-status dangerous waste regulations during 1988.

The compliance assessment noted a specific area of noncompliance, the contingency plan. Compliance action schedules are being developed as part of the Tri-Party Agreement (Ecology et al. 1990). Interim status compliance was achieved in June 1990.

3.13.4 Treatment

This section describes the treatment of the mixed waste currently stored in the SWOC.

3.13.4.1 Description of Current Treatment. The waste in the SWOC currently is not undergoing any treatment but is in storage pending the construction and operation of the WRAP Facility. The PCB, TRU, and mixed LLW is being stored until an approved processing facility is available.

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3.13.4.2 **Description of Proposed Treatment.** The waste currently stored in the SWOC, excepting PCB waste, will be treated at the WRAP Facility. The WRAP Facility will be constructed in modules, with Module 1 operational in 1997 and proposed Module 2A operational in 1999. Module 1 will provide examination, characterization certification, and shipping for boxes and drums of contact-handled LLW and TRU waste, but only drums would be opened and processed. It also will provide for decontamination of small items, primarily for decontamination of drums and overpacks. Most mixed LLW will be characterized and repackaged pending processing in Module 2A.

Module 2A would contain size reduction and mixed waste treatment processes. All stored and newly generated mixed LLW and secondary solids from the Effluent Treatment Facility will be processed. Mixed LLW and effluent treatment unit secondary solids will be characterized, treated, solidified, and repackaged. Low-level liquid organic waste will be characterized, repackaged, and transported offsite for incineration. All nonorganic radioactive, mixed LLW will be treated and certified for disposal in accordance with all regulations, including the LDRs.

Module 2B, with an undetermined startup date, is for characterizing, treating, and repackaging as required to permit permanent disposal of newly generated TRU and suspect-TRU waste in containers too large or heavy to be handled in Module 1 and all remote-handled TRU waste.

The WRAP Facilities will provide the capability to process retrieved suspect TRU waste, certify newly generated TRU waste and LLW for disposal, process large and heavy items, and process radioactive mixed waste for permanent disposal. These capabilities will be in accordance with LDRs and Hanford Site disposal criteria for LLW and in accordance with WIPP waste acceptance criteria and TRUPACT 2 (TRU package transporter) transportation criteria for TRU waste. An engineering study for the WRAP Facility, Module 2A (WHC 1990b), examined the mixed waste streams that would feed the WRAP Facility, examined potentially applicable treatment processes, and evaluated five alternative processing configurations. Following is a discussion of the treatment process that will be included in the WRAP Facility for mixed waste.

A basic schematic showing potential radioactive mixed waste streams with corresponding treatment processes is found in Figure 3-14. Major unit processes include solidification for sludge waste and ion exchange resins, mineralization, and miscellaneous processes such as drum handling and treatment of decontamination solutions.

When drums enter the WRAP Facility, Module 1, they will undergo nondestructive examination and analysis, container opening and sorting, sampling, and compaction. The TRU and LLW drums will be opened and material sorted in separate enclosures, but the opening and sorting process will be similar. After entering the enclosure, each drum will be deheaded and tipped onto a vibrating sorting table, and the inner plastic liner opened. All sorting will be performed automatically manual sorting although some through gloveports with extension tools can be performed.

For drums that have been identified as containing potentially noncompliant items based on real-time radiography examination or visual inspection, those items will be removed, placed on a transfer cart, and

transferred to Special Processing. Examples of noncompliant items include free or containerized liquids, high-efficiency particulate air (HEPA) filters, and large quantities of particulates, aerosol cans, and suspect radioactive mixed waste. The vibrating table will have a liquid collection tank beneath for liquids that flow freely from the opened waste. Collected liquids will be transferred to Special Processing.

In the Special Processing enclosure, several operations will be carried out by operators through gloveports with the aid of extension tools. Any materials suspected of containing dangerous constituents will be sampled, and the samples will be transferred to the Sample Management area for transfer to Hanford Site laboratories for analysis. Treatment and disposal methods will be determined on a case-by-case basis for materials identified as mixed waste. The process enclosure in Module 1 primarily will be for characterization of any identified mixed waste and not for treatment although some elemental treatment will occur. Some mixed waste may be packaged and sent to be processed in Module 2A.

The Special Processing operators will enter descriptive information on waste materials into the computer database, bar code labels will be applied to all drums exiting the Special Processing area, and the drums will be routed back to nondestructive assay. Special Processing will include operations for the following:

- Mixed waste sampling
- Immobilization of particulates
- TRU waste and LLW supercompaction
- Absorption of liquids
- HEPA filter immobilization
- Pyrophoric material
- Reactive metal
- Aerosol cans
- Lead waste segregation.

The WRAP Facility, Module 2A, will contain the mixed waste treatment processes, which will provide for all necessary nonthermal treatment of mixed LLW. Waste received will include sludges, ion exchange resins, and metallic waste. All waste containers will be accompanied by paperwork attesting to the physical, chemical, and radiological contents.

Alternatives studied for WRAP, Module 2A, but not part of Title 1 design, are compaction, size reduction, thermal treatment, and lead decontamination.

3.13.4.3 Treatment Alternatives for Mixed Organic Wastes. In addition to WRAP, Module 2A, it is proposed to design, construct, and operate a Module 2B as described in Section 3.13.4.2. This separation of Module 2 into the 2A and

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2B components has not been formally approved through the Tri-Party Agreement change request process. A diagram showing the various WRAP modules is shown in Figure 3-15.

The established best demonstrated available treatment (BDAT) methods for hazardous organic waste is incineration; hence, the treatment standards promulgated for such waste are based on incineration.

A recent assessment of DOE's incineration facilities indicates offsite incineration is not a viable option for Hanford's waste because of the alpha-bearing contamination. Neither Idaho National Engineering Laboratory nor Oak Ridge National Laboratory incinerators can accept RMW with any alpha contamination or fissile materials. The waste acceptance criteria for Idaho specifies a maximum allowable alpha contamination of 0.1 nCi/g for both liquid and solid waste. The incinerator at Oak Ridge has equally restrictive criteria for alpha-contaminated waste; it is questionable that Hanford's waste can be made to meet this stringent criteria.

The alternative treatment option proposed for WRAP is stabilization/solidification. This technology has not been proven effective at meeting the BDAT treatment standard for many of the nonwaste water organic wastes. Results of laboratory and field-scale tests indicate a greater amount of organic contamination can leach from the waste after treatment, thereby making the treated waste unacceptable for disposal according to the requirements of EPA's LDRs. In general, the presence of organics in the waste can adversely affect the process; organics the presence of organics in the waste can adversely affect the process; organics are known to retard the setting of the matrix and can decrease the matrix durability over the short and/or long term. For these reasons stabilization/solidification should not be considered an option for treatment of organic LDR wastes.

Since offsite incineration is not a feasible option for disposal of Hanford's organic RMW and stabilization/solidification is not likely to meet the required treatment standards, it will be necessary to reevaluate onsite treatment alternatives. The high-temperature thermal destruction process ranks highest among the permanent treatment technologies because of its overall degree of waste destruction, volume reduction, and control of the broadest range of hazardous waste streams. An effort is proposed to identify and evaluate thermal treatment technologies which could be applied to Hanford's stored and newly generated mixed waste as well as the LLW and TRU wastes which are to be processed at the WRAP Facility.

Technologies will be screened to eliminate those which are not applicable because of limited capability. For example, since liquid injection incinerators are only applicable on liquid combustible waste, they would not be included in the evaluation.

Treatment processes will be evaluated on the basis of the most important site-specific criteria to be considered in making decisions on the treatment of mixed waste, such as technology performance, operating requirements, final waste form, versatility, effluent characteristics and management, throughput, level of development, and cost. As the evaluation of thermal treatment technology is very dependent on the volume and chemical and physical characteristics of the waste, general characteristics of Hanford's mixed LLW

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and TRU wastes are to be developed to evaluate each technology on a common basis. The overall cost effectiveness of the high-temperature thermal destruction process is to be compared to the conventional stabilization/solidification proposed for WRAP operation.

Available data will be obtained from the operation of existing thermal treatment systems, including laboratory units, pilot-scaled systems and full-scale systems. All pertinent regulatory and permitting issues will be identified and related to the regulatory environment at Hanford. The experiences of other facilities with the DOE complex to construct, permit, and operate thermal treatment systems and the lessons learned will be studied. Efforts to determine commercial treatment capacity for this waste are ongoing.

3.13.4.4 Accelerated Treatment. It would not be practical to accelerate treatment of mixed waste beyond the scheduled dates for WRAP start up. Due to the large costs involved in designing and building this facility, accelerated treatment would not be feasible.

3.13.5 Waste Reduction

All plants and processes that generate waste that is shipped to the SWOC are required to have a waste minimization program and a LLW certification plan in place. The effectiveness and implementation of these programs are audited on a regular basis. Key elements of this program are described in Section 2.5.

3.13.6 Variances, Exemptions, Time Extensions

The SWOC contains waste that is restricted from disposal because it contains constituents on the California list (40 CFR 268.32), solvents (40 CFR 268.30), and waste identified by the Third-Third LDRs (55 FR 22520).

The national capacity variance for Third-Third Waste (55 FR 22520) provided for a 2-year national capacity variance from the LDR for third-third mixed waste expiring on May 8, 1992. This variance allowed continued storage of these wastes. A Federal Register notice dated May 26, 1992, stated that EPA could not grant a case-by-case extension for Third-Third mixed waste due to questions regarding the DOE's demonstration that they have entered into binding contractual commitments to construct or otherwise provide treatment capability. A final decision has yet to be made. This extension would allow DOE to store LDR mixed wastes until May 8, 1993, and this date could be extended for up to an additional year. The Tri-Party Agreement will allow continued storage of these wastes in accordance with the schedules in the Tri-Party Agreement. The Federal Facility Compliance Act of 1992 also allows DOE facilities to store their wastes for 3 years if compliance with the Act's provisions for providing waste inventory and treatment plans are met.

The Tri-Party Agreement requires treatment and disposal capacity wastes to be developed on the following schedule:

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- Completion of WRAP Facility, Module 1; required to sort and repackage waste and initiation of operations by March 1997 (Milestone M-18-00)

- Completion of WRAP Facility, Module 2A; required to provide waste treatment capabilities that minimize the land disposal of low-level radioactive and mixed waste by September 1999 (Milestone M-19-00 proposed).

If additional variances, exemptions, or time extensions are required as a result of delays in the development of treatment, storage, or disposal capacity or the demonstrated need for using alternative treatment technologies, they will be applied for in accordance with the procedures detailed in the Tri-Party Agreement or regulations.

The required treatment for PCB waste is incineration. Currently there are no facilities available for incineration of mixed PCB waste. Alternative treatments currently are being investigated. The PCB waste will be stored at the SWOC until an equivalent treatment technology is demonstrated and approved by EPA and Ecology. If availability of required treatment will extend the length of PCB waste storage beyond the time allotted to treat and dispose of other SWOC waste, a variance to the storage prohibition will be applied for.

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3.14 RETRIEVABLY STORED LOW-LEVEL AND TRANSURANIC WASTE

Since 1970, defense materials production, research, and waste management have produced TRU waste. Before 1970 there were no regulations that defined or required separation of TRU waste and it was commingled and buried with LLW. Initially, the definition of TRU waste included any waste with suspect alpha contamination. This definition was later (1972) changed to include only waste containing greater than 10 nanocuries per gram of alpha-emitting isotopes with half-lives greater than 20 years, and still later (1982) the definition was changed to include only waste with greater than 100 nanocuries per gram of TRU radionuclides. TRU radionuclides are those having an atomic number greater than 92. Because existing technology in the 1970s could not determine the concentration of TRU radionuclides at 10 or even 100 nanocuries per gram, any solid waste that was suspected to be TRU was placed in retrievable storage (WHC 1989a).

Retrievably stored LLW is waste that was generated after 1980 and in 1987 or before, when use of retrievable storage units was terminated. The waste contained liquid organics that precluded disposal as solid LLW because of concerns about affecting the ion exchange capacity of the soil. This waste is stored in retrievable storage units in the same manner as retrievably stored TRU waste.

The retrievably stored waste at the Hanford Site was not segregated based on the physical or chemical characteristics of the waste. The waste containers are filled with mixtures of materials such as failed process equipment including pumps, resin columns, and tanks; laboratory and room trash including paper, plastics, glassware, cloth, solidified liquids, and animal carcasses; and decontamination and decommissioning rubble including concrete, piping, and soils.

The waste is contained primarily in 0.21-cubic-meter drums and metal or wood boxes. Waste also is contained in casks, concrete boxes, concreted culverts, and other miscellaneous containers.

Before 1986, TRU waste had been placed in a variety of storage configurations. These storage configurations consisted of shallow land trenches, concrete-lined "V" trenches, and earth-covered asphalt pads and caissons (WHC 1991c). The TRU waste has been stored in the TRUSAF since 1986 (Section 3.15) and in the SWOC since 1987 (Section 3.13).

The majority of the TRU waste stored in the 200 Areas is generated by onsite activities; however, some of the TRU waste is generated offsite and shipped to the Hanford Site for retrievable storage (RHO 1985). Approximately 15,000 cubic meters of TRU waste had been placed in storage in the 200 Areas in over 38,700 containers.

Also in the low-level category are naval submarine reactor compartments currently stored in the 200 East Area Burial Ground 218-E-12B, Trench 94. These defueled reactor compartments are intended for permanent disposal, without further treatment, in their current location. For this reason, the compartments are not included in the storage inventory tables, waste minimization sections, or treatment discussions of this report. Although the compartments currently are stored, permit applications have been filed to allow disposal. Two permits are required: one from Ecology for lead disposal in a dangerous waste disposal facility and one from the EPA for PCB disposal in a chemical waste landfill. As much of the PCBs and lead as practical have been removed. The remaining lead and PCBs are encapsulated within the thick sealed hulls of the compartments.

As of mid-April 1993, 30 compartments were stored awaiting disposal. Additional reactor compartments are expected to be shipped to the Hanford Site in the future.

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3.14.1 Generation

Extensive process knowledge is not available for many of the containers that have been placed in retrievable storage. The best available information is maintained in the computerized Solid Waste Information and Tracking System database. The Solid Waste Information and Tracking System contains only that information provided by the waste generator. In the past, exhaustive waste descriptions that could be used to classify a waste accurately were not required and data entries such as "contaminated debris" and "mixed fission products" were common (WHC 1989a). Because of incomplete classification of waste in the past, it is estimated that 10 percent of the TRU waste may be mixed waste.

3.14.2 Characterization

This section discusses waste characterization based on process knowledge and sample analysis, identifies known designations, and addresses any further characterization required or planned.

3.14.2.1 **Process Knowledge.** Limited process knowledge has been used to characterize the TRU mixed waste currently in storage. In the past few years changing waste reporting, manifesting, and packaging requirements have greatly increased the availability of process waste data for what may be used to characterize waste. Information related to the physical, chemical, and radiological properties of newly generated TRU waste is available. This availability is anticipated to reduce the amount of sampling and treatment required to meet long-term storage packaging requirements.

3.14.2.2 **Sample Analyses.** Sampling for mixed waste constituents will be performed when the TRU waste is retrieved from storage for processing. All drums and boxes of TRU waste in interim storage will be opened. Each individual container will be sampled and these samples will be prepared for transport to analytical laboratories in the 200 West Area for analysis.

3.14.2.3 **Waste Designation and Basis.** A review of data on TRU waste in retrievable storage units identified many constituents in each waste container that are designated dangerous waste. Data entered since 1988 has the designation of the dangerous constituents of each waste package assigned. When the designation was not found in database reports, waste designation tables were used to assign a designation to the constituents identified in TRU waste placed in storage before 1988.

It is anticipated that additional TRU mixed waste will be identified when waste is retrieved from storage for repackaging for disposal (WHC 1989a).

3.14.2.4 **Uncertainty of Waste Designation.** There is high confidence in the accuracy of the designations for newly generated TRU waste material. Older waste will require additional characterization before treatment and disposal.

3.14.2.5 **Schedule for Further Characterization.** In situ sampling of retrievably stored TRU waste was initiated in FY 1991 with characterization to be completed by FY 1994 (WHC 1989b). The purpose of the sampling is to assess the current and future integrity of the retrievably stored waste containers and analyze contents. These objectives will be achieved by visual and nondestructive examination of waste containers, retrieval, and nondestructive assay.

Additional sampling will be performed as necessary to adequately characterize suspected mixed waste when waste packages are retrieved and processed through the WRAP Facility.

3.14.3 Storage

This section describes the current storage units and inventories and assesses compliance with applicable regulations.

3.14.3.1 **Storage Unit and Capacity.** The waste stored in the retrievable storage unit is primarily contained in 0.21-cubic meter drums and boxes. Initially drums were painted; however, after 1982, galvanized drums were used to minimize corrosion attributed to high humidity in storage modules. Initially boxes were constructed of plywood and steel, later of plywood coated

with fiberglass reinforced polyester, and currently of steel. Waste also is contained in casks, concrete boxes, concreted culverts, and other miscellaneous containers. These containers were placed in a variety of storage configurations. These storage configurations consisted of shallow land trenches, concrete lined "V" trenches, and earth-covered asphalt pads and caissons (WHC 1990i) (Figures 3-16 and 3-17).

Retrievably stored TRU waste is located in the 218-W-3A, -4B, -4C, and 218-E-12B Burial Grounds. Newly generated (after 1985) TRU waste is stored in the TRUSAF and SWOC storage buildings.

Four different container storage configurations were used for contact-handled TRU waste at the Hanford Site. The first storage configuration consists of waste drums stacked horizontally in a gravel-bottom "V" trench. The waste drums were covered directly with soil. This storage configuration was used from 1970 through 1972.

The second storage configuration was an engineered concrete and metal storage structure known as the V-7 trench. In the V-7 trench, drums were stacked on a 45-degree angle. This storage concept proved too expensive to implement and was used only between June 1972 and March 1973.

The third configuration consists of wide bottom and "V" trenches. In both cases it is unknown if the trench floor was covered with plywood and drums were stacked vertically or if it was placed similar to configuration one (Figure 3-15). Boxed waste in this configuration may contain shoring used to protect it from collapse because of soil pressure. This storage configuration was used in the 200 West Area 218-W 3A and 218-W 4B Burial Grounds starting in 1974.

The fourth configuration consists of wide-bottom trenches. This storage configuration is the same as the third except the floor is asphalt. This storage configuration was used in the 218-W-4B Burial Ground, trench 07, from 1974 until 1980 and in the 218-W-4C Burial Ground from 1978 to the present.

Some of the waste mentioned above is remote-handled waste. In addition, small containers of remote-handled TRU waste are stored in buried caissons; these caissons no longer are used for newly generated waste. The caissons are reinforced concrete cylinders 2.7 meters in diameter by 3 meters high and are buried 4 meters below grade. The caissons have 0.9-meter diameter inlet chutes, offset or convoluted to reduce radiation or "shine" from the contents (Figure 3-17). Caissons are equipped with electrically driven exhausters fitted with HEPA filters.

Because the practice of placing TRU waste in burial ground retrievable storage units was discontinued in 1986, and no additional waste is planned to be added, the storage capacity for this waste is adequate.

3.14.3.2 Amount in Storage. Approximately 15,440 cubic meters of waste have been placed in storage in the 200 Area retrievable storage units. Of this volume, 14.1 percent or 2,184 cubic meters are known to be dangerous waste based on information contained in the Solid Waste Information and Tracking System. Additional waste may be redesignated as dangerous land disposal restricted waste upon retrieval.

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3.14.3.3 Storage Compliance Assessment. The retrievable storage units were reviewed for compliance with interim status dangerous waste regulations during 1988. This section discusses past and present disposal practices and discusses the interim status compliance requirements.

Waste was placed routinely in the retrievable storage units in shallow unlined trenches since 1960. From 1982 through 1987, radioactive liquid organic waste was placed in retrievable storage units. Burial of mixed waste with dose rates less than 200 millirems per hour at the container surface was halted in 1987. Mixed LLW, after the waste has been processed to remove the hazardous constituent to LDR levels, will be placed in lined trenches with leachate collection and removal systems. The TRU mixed waste eventually will be retrieved, treated to comply with LDR requirements at the WRAP Facility or other appropriate treatment unit, and disposed of at a permitted dangerous waste disposal unit.

The compliance assessment noted the following specific areas of noncompliance with interim status requirements:

- The contingency plan should be upgraded to account for unit requirements of dangerous waste management
- A plan to inspect mixed waste placed in retrievable storage units should be developed
- Dangerous waste containers and accessible mixed waste backlog should be labeled
- A burial box and cardboard compaction and segregation strategy should be developed
- Additional groundwater monitoring wells around the low-level burial grounds, which include the retrievable storage units, should be installed.

Compliance action schedules were developed as part of the Tri-Party Agreement (Ecology et al. 1990). Compliance with contingency plan upgrade, inspection, and labeling requirements was achieved by June 1990. Use of cardboard boxes for burial was terminated effective January 1990. Processing facilities for compatible wastes currently are available. Additionally, a total of 81 groundwater monitoring wells were installed by February 1993.

The Part B permit application, which documents the current compliance status with the dangerous waste regulations, was submitted in December 1989. Therefore, the retrievable storage units comply with the storage unit regulations as modified by the Tri-Party Agreement.

3.14.4 Treatment

This section describes the current and proposed treatment of retrievably stored TRU waste.

3.14.4.1 Current Treatment. No waste in retrievable storage units is being treated.

3.14.4.2 Proposed Treatment. Waste from retrievable storage units will be retrieved and shipped to the WRAP Facility. Organics will be burned in a planned incinerator or will be sent offsite for treatment. The purpose of the WRAP Facility is to treat waste so that it is acceptable for permanent disposal. Treatment activities include segregation of LLW and TRU waste from hazardous waste, repackaging waste, conducting nondestructive examination and nondestructive assaying of packaging, and certifying packages for shipment and disposal.

The WRAP Facility is proposed to be constructed as three modules with Module 1 operations in 1996 and Module 2A operations in 1999 and Module 2B operational startup to be determined. Detailed descriptions of these modules as well as treatment plans are provided in Section 3.13.4.

3.14.5 Waste Reduction

The retrievable storage units no longer accept waste; therefore, a waste minimization program is not applicable. However, waste minimization will be considered when evaluating cleanup and disposal alternatives.

3.14.6 Variances, Exemptions, Time Extensions

The waste stored in the retrievable storage units after 1982 is restricted from land disposal because it contains California list waste (40 CFR 268.32) and/or solvent waste (40 CFR 268.30) and/or waste identified in the Third-Third Promulgation (55 FR 22520).

The national capacity variance for Third-Third Waste (55 FR 22520) provided for a 2-year national capacity variance from the LDR for third-third mixed waste expiring on May 8, 1992. This variance allowed continued storage of these wastes. A Federal Register notice dated May 26, 1992, stated that EPA could not grant a case-by-case extension for Third-Third mixed waste due to questions regarding the DOE's demonstration that they have entered into binding contractual commitments to construct or otherwise provide treatment capability. A final decision has yet to be made. This extension would allow DOE to store LDR mixed wastes until May 8, 1993, and this date could be extended for up to an additional year. The Tri-Party Agreement will allow continued storage of these wastes in accordance with the schedules in the Tri-Party Agreement. The Federal Facility Compliance Act of 1992 also allows DOE facilities to store their wastes for 3 years if compliance with the Act's provisions for providing waste inventory and treatment plans are met.

The Tri-Party Agreement requires treatment and disposal capacity wastes to be developed on the following schedule:

- Completion of WRAP Facility Module 1, required to sort and repackage waste, and initiation of operations by March 1997 (Milestone M-18-00)

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- Completion of WRAP Facility Module 2A, required to provide waste treatment capabilities that minimize the land disposal of low-level radioactive and mixed waste by September 1999 (Milestone M-19-00).

If additional variances, exemptions, or time extensions are required as a result of delays in the development of treatment, storage, or disposal capacity or the demonstrated need for using alternative treatment technologies, they will be applied for in accordance with the procedures detailed in the Tri-Party Agreement or regulations.

3.15 TRANSURANIC WASTE STORAGE AND ASSAY FACILITY STORED WASTE

TRU solid waste packaged in compliance with the WIPP/Waste Acceptance Criteria is stored in the 200 West Area, in the 224-T Building, also known as the TRUSAF.

3.15.1 Generation

The following are descriptions of current sources of TRU mixed waste.

- The PUREX Plant reprocessed irradiated fuel from N Reactor. Radioactive solid waste collected from the PUREX Plant consists of room waste such as gloves, paper, and plastics. The TRU portion is separated from the LLW. Some of the waste, such as mercury-filled light tubes, rags, and aerosol cans, are definitely dangerous and separate collection receptacles are established for collection of this waste. To ensure that dangerous waste is not inappropriately discarded with the LLW or TRU waste, the waste is sorted before packaging and shipment.

- The PFP routinely generates mixed solid waste. Fluorescent light tubes containing mercury are used in processing gloveboxes and radiation areas throughout the PFP. The majority of PCB ballasts and fluorescent light tubes are surveyed for radiological contamination and released. These waste streams are handled as hazardous waste. A small portion of the ballasts and fluorescent light tubes are radiologically contaminated and must be treated as mixed waste. Lead-lined gloves on processing gloveboxes are routinely replaced to minimize the potential for glove failure and subsequent spread of radioactive contamination. Laboratory waste containing xylene and toluene are generated during the analysis of samples for neptunium and plutonium. The waste is packaged and shipped as solid waste.

- Operations of the analytical laboratories in the 200 West Area generate TRU mixed waste. Included in this solid waste is radioactively contaminated lead, outdated solid commercial chemicals, and lead shielded waste from laboratory hot-cell operations.

- The PNL generates small quantities of TRU mixed waste from research operations that are fully characterized by process knowledge.

The TRUSAF receives some containers of waste from offsite sources (Battelle Columbus, Ohio; Argonne National Laboratory, Chicago; Rocky Flats Plant, Colorado; and Lawrence Berkeley Laboratories, California). Annual projected receipt rates range from 14 to 30 cubic meters. Onsite generation projections are 266 cubic meters annually. These containers are sent to TRUSAF for storage before their planned shipment to the WIPP. The TRUSAF only accepts waste certified for disposal at the WIPP that is packaged in 0.21-cubic meter drums.

3.15.2 Characterization

This section discusses waste characterization based on process knowledge and sample analysis, identifies known designations, and addresses any further characterization required or planned.

To be accepted at TRUSAF, waste must be packaged and characterized as described in the *Hanford Site Solid Waste Acceptance Criteria* (WHC 1991b). These criteria require that the generator of the waste characterize each individual container of waste with sufficient accuracy to permit proper certification, shipment, and storage. Kinds and quantities of dangerous constituents in the waste and physical and chemical characteristics of the waste must be known and recorded on appropriate forms.

3.15.2.1 Process Knowledge. The waste characteristics are determined by the waste generator based on documented knowledge of the process generating the waste. The generators of all waste shipped to TRUSAF are periodically audited to ensure that waste is being properly characterized. Currently, only three facilities (PUREX, PFP, and Strontium Semi-Works) are able to certify waste.

3.15.2.2 Sample Analyses. Samples are collected at the point of generation for any sample analysis required to adequately characterize for waste designation. No samples are collected at TRUSAF. Any waste that requires sampling will not be certified and consequently will be shipped to the SWOC for storage and subsequent treatment.

3.15.2.3 Waste Designation and Basis. The dangerous waste designation of each waste container is determined at its point of generation based on knowledge of the waste placed in the container.

3.15.2.4 Uncertainty of Waste Designation. The designations of waste stored in TRUSAF are considered to be accurate.

3.15.2.5 Schedule for Further Characterization. Certified waste in interim storage is awaiting shipment to the WIPP. No further characterization is required for this waste.

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3.15.3 Storage

This section addresses current storage units, describes inventories, and assesses compliance with applicable regulations.

3.15.3.1 Storage Unit and Capacity. The TRUSAF building originally was constructed to purify plutonium nitrate by the lanthanum fluoride process; it was idle for several years after new technology made it obsolete. In the early 1970s, the building was modified to meet requirements for storage of plutonium-bearing scrap and liquids. The cells in the processing areas have been completely sealed and isolated from the operating gallery and service areas. These operating and service areas have been stripped of all unnecessary control equipment, panelboards, and partitions to provide approximately 1,068 square meters of storage space on three floors (Figure 3-18). The unit storage capacity is 420 cubic meters (2,000 drums).

Accumulation of certified TRU waste in 0.21-cubic meter drums that exceeds the capacity of TRUSAF will be stored in the SWOC. Future plans for the SWOC include a TRUSAF replacement to be called Mixed Waste Storage Phase V, which will be operational concurrently with the WRAP Facility, Module 1.

3.15.3.2 Amount in Storage. As of December 31, 1992, there are 43 cubic meters of TRU mixed waste stored in TRUSAF.

3.15.3.3 Storage Compliance Assessment. The TRUSAF unit was reviewed for compliance with interim status dangerous waste regulations during 1988. The need for an upgraded contingency plan was identified and the plan was completed.

A Part B permit application has been submitted.

3.15.4 Treatment

This section describes the current and proposed treatment of stored TRU waste.

3.15.4.1 Current Treatment. At TRUSAF, packaged TRU waste is x-rayed (to ensure what can be identified generally agrees with the documentation) and assayed to determine TRU activity. All TRU waste packages that meet the WIPP/Waste Acceptance Criteria requirements are placed in interim storage pending shipment to the WIPP. Noncertifiable TRU waste is sent to the SWOC or stored in the TRUSAF. When the WRAP Facility, Module 1, begins operating, nondestructive evaluation and assay activities will be transferred from TRUSAF to the WRAP Facility.

3.15.4.2 Proposed Treatment. Certified TRU waste in TRUSAF interim storage will be shipped to the WIPP for permanent storage.

3.15.4.3 Treatment Alternatives. The waste is not planned to be treated. The WIPP facility will be the only facility in the nation capable of permanent storage of these wastes.

3.15.4.4 Accelerated Treatment. Current plans are to ship the waste to WIPP for permanent storage. No treatment plans have been proposed. Acceleration of shipment to WIPP is not possible because WIPP has not yet opened.

3.15.5 Waste Reduction

All plants and processes that generate waste that is shipped to TRUSAF are required to have a waste certification program in place. The effectiveness and implementation of this program is audited on a regular basis. Key elements of this program are described in Section 2.5.

3.15.6 Variances, Exemptions, Time Extensions

The national capacity variance for Third-Third Waste (55 FR 22520) provided for a 2-year national capacity variance from the LDR for third-third mixed waste expiring on May 8, 1992. This variance allowed continued storage of these wastes. A Federal Register notice dated May 26, 1992, stated that EPA could not grant a case-by-case extension for Third-Third mixed waste due to questions regarding the DOE's demonstration that they have entered into binding contractual commitments to construct or otherwise provide treatment capability. A final decision has yet to be made. This extension would allow DOE to store LDR mixed wastes until May 8, 1993, and this date could be extended for up to an additional year. The Tri-Party Agreement will allow continued storage of these wastes in accordance with the schedules in the Tri-Party Agreement. The Federal Facility Compliance Act of 1992 also allows DOE facilities to store their wastes for 3 years if compliance with the Act's provisions for providing waste inventory and treatment plans are met.

If additional variances, exemptions, or time extensions are required as a result of delays in the development of treatment, storage, or disposal capacity, they will be applied for in accordance with the procedures detailed in the Tri-Party Agreement or regulations. Treatment of radioactive mixed waste is expected to be initiated in 1999.

3.16 303-K STORED WASTE

The 303-K Radioactive Mixed Waste Storage Facility (303-K Facility) is located in the northwest portion of the 300 Area of the Hanford Site. Since 1943, the 303-K Facility has stored various radioactive and dangerous process materials generated by fuel fabrication in the 300 Area (DOE-RL 1990c). The 303-K Radioactive Mixed-Waste Storage Facility has been used for the interim storage of the following mixed waste streams generated within the 300 Area:

- Spent degreasing solvents
- Zircaloy-2 and beryllium/Zircaloy-2 chips and fines

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- Precipitates from neutralization of acid wastes
- Miscellaneous uranium-contaminated hazardous materials.

Routine waste has not been added to the 303-K Facility since mid-1987.

3.16.1 Generation

This section describes the waste generation process and estimates the generation rate for the 303-K Facility. The 303-K Facility has been in operation since 1943 and continues today as an interim storage facility for dangerous and mixed waste generated by cleanup activities in the fuel manufacturing processing in the 300 Area.

The 303-K Facility has the capacity to store 200 drums that may contain waste designated D001, D002, D004, D005, D006, D007, D008, D009, D011, D037, D039, D040, F001, F003, WC01, WC02, WP01, WP02, WT01, and WT02.

The 303-K Facility has been used since January 1986 for the storage of containers filled with low-level radioactive waste and mixed waste generated at other N Reactor fuel manufacturing buildings in the 300 Area. Before 1987 the waste that was potentially contaminated with uranium included waste oils and cutting lubricants, concreted waste from the 304 Facility, salt crystals from the waste-acid tanks in Building 334-A, degreaser solvents, acid absorbed on opal clay, solids from the 313 Building waste-acid treatment process, and waste cutting oils with solvents from uranium machining operations in the 333 Building.

Approximately fifty to one hundred 0.21-cubic-meter drums of waste were accumulated at the 303-K Facility annually before 1987. The maximum estimated inventory of containerized waste stored inside the 303-K Facility at any time was 200 drums or 42 cubic meters of waste.

Current wastes stored or planned to be stored in the 303-K Facility and the approximate volume or weight to be generated are shown below.

- Approximately 4,350 kilograms of spent degreasing solvents (D039, D040, F001, WC02, WP01, and WT02) and occasionally mixed with ethyl acetate (D001, F003, and WT02). About 360 kilograms of this waste also contains cobalt-60. No future generation of waste degreaser solvent is anticipated.
- Approximately 770 kilograms of Zircaloy-2 and beryllium/Zircaloy-2 chips and fines before concreting the waste. This material is designated ignitable (D001) because of its pyrophoric properties before concreting and is nonhazardous after concreting. None of this waste was generated in FY 1992. About 15 kilograms of this waste are anticipated to be generated in FY 1993.
- One 55-gallon drum containing about 20 kilograms of black "balls" found in the inlet air treatment room (313 Building) and designated WP02 and D037 due to pentachlorophenol. The drum also contains part

of a lead brick (about 7 kilograms) that is designated D008. No future generation of these black "balls" is anticipated.

- One 55-gallon drum containing about 6 kilograms of rags contaminated with various solvents from the Engineering Laboratory (313 Building) is designated as F003, WP01, and WC02. No future generation of this solvent waste is anticipated.

- One 0.73-cubic-meter metal box containing a belt sander contaminated with pyrophoric Zircaloy-2 fines and entombed in dry sand is designated as ignitable (D001). No future generation of Zircaloy-2 ignitable contaminated equipment entombed in dry sand is anticipated.

- Eight 30-gallon drums containing about 780 kilograms of filter press and in-line filter sludge were stored in 303-K in 1992. This waste contains sodium diuranate and is designated D006 due to cadmium, D007 due to chromium, and D008 due to lead. One 55-gallon drum of centrifuge sludge waste is anticipated to be generated in FY 1993.

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3.16.2 Characterization

The 303-K Facility contains radiologically contaminated spent chlorinated solvents, filter press and in-line filter sludge, black "balls" with pentachlorophenol, lead brick, and pyrophoric chips and fines from cleanup activities of the N Reactor fuels manufacturing area in the 300 Area. Waste descriptions are provided in Table 3-16.

3.1.6.2.1 Process Knowledge. Pyrophoric beryllium/Zircaloy-2 alloy and Zircaloy-2 chips and fines in water-filled drums are awaiting concretion in the 304 Building. After concreting, the waste will be nonhazardous and will be sent to the low-level burial ground.

In 1988 spent degreaser solvents (consisting of perchloroethylene, 1,1,1-trichloromethane, and rinse water from vapor degreasers) were absorbed on pads and placed in steel drums. A small amount of ethyl acetate/bromine solution generated during laboratory analysis of uranium oxides was occasionally mixed in some of the drums of spent degreaser solvent.

3.16.2.2 Sample Analysis. Fifty-seven drums of degreaser solvent stored at 303-K were analyzed for radioactivity by PNL's barrel assayer. Twenty-four were found to be radioactive and eight of these contained cobalt-60. The reason for the cobalt contamination is unknown. Thirty-three drums were found to be nonradioactive but are considered "moratorium" waste and have to be handled as mixed waste. Further sampling and characterization is scheduled for FY 1993.

The eight drums of filter press and in-line filter sludge were analyzed for pH, uranium by laser fluorimetry, and inorganic constituents by inductively coupled plasma and ion chromatography.

The black "balls" found in the inlet air treatment room (Building 313) were analyzed for pH, TCLP metals, polynuclear aromatics, and volatile and semivolatile organics.

3.16.2.3 **Waste Designation and Basis.** The designation for waste currently stored at the 303-K Facility is based on analytical results and process knowledge of the N Reactor fuel fabrication operations in the 300 Area:

- F003, WP01, and WC02 for rags contaminated with various degreasing solvents
- D001, D039, D040, F001, F003, WC02, WP01, and WT02 for spent degreasing solvents
- F003, WP01, and WC02 for solvent-contaminated rags.
- D001 for Zircaloy-2 and beryllium/Zircaloy-2 chips and fines.
- D006, D007, and D008 for filter press and in-line filter sludge.
- D008 for contaminated lead brick.
- D037 and WP02 for pentachlorophenol-contaminated black "balls."

3.16.2.4 **Uncertainty of Waste Designation.** The designations of stored container wastes at the 303-K Facility are considered to be accurate except for degreaser solvents.

3.16.2.5 **Schedule for Further Characterization.** Currently it is planned to sample and further characterize the 57 drums of waste degreaser solvents in FY 1993.

3.16.3 Storage

This section discusses the 303-K Facility waste storage and capacity, identifies stored quantities, and assesses the compliance status of the unit.

3.16.3.1 **Storage Unit Capacity.** The 303-K Facility has a total storage capacity of 200 drums or 42 cubic meters of waste.

3.16.3.2 **Amount in Storage.** The amount of containerized mixed waste in storage (as of December 1992) in the 303-K Facility is 6,984 kilograms. This includes 57-0.11-cubic-meter drums, 36-0.21 cubic meter drums, and 1-0.73 cm^3 metal box.

3.16.3.3 **Storage Compliance Assessment.** The 303-K Facility currently is scheduled for clean closure with an interim use as a less-than-90-day accumulation unit. The unit currently is operating under interim status as a RCRA treatment, storage, and disposal facility.

3.16.4 Treatment

This section discusses the 303-K Facility current and proposed waste treatment processes.

3.16.4.1 Current Treatment. The solvent, lead brick, pentachlorophenol, and sludge waste currently stored at the 303-K Facility will be transferred to the SWOC for long-term storage until a final treatment or disposal option for the waste is established. The pyrophoric chips and fines will be concreted in the 304 Building and sent to the low-level burial ground.

3.16.4.2 Proposed Treatment. Current plans for the existing inventories of waste solvents at the 303-K Facility call for treatment offsite beginning in 1999.

Treatment plans in FY 1993 for the one metal box containing the belt sander is to remove the sand and separate the pyrophoric fines from the surfaces of the belt sander. The removed pyrophoric fines will be concreted in the 304 Building and sent to the low-level burial ground. The belt sander, sand and metal box will be sent to the low-level burial ground.

3.16.4.3 Accelerated Treatment. Any plans for accelerated treatment of 303-K Facility waste will be made as part of planning for WRAP Facility operations (Section 3.13.4). This would include onsite or offsite treatment.

3.16.4.4 Treatment Alternatives. Alternatives treatments for the relatively small quantities of 303-K wastes will be considered as part of design and operating plans for the WRAP Facility. Concretion has been determined to be the best disposal option for the pyrophoric chips and fines.

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3.16.5 Waste Reduction

Because N Reactor fuel has not been fabricated since December 1986, the 303-K Facility no longer receives routine waste products for long-term storage.

The containerized solvent waste products stored at the 303-K Facility are to be transferred to the SWOC for interim storage until shipped offsite for treatment.

3.16.6 Variances, Exemptions, Time Extensions

The dangerous waste and waste residues are being placed in containers and transported to the SWOC for storage, as discussed in Section 3.16.3. This waste will be managed with other SWOC stored waste.

The national capacity variance for Third-Third Waste (55 FR 22520) provided for a 2-year national capacity variance from the LDR for third-third mixed waste expiring on May 8, 1992. This variance allowed continued storage of these wastes. A Federal Register notice dated May 26, 1992, stated that EPA could not grant a case-by-case extension for Third-Third mixed waste due to questions regarding the DOE's demonstration that they have entered into

binding contractual commitments to construct or otherwise provide treatment capability. A final decision has yet to be made. This extension would allow DOE to store LDR mixed wastes until May 8, 1993, and this date could be extended for up to an additional year. The Tri-Party Agreement will allow continued storage of these wastes in accordance with the schedules in the Tri-Party Agreement. The Federal Facility Compliance Act of 1992 also allows DOE facilities to store their wastes for 3 years if compliance with the Act's provisions for providing waste inventory and treatment plans are met.

If additional variances, exemptions, or time extensions are required as a result of delays in the development of treatment, storage, or disposal capacity, they will be applied for in accordance with the procedures detailed in the Tri-Party Agreement or regulations.

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Table 3-1. Plutonium Finishing Plant Radioactive Liquid Waste Stream Composition. (sheet 1 of 2)

	UNITS	PRF CAW		PRF CXP	PRF CUU	RMC HSW	PRF LSW	RMC LSW	D&AL LSW
Normal Flow	Flow L/h	158		18	20	25	25	66	20
Peak Flow	L/h	250		30	25	100	110	90	200
SpG	g/cc	1.18		1.05	1.05	1.27	1.06	1.03	1.01
				Nominal Composition					
Species			Range						
Al^{+++}	ppm	20,000		0	0	0	0	0	0
Ba^{++}	ppm	1		0	0	0	1	0	0
Ca^{++}	ppm	50		1	0	0	6	2	0
Cr	ppm	70	10-100	<.01	<.01	<.1	<.01	<.01	<.01
Fe^{++}	ppm	50	0-10,000	50	50	50	60	54	50
H^{+}	ppm	2,000	2,000-3,000	0	400	0	2,000	800	100
K^{+}	ppm	40	0-7,000	0	0	200,000	200	90	0
Mg^{++}	ppm	1		0	0	0	1	0	0
Mn^{++}	ppm	50	0-9,000	0	0	0	100	300	0
Na^{+}	ppm	600	0-10,000	20,000	0	20,000	100	100	100
Ni^{++}	ppm	40	10-100	<.01	<.01	<.1	<.01	<.01	<.01
Pb^{++}	ppm	90		0	0	0	0	0	0
Sr^{++}	ppm	2		0	0	0	0	0	0
OH^{-}	ppm	0		80	0	30,000	0	0	0
$CO3^{--}$	ppm	0		30000	0	1,000	0	0	0
Cl^{-}	ppm	300	0-20,000	3	3	9,000	200	30	10
F^{-}	ppm	800	300-1,000	1,000	1,267	44,280	0	0	0
I^{-}	ppm	0		0	0	0	0	0	0
NO_3^{-}	ppm	300,000	(2.-3.)E5	20,000	20,000	0	100,000	50,000	1,000
NO_2^{-}	ppm	1,000		60	0	0	400	400	20
PO_4^{--}	ppm	20		2	0	0	8	4	0
SO_4^{--}	ppm	200		0	0	0	0	0	0
CC14	ppm	600		700	700	0	300	0	0
Ammonia	ppm	200		0	0	0	0	0	0
TBP	ppm	4,000		6,000	6,000	0	0	0	0
BUTANOL	ppm	12	11-13	0	0	0	500	0	0
DBP	ppm	0		800	0	0	0	0	0
MBP	ppm	0		0	0	0	0	0	0
TOC*	ppm	3,000		3,000	3,000	0	400	0	0
Silica	ppm	90		0	0	0	0	0	0

Table 3-1. Plutonium Finishing Plant Radioactive Liquid Waste Stream Composition. (sheet 2 of 2)

Species		Nominal Composition	Range						
Pu	ppm	9	2-200	60	20	<1	2	6	0
Am	ppm	1	0-8	0	3	0	1	1	0
U	ppm	1		0	20	0	0	3	0

NOTE: These compositions assume no slag and crucible processing, per current planning.

CAW = CA Column Aqueous Waste Stream
CUU = CU Column Aqueous Waste Stream
CXP = CX Column Aqueous Waste Stream
D&AL = Development and Analytical Laboratories
DBP = Di-Butyl Phosphate
HSW = High-Salt Waste
LSW = Low-Salt Waste
MBP = Mono-Butyl Phosphate
PFP = Plutonium Finishing Plant
PRF = Plutonium Reclamation Facility
RMC = Remote Mechanical "C" Line
SpG = Specific Gravity
TBP = Tri-Butyl Phosphate
TOC = Total Organic Carbon

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Table 3-2. Chemical Concentrations in Double-Shell Tank Waste.

Constituent	N*	Average (moles/L)	Minimum (moles/L)	Maximum (moles/L)
Aluminum	91	7.8 E-01	1.8 E-05	2.9 E+00
Ammonium	31	9.7 E-02	5.0 E-03	4.1 E-01
Barium	12	1.4 E-03	1.8 E-05	5.0 E-03
Boron	22	1.9 E-02	5.8 E-04	1.2 E-01
Cadmium	9	4.1 E-04	5.9 E-05	1.4 E-03
Calcium	40	5.2 E-03	1.9 E-05	1.8 E-02
Carbonate	86	2.4 E-01	1.0 E-03	1.1 E+00
Chloride	74	1.2 E-01	2.6 E-04	9.9 E-01
Chromium	33	1.9 E-02	4.7 E-05	3.2 E-01
Copper	12	2.2 E-04	8.2 E-06	1.2 E-03
Fluoride	56	1.0 E+00	2.5 E-04	1.1 E+01
Hydroxide	97	1.7 E+00	4.6 E-02	6.9 E+00
Iron	21	7.0 E-04	1.0 E-05	3.3 E-02
Lanthanum	11	2.8 E-03	2.1 E-04	1.5 E-02
Lead	3	5.7 E-03	6.0 E-04	1.5 E-02
Magnesium	30	4.3 E-03	1.6 E-06	4.2 E-02
Manganese	15	5.9 E-02	5.7 E-05	8.3 E-01
Mercury	1	1.5 E-04	- -	- -
Molybdenum	11	8.8 E-04	1.1 E-04	2.2 E-03
Nickel	22	2.5 E-03	4.2 E-04	8.8 E-03
Nitrate	99	1.5 E+00	2.0 E-03	4.1 E+00
Nitrite	101	9.9 E-01	1.6 E-05	3.6 E+00
Phosphate	77	5.8 E-02	2.0 E-07	3.9 E-01
Phosphorus	19	9.6 E-02	3.9 E-03	3.8 E-01
Potassium	68	2.0 E-01	1.1 E-04	6.9 E-01
Silicon	20	8.0 E-02	4.8 E-04	4.7 E-01
Silver	1	1.8 E-03	- -	- -
Sodium	79	5.7 E+00	4.0 E-04	1.6 E+01
Sulfate	48	5.0 E-02	1.5 E-04	8.9 E-01
Zinc	10	5.1 E-04	2.1 E-04	1.2 E-03
Zirconium	16	5.7 E-01	3.4 E-04	1.6 E+00
TOC	91	1.3 E+01	1.5 E-02	8.9 E+01

*N = number of samples in which analyte was found.

Table 3-3. Waste Generation for Various Facilities and Programs (cubic meters)

	B Plant	PUREX	Tank Farms	SST To DST Pumping	UO_3 Plant	PFP	T Plant	S Plant (Laboratories)	100 Area	300 Area	400 Area
FY 1990	2393	6882	1226	0	0	53	151	121	193	136	0
FY 1991	1317	984	776	859	0	0	140	170	0	208	0
FY 1992	435	363	155	458	0	136	250	106	0	132	30

DST = double-shell tank
PFP = Plutonium Finishing Plant
SST = single-shell tank

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Table 3-4. Plutonium-Uranium Extraction Aging Waste Composition.

Constituent	Concentration (moles/L)
Na^+	3.97
OH^-	0.77
AlO_2^-	0.55
$NO_3^- + NO_2^-$	2.02
SO_4^{-2}	0.13
F^-	0.13
$Fe(OH)_3$	0.10
$Cr(OH)_3$	0.009
$Ni(OH)_2$	0.006
Density	1.17-1.20 g/cm^3

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Table 3-5. Sample Analysis for Plutonium-Uranium Extraction Aging Waste Stored in Tanks 241-AZ-101 and 241-AZ-102.

Constituent	N*	Average (moles/L)	Minimum (moles/L)	Maximum (moles/L)
Aluminum	18	2.2 E-01	2.0 E-05	4.8 E-01
Barium	2	1.4 E-03	4.0 E-10	2.8 E-03
Boron	2	5.9 E-04	7.1 E-06	1.2 E-03
Cadmium	2	2.9 E-04	9.0 E-09	5.7 E-04
Calcium	9	3.2 E-02	3.2 E-07	2.5 E-01
Carbonate	10	1.6 E-01	6.7 E-04	2.7 E-01
Chloride	4	2.7 E-02	7.0 E-03	6.1 E-02
Chromium	12	6.3 E-03	2.6 E-07	1.3 E-02
Copper	4	1.7 E-04	4.4 E-05	3.5 E-04
Fluoride	8	1.6 E+00	4.6 E-03	1.3 E+01
Hydroxide	12	5.1 E-01	7.1 E-03	1.1 E+00
Iron	4	2.4 E-01	2.4 E-07	6.2 E-01
Lanthanum	1	1.4 E-02	- - -	- - -
Lead	2	3.7 E-03	4.0 E-04	7.0 E-03
Magnesium	6	4.5 E-02	6.9 E-08	2.0 E-01
Molybdenum	3	3.4 E-03	9.0 E-04	1.6 E-03
Nickel	5	1.7 E-02	2.1 E-08	8.0 E-02
Nitrate	14	7.1 E-01	2.5 E-02	1.8 E+00
Nitrite	13	3.3 E-01	3.5 E-03	7.9 E-01
Phosphate	11	1.4 E-01	3.1 E-04	8.7 E-01
Phosphorus	7	2.0 E-01	6.4 E-07	8.2 E-01
Potassium	6	5.4 E-02	3.8 E-06	1.2 E-01
Silicon	4	1.3 E-02	1.7 E-05	5.0 E-02
Silver	1	1.7 E-04	- - -	- - -
Sodium	16	3.4 E+00	2.6 E-04	8.5 E+00
Sulfate	9	9.3 E-02	6.9 E-03	1.6 E-01
Zinc	2	8.5 E-04	7.0 E-09	1.7 E-03
Zirconium	2	1.9 E-01	7.5 E-08	3.7 E-01
TOC	16	1.3 E+01	5.2 E-02	1.0 E+02

*Number of samples.

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Table 3-6. Estimated Mass of Nonradioactive Chemical Components of Existing Single-Shell Tank Waste after Completion of Jet Pumping.

Chemical	Total bulk sludge (t)	Total bulk salt cake (t)	Interstitial liquid (t)
$NaNO_3$	20,000	110,000	2,500
$NaNO_2$	3,000	2,300	1,900
Na_2CO_3	1,700	730	70
NaOH	4,200	2,000	740
$NaAlO_2$	950	1,900	1,500
Na_3PO_4	12,500	2,100	280
Cancrinite*	2,700	--	--
$Al(OH)_3$	2,300	--	--
$Ce(OH)_3$	320	--	--
$Cr(OH)_3$	190	--	--
$Cd(OH)_2$	5	--	--
$Fe(OH)_3$	1,200	--	--
$Sr(OH)_2$	50	--	--
$BiPO_4$	380	--	--
$CaCO_3$	320	--	--
F^-	800	--	--
Cl^-	40	--	--
Hg^+	0.9	--	--
MnO_2	190	--	--
$Ni_2Fe(CN)_6$	500	--	--
$P_2O_5 \bullet 2H_2O \bullet 44H_2O$	20	--	--
$ZrO_2 \bullet 2H_2O$	430	--	--
Organic Carbon	--	--	200
H_2O	26,000	14,000	4,800
Totals	77,796	133,030	11,990

NOTE: This table is from RHO-RE-ST-30P, page 2-11 (RHO 1985).
(t) = Metric tons.
*Known silica additions are assumed to have reacted with aluminates and hydroxides to form cancrinite (assumed to be $2NaAlSiO_4 \bullet 0.52NaNO_3 \bullet 0.68H_2O$).

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Table 3-7. Hanford Site Single-Shell Tank Releases.* (sheet 1 of 3)

Tank	Volume (m^3)	Leak Reported
241-A-103	21	1987
241-A-104	9.5	1975
241-A-105	19	1963
241-AX-102	11	1988
241-B-107	30	1980
241-B-110	38	1981
241-B-201	4.5	1980
241-B-203	1.1	1983
241-BX-102	265	1971
241-BX-108	9.5	1974
241-BY-103	<19	1973
241-BY-108	<19	1972
241-C-101	76	1980
241-C-201	2.1	1988
241-C-202	1.7	1988
241-C-203	1.5	1984
241-C-204	1.3	1988
241-SX-104	23	1988
241-SX-107	19	1964
241-SX-108	9.1	1962
241-SX-109	19	1965
241-SX-110	21	1976
241-SX-111	7.6	1974
241-SX-112	114	1969
241-SX-113	57	1962
241-SX-115	189	1965
241-T-101	<28	1992
241-T-106	436	1973
241-T-108	<3.8	1974
241-T-111	<3.8	1984

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Table 3-7. Hanford Site Single-Shell Tank Releases.* (sheet 2 of 3)

Tank	Volume (m^3)	Leak Reported
241-TY-107	9.5	1984
241-TY-101	<3.8	1973
241-TY-103	11	1973
241-TY-104	5.3	1981
241-TY-105	133	1960
241-TY-106	76	1959
241-U-101	114	1959
241-U-104	208	1961
241-U-110	31	1975
241-U-112	32	1980
241-B-204	1.5	1984
241-BY-107	57	1984
241-C-111	21	1968
241-S-104	91	1968
241-T-103	<3.8	1974
241-T-109	<3.8	1974
241-B-112	7.6	1978
241-C-110	7.6	1984
241-AX-104**		1977
241-B-101**		1974
241-B-103**		1978
241-B-105**		1978
241-B-111**		1978
241-BX-101**		1972
241-BX-110**		1976
241-BX-111**		1984
241-BY-105**		1984
241-BY-106**		1984
241-SX-114**		1972

9 3 1 2 9 7 0 9 6 9

Table 3-7. Hanford Site Single-Shell Tank Releases.* (sheet 3 of 3)

Tank	Volume (m^3)	Leak Reported
241-T-107**		1984
241-TX-105**		1977
241-TX-110**		1977
241-TX-113**		1974
241-TX-114**		1974
241-TX-115**		1977
241-TX-116**		1977
241-TX-117**		1977
Total estimated leakage volume from 67 tanks: 2,840 m^3.		

*After some tanks were declared to be leaking, cooling water may have been added to aid evaporative cooling. It is believed that some of this water did not evaporate and, therefore, went into the ground. As of October 1990, estimates ranged from 190 to 3,000 cubic meters. The past practice was to exclude the cooling water from the leak volume estimate. The volumes provided and date of initial release are the subject of continued evaluation and refinement and may be revised for improved accuracy as a result of these evaluations. In addition, documents show that from 1946 to 1966, 456,725 cubic meters (120,661,000 gallons) of liquid wastes were intentionally discharged from SSTs at the Hanford Site directly to the ground on the 200 Area plateau (WHC 1991c). The majority of this waste was discharged from 1946 to 1958 as a result of the early plutonium and uranium recovery processes conducted in the 221-B Facility (B Plant), 221-T Facility (T Plant), and the 221-U Facility (U Plant). In addition, from 1960 to 1966 laboratory wastes from the 300 Area and equipment decontamination wastes from the 200 West Area were routed through SSTs before discharge to the ground. No wastes have been discharged intentionally to the ground from SSTs since 1966, and no wastes have ever been discharged directly to the ground from the newer DSTs located at the Hanford Site.

**Individual release volumes for these tanks have not been determined. The total volume release from these tanks is estimated to be 570 cubic meters.

SST = single-shell tank.

9 3 1 2 9 3 7 0 9 7 0

Table 3-8. Analytes Detected in 242-A Evaporator Process Condensate. (sheet 1 of 3)

Analyte	Number of samples containing analyte	Average concentration (ppb)
Total organic carbon	31	2.6 E+04
INORGANIC CATIONS		
Aluminum	29	8.4 E+02
Ammonium	31	4.1 E+05
Barium	4	6.8 E+00
Boron	1	1.3 E+01
Cadmium	1	5.0 E+00
Calcium	31	2.7 E+03
Copper	5	2.6 E+01
Iron	9	6.3 E+01
Magnesium	14	5.0 E+02
Manganese	1	5.0 E+00
Mercury	24	3.0 E-01
Nickel	5	1.4 E+01
Potassium	30	2.6 E+03
Silicon	4	6.8 E+03
Sodium	25	3.3 E+03
Vanadium	4	6.3 E+00
Zinc	15	1.3 E+01
INORGANIC ANIONS		
Chloride	7	1.0 E+03
Fluoride (ion chromatogram)	1	2.1 E+03
Fluoride (ion-specific electrode)	7	4.0 E+01
Nitrate	4	2.8 E+03
Sulfate	17	2.6 E+03
Sulfide	2	3.6 E+04

9 3 1 2 9 7 0 9 7 1

Table 3-8. Analytes Detected in 242-A Evaporator Process Condensate. (sheet 2 of 3)

Analyte	Number of samples containing analyte	Average concentration (ppb)
ACIDS		
Caproic acid	1	7.0 E+01
PARAFFINS		
2-Methylnonane	2	1.6 E+01
Dodecane	2	4.3 E+01
Heptadecane	1	1.8 E+01
Hexadecane	1	1.7 E+01
Pentadecane	1	2.0 E+01
Tetradecane	23	7.6 E+01
Tridecane	23	7.0 E+01
ALCOHOLS		
2-Propanol	10	2.2 E+01
Butyl alcohol	30	9.8 E+03
Ethyl alcohol	1	2.0 E+00
ALDEHYDES		
Butylaldehyde	14	5.6 E+01
KETONES		
Acetone	36	9.8 E+02
Methyl ethyl ketone	25	5.1 E+01
Methyl n-butyl ketone	16	1.3 E+01
Methyl n-propyl ketone	8	9.3 E+00
Hexone	10	1.1 E+01
CYCLICS		
Benzaldehyde	1	2.3 E+01
Benzyl alcohol	9	1.3 E+01
Phenol	1	3.3 E+01
Tetrahydrofuran	24	3.7 E+01
ESTERS		
Tributyl phosphate	31	3.9 E+03

9 3 1 2 9 3 7 0 9 7 2

Table 3-8. Analytes Detected in 242-A Evaporator Process Condensate. (sheet 3 of 3)

Analyte	Number of samples containing analyte	Average concentration (ppb)
NITROGEN-CONTAINING ORGANICS		
3,5-Dimethylpridine	3	2.1 E+01
Dimethylnitrosamine	1	5.7 E+01
Pyridine	1	5.5 E+02
ETHERS AND GLYCOLS		
2-Butoxyethanol	25	3.8 E+02
Butoxydiglycol	2	1.9 E+01
Butoxyglycol	21	2.8 E+02
Butoxytriethylene glycol	1	3.5 E+01
Ethoxytriethylene glycol	4	9.9 E+01
Methoxydiglycol	2	4.0 E+01
Methoxytriglycol	2	2.2 E+02
Triglyme	1	9.0 E+01
RADIONUCLIDES		
Strontium	4	1.6 E+01
Uranium	21	4.4 E-01

9 3 1 2 9 7 0 9 7 3

Table 3-9. Analytes Reported in Plutonium-Uranium Extraction Plant Ammonia Scrubber Discharge.

Constituent	N[a]	Average concentration[b]
Calcium	4	6.80 E+01
Chloride	4	1.17 E+03
Chromium	4	1.06 E+01
Magnesium	1	2.10 E+01
Nickel	4	1.02 E+01
Nitrate	4	5.50 E+02
Sodium	4	2.79 E+02
Uranium	4	3.91 E-01
Zinc	4	3.50 E+01
Ammonia	4	3.66 E+05
1-Butanol	1	1.20 E+01
Alpha Activity (pCi/L)	4	3.01 E+01
Beta Activity (pCi/L)	4	3.99 E+04
Conductivity (μS)	4	1.79 E+02
pH (dimensionless)	4	9.35 E+00
Temperature (°C)	4	3.24 E+01
TOC	4	2.16 E+03

[a]N is the number of samples in which the analyte was detected. The average concentrations do not reflect "less than" values. It is the sum of the detected values divided by N.

[b]Units are parts per billion unless otherwise stated. This ammonia scrubber discharge was sent to cribs.

TOC = total organic hydrocarbon.

9 3 1 2 9 3 7 0 9 7 4

Table 3-10. Analyses for Plutonium-Uranium Extraction Plant Ammonia Scrubber Feed Stored in Double-Shell Tanks.

Analyte	Average Concentration
Sodium nitrite	0.04 M
Ammonium hydroxide	0.09 M
Fluoride	2.6×10^{-4} M
Hydroxide ion	0.02 M
pH	>12.5
Total alpha	0.11 μCi/L

9 5 1 2 2 0 7 0 9 7 5

Table 3-11. Analytes Reported in the Plutonium-Uranium Extraction Plant Process Condensate.

Constituent	N*	Average concentration (ppb)
Boron	5	1.64 E+01
Calcium	5	5.02 E+01
Cyanide	5	3.57 E+01
Fluoride	5	8.60 E+02
Mercury	5	9.66 E-01
Nitrate	5	5.56 E+04
Nitrite	5	4.93 E+04
Potassium	5	5.08 E+02
Silicon	5	2.19 E+02
Sodium	5	1.29 E+04
Acetone	4	5.75 E+01
Ammonia	5	5.32 E+01
1-Butanol	3	1.90 E+01
2-Butanone	4	2.85 E+01
Butylated hydroxy toluene	1	1.00 E+02
Dibutylphosphate	4	1.74 E+04
Dodecane	7	9.14 E+03
Tetradecane	8	2.10 E+04
Tetrahydrofuran	4	7.45 E+01
Tributylphosphate	8	7.78 E+04
Tridecane	8	3.28 E+04
Undecane	1	1.20 E+02
Unknown aliphatic HC	2	1.19 E+03
Unknown ester	4	5.24 E+02
Unknown ester	3	3.07 E+01
Unknown hydrocarbon	2	1.55 E+04
Ignitability (°F)	5	2.08 E+02
pH (dimensionless)	4	3.04 E+00
Temperature (°C)	3	4.66 E+01
TOC	5	1.06 E+05
TOX (as Cl)	5	4.80 E+01

*N is the number of samples in which the analyte was detected. The average concentrations do not reflect "less than" values. This analysis is for waste discharged to cribs.

TOC = total organic hydrocarbon
TOX = total organic halide

9 3 1 2 9 3 7 0 9 7 6

Table 3-12. Analyses of Hexone Waste.

Analysis Before Distillation in 1990

Compound	Concentration (Weight Percent)		
	Tank 276-S-141	Tank 276-S-142	
		Organic Phase	Aqueous Phase
Hexone	99.0	65.2	1.0
N-alkanes (nC_{10} - nC_{15})	ND	14.2	ND
N-tributyl phosphate	ND	8.4	ND
Water	1.0	1.0	99.0
Mono- and di-butyl phosphates, and n-alkanes out of the C_{10} - C_{15} range	ND	12.2	ND
Total	100.0	100.0	100.0

ND = not detected.

Analysis of Sludge/Tar Residual Composition for
Tanks 276-S-141 (250 Gallons) and
Tanks 276-S-142 (250 Gallons).

Radionuclides	nCi/g	Metals (TCLP)	μg/g
^{241}Am	32.3	Ba	0.8
^{155}Eu	0.4	Cd	0.6
^{154}Eu	3.8	Cr	5.1
^{137}Cs	2.3	Pb	7.7
^{60}Co	0.003	Ag	<0.5
^{175}Sb	0.8	As	0.4
Total alpha	36.0	Se	<0.1
Total beta	38.5	Hg	<0.2
$^{239/40}Pu$	7.4	--	--

9 3 1 2 9 7 0 9 7 7

Table 3-13. Routine Wastes Discharged to 183-H Solar Evaporator Basins.

Constituent	Amount
Uranium	1,988 kg
Chromium	744 kg
Manganese	1,411 kg
Copper	197,948 kg
Nitrate ion	1,371,391 kg
Sulfate ion	341,646 kg
Ammonium ion	1,760 kg
Fluoride ion	88,360 kg
Average pH	9.8

(Total volume = 9,623 m^3)

9 3 1 2 9 3 7 0 9 7 8

Table 3-14. Plutonium-Uranium Extraction Plant Storage Tunnels 1 and 2 Waste (Lead and Silver) Generation.

Date	Amount		Tunnel
	Lead	Silver	
6/60	113 kg	--	1
12/60	113 kg	--	1
12/71	--	624 kg	2
11/87	2540 kg	--	2
5/88	230 kg	113 kg	2
Total	2996 kg	737 kg	
	(0.26 m^3)	(0.17 m^3)	

9 3 1 2 9 7 0 9 7 9

Table 3-15. Projected Generation of Solid Waste Operations Complex Stored Low-Level and Transuranic Waste.*

Year	Total (cubic meters)
1993	870
1994	1,773
1995	1,864
1996	1,734
1997	1,959
1998	1,368
1999	2,162
2000	2,032
2001	2,064
2002	3,298
2003	5,255
2004	5,852
2005	6,119
2006	6,345
2007	5,982
2008	5,916
2009	5,973
2010	5,954
2011	5,811
2012	5,811
2013	2,831
2014	1,706
2015	1,642
2016	1,586
2017	1,388
2018	1,386
2019	1,183
2020	1,184
2021	1,182

*These numbers represent total forecasts for the Hanford Site from all known generators of solid waste. The values in Table 2-1 for this stream are higher as they represent specific feeds for WRAP.

9 3 1 2 9 3 7 0 9 8 0

Table 3-16. Designation of 303-K Facility Stored Waste (December 1992).

	Waste description
Organic Constituents	
Perchloroethylene	Spent halogenated solvent
1,1,1-trichlorethane	Spent halogenated solvent
Trichlorethylene	Spent halogenated solvent
Ethyl acetate	Spent nonhalogenated solvent
Pentachlorophenol	Solid black "balls" found in inlet air treatment room, Building 313
Organic Degradation Products	
1,1-dichloroethylene	Spent halogenated solvent
cis-1,2-dichloroethylene	Spent halogenated solvent
trans-1,2-dichoroethylene	Spent halogenated solvent
Vinyl chloride	Solvent
Inorganic Constituents	
5% Beryllium/Zircaloy-2[a]	Metal alloy
Cadmium ion	Sludge
Chromium	Sludge
Zircaloy-2[a]	Metal alloy
Lead	Lead brick and sludge

[a]Comprises zirconium with 1.2-1.7% tin, 0.07-0.2% iron, 0.05-0.15% chromium, and 0.03-0.08% nickel.

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9 3 1 2 9 3 7 0 9 8 2

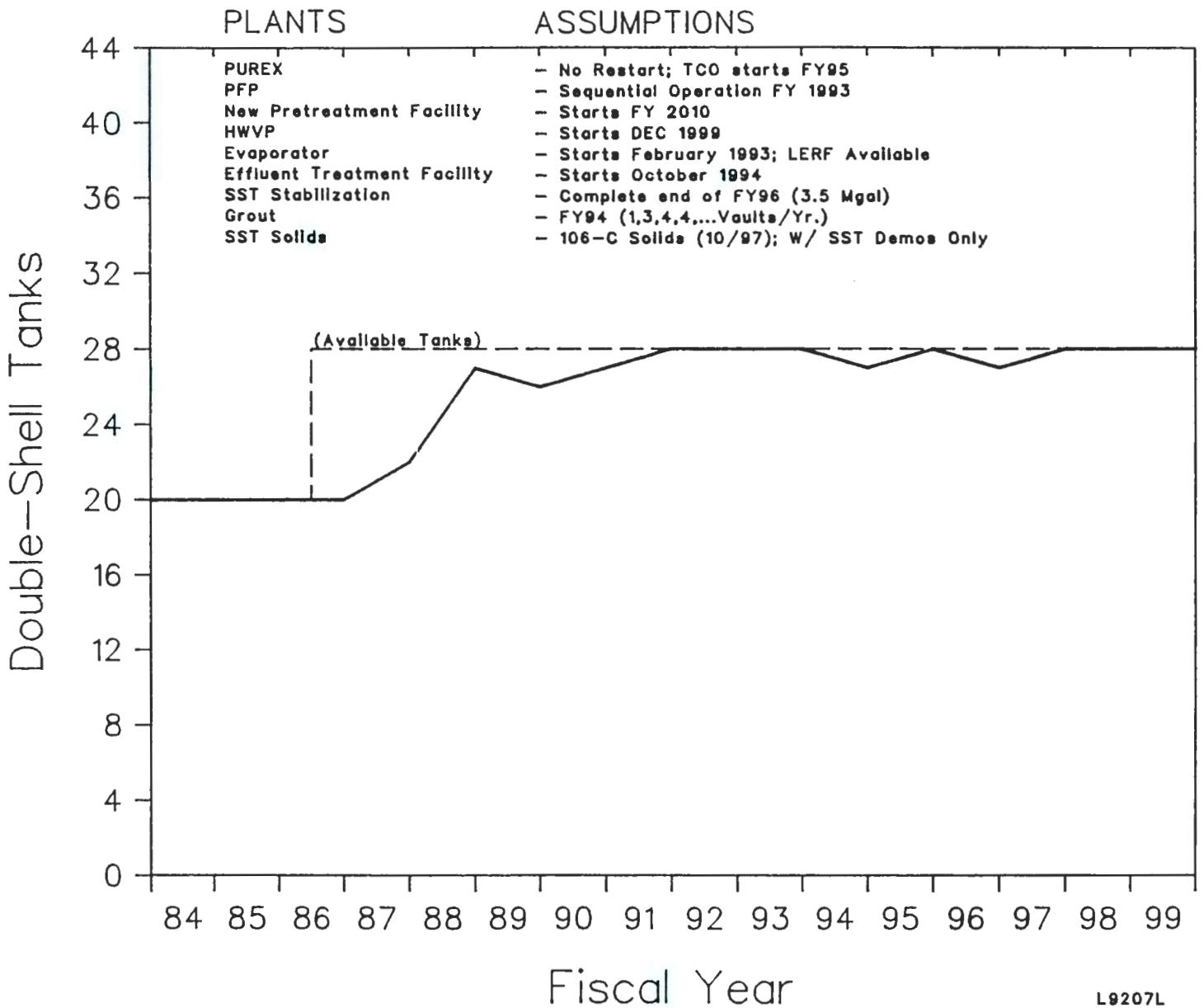


Figure 3-1. Double-Shell Tank Space Summary.

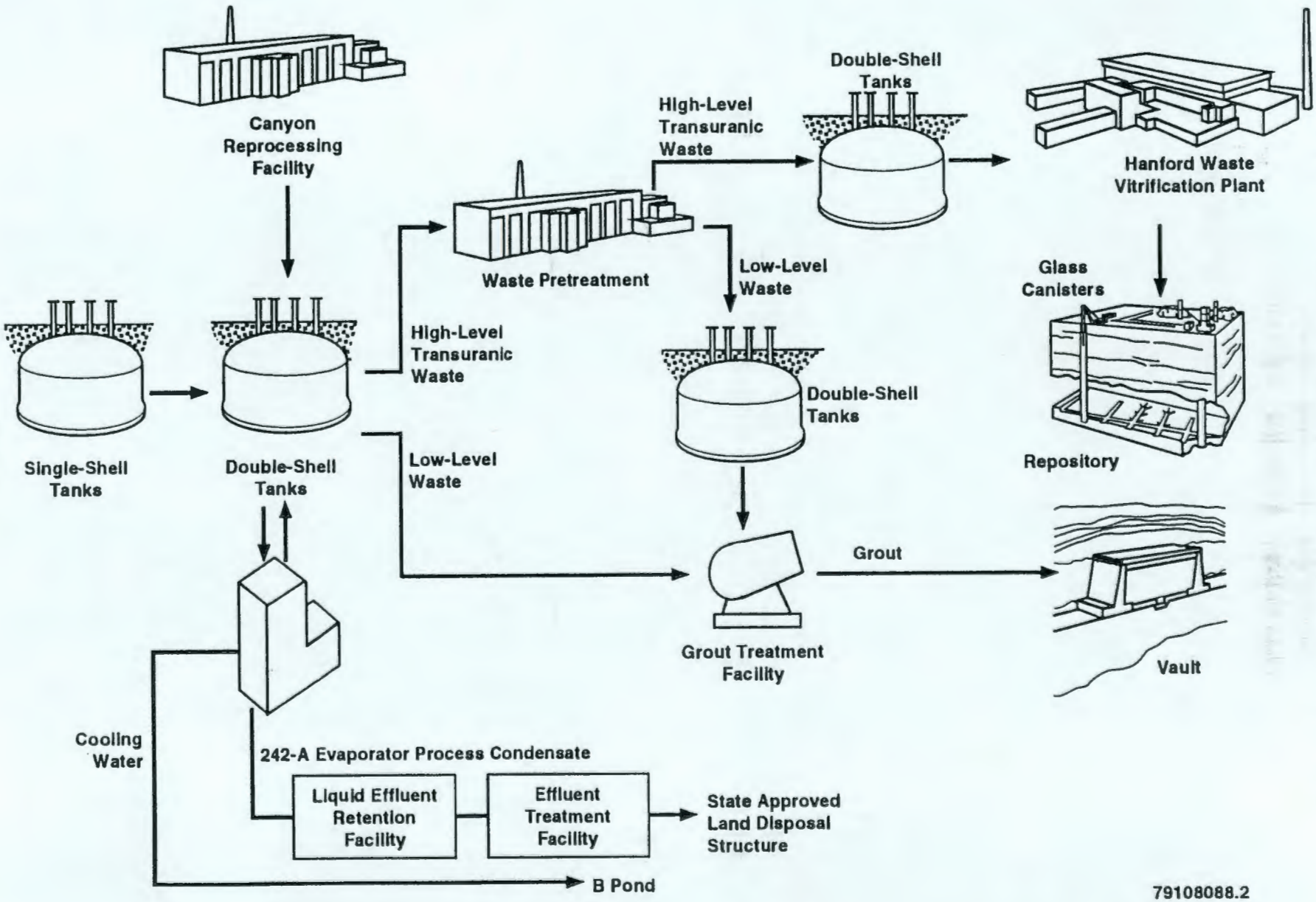


Figure 3-2. Double-Shell Tank Waste Disposal Flow Diagram.

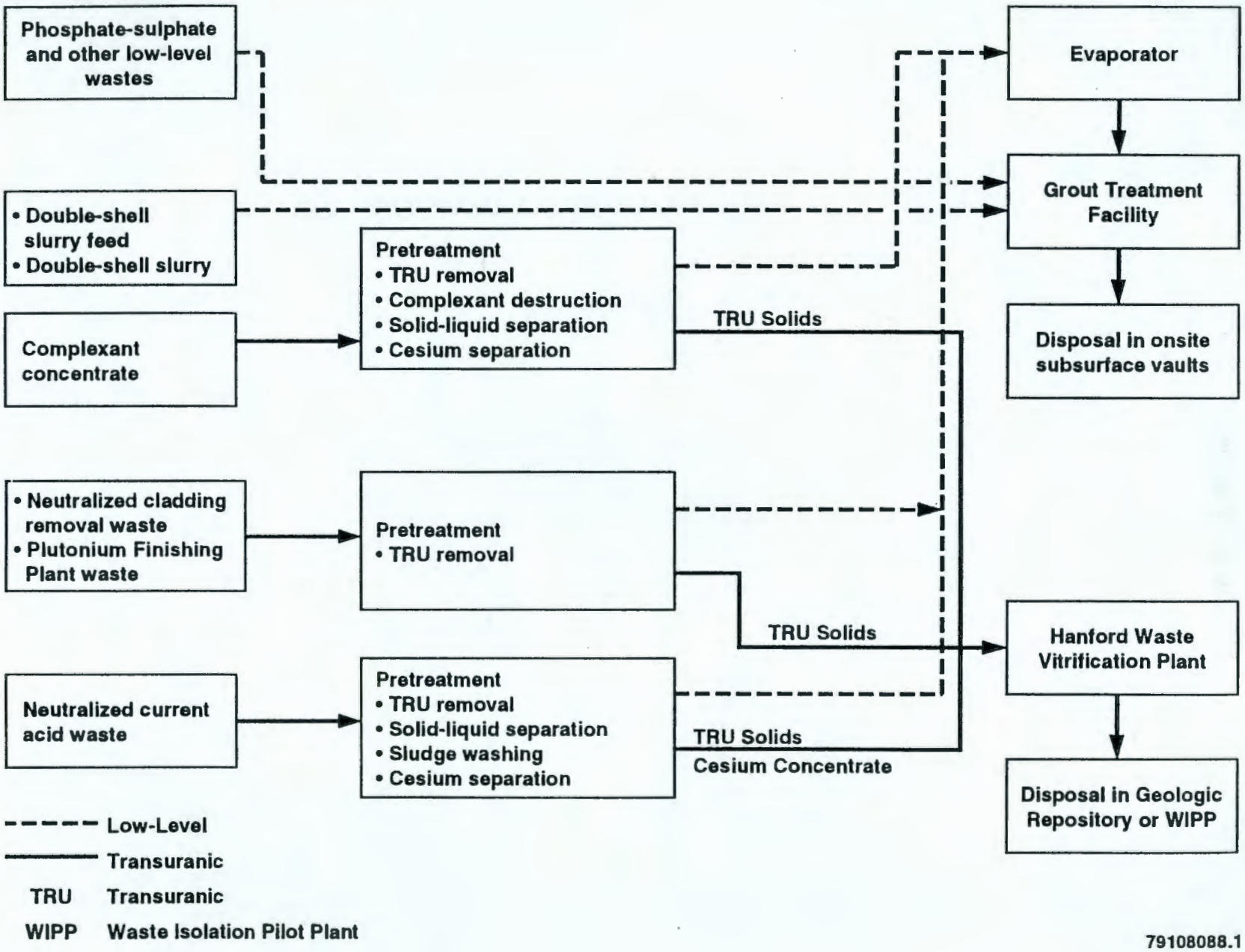


Figure 3-3. Process Flow Diagram for Disposal of Double-Shell Tank Waste.

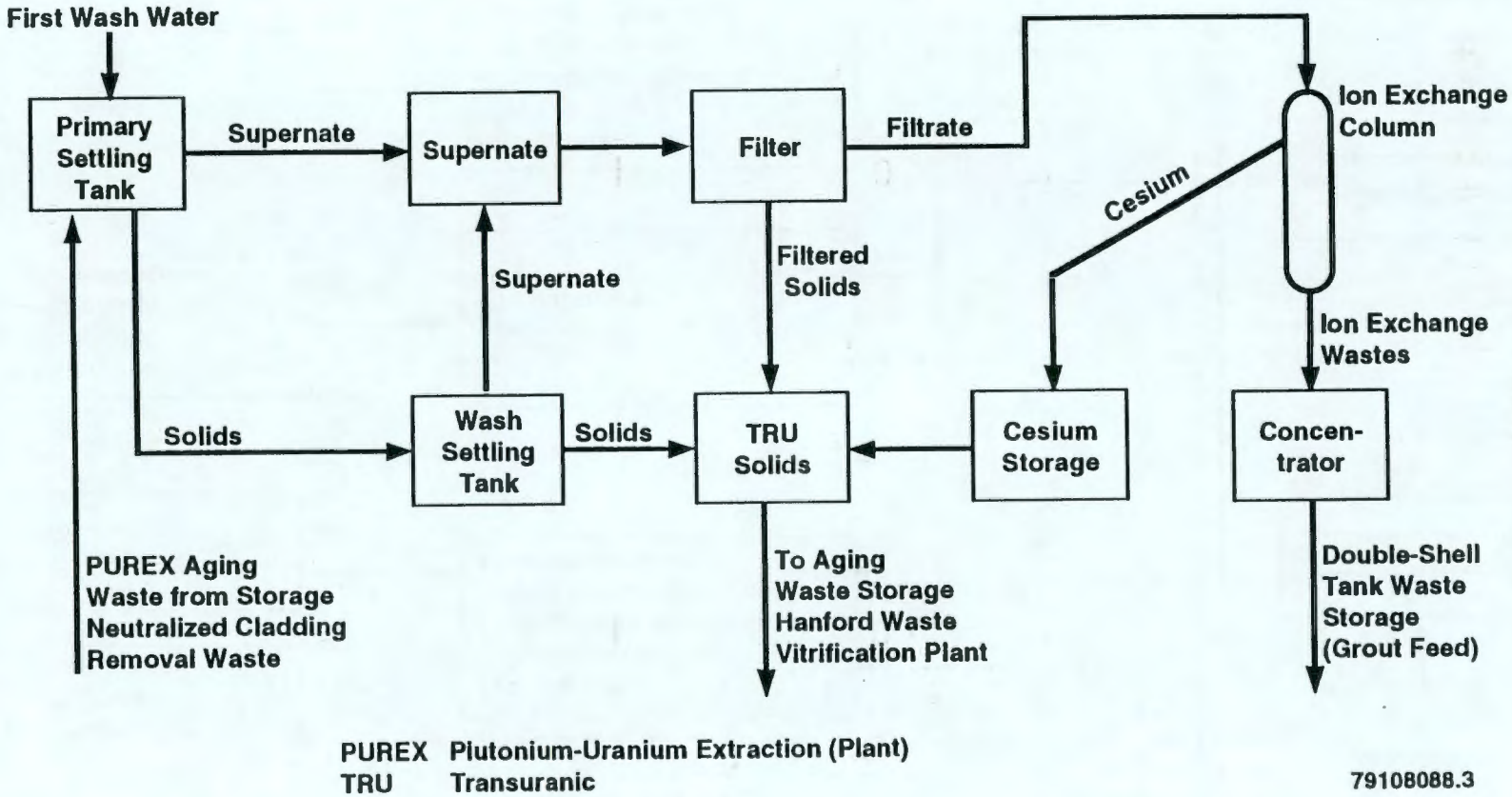


Figure 3-4. Process Flow Diagram for Neutralized Current Acid Waste Pretreatment.

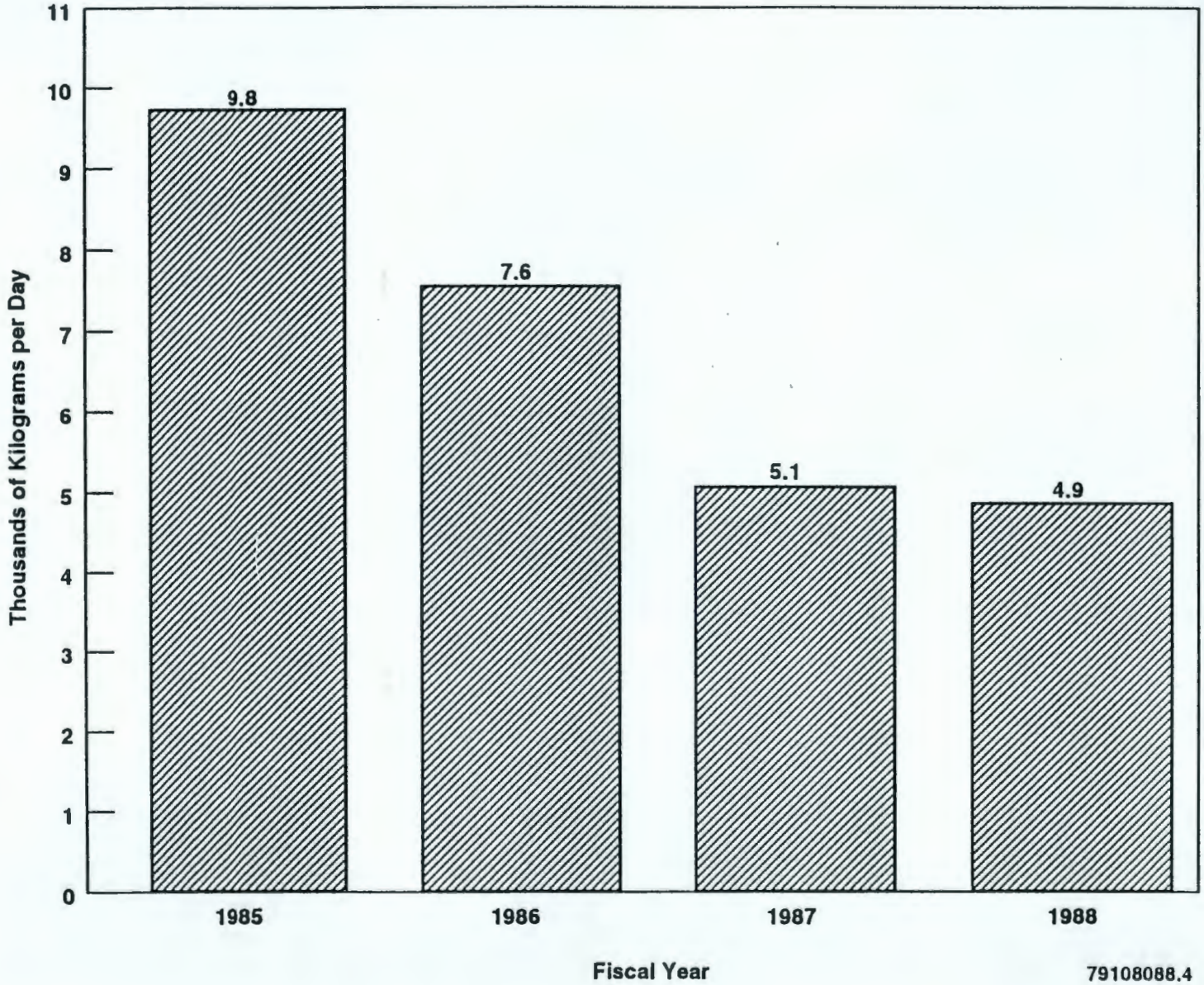


Figure 3-5. PUREX Aging Waste Transfers to Aging Waste Storage.

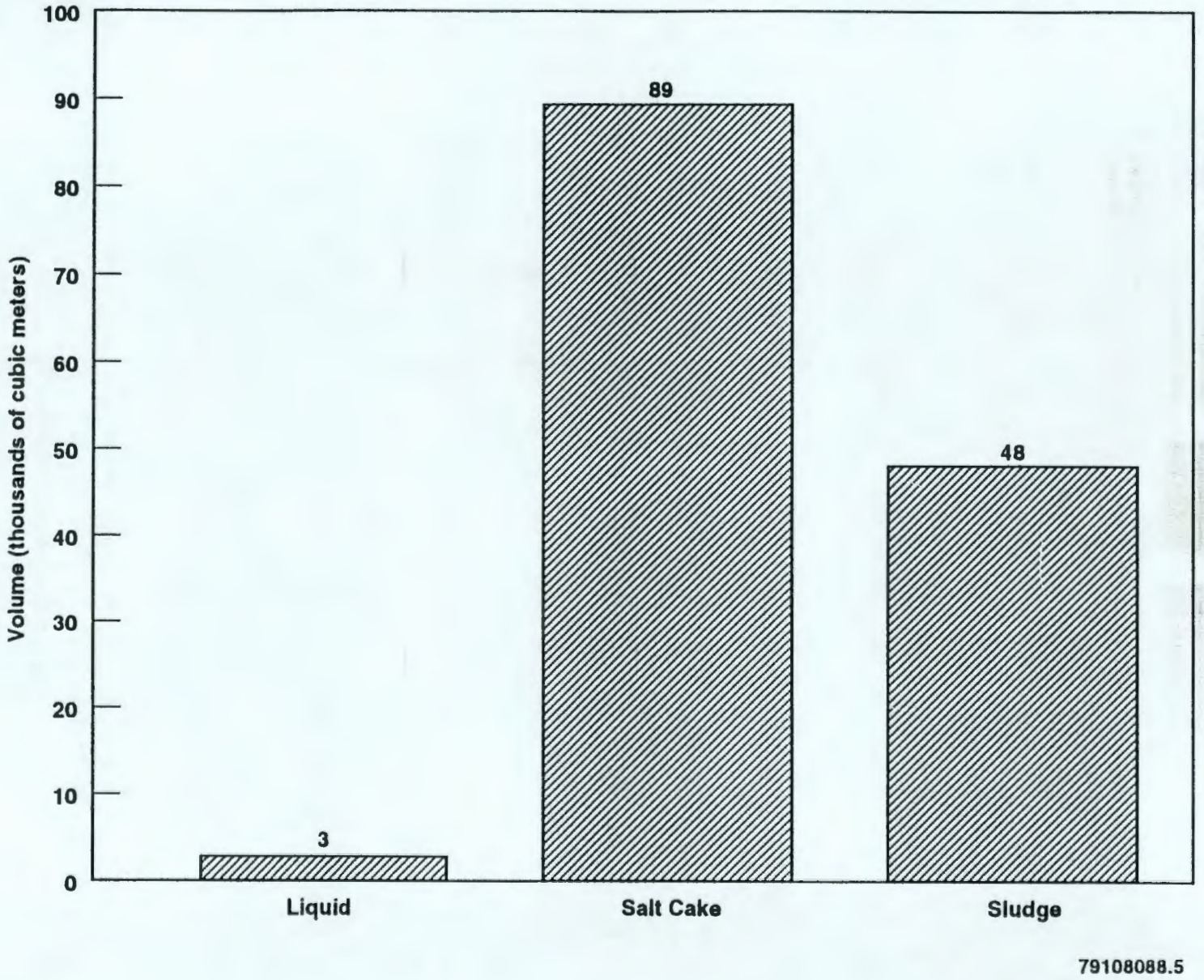


Figure 3-6. Relative Proportions of Supernatant, Sludge, and Salt Cake in Single-Shell Waste.

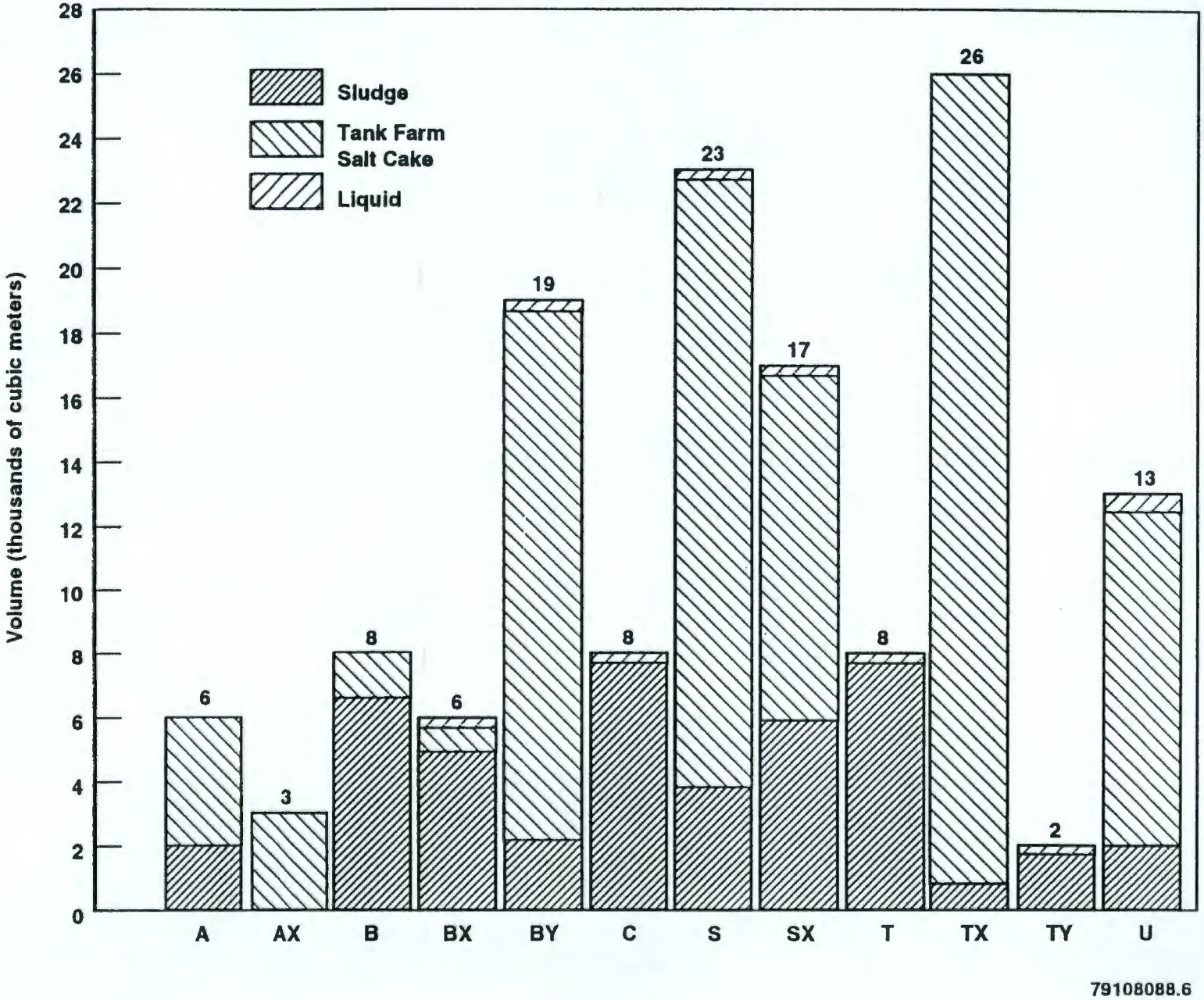
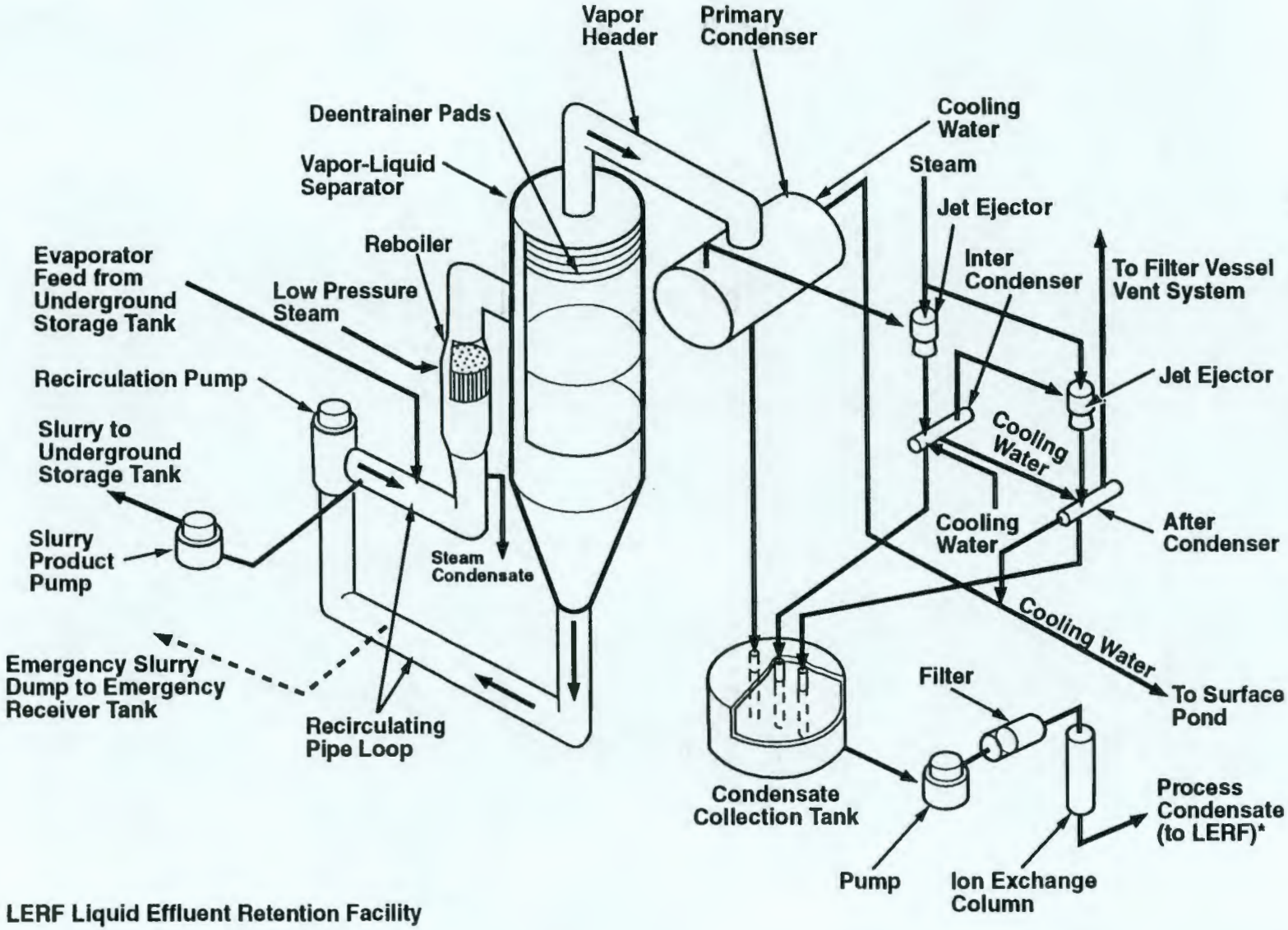


Figure 3-7. Single-Shell Tank Waste Inventory by Tank Farm.

Figure 3-8. Process Flow Diagram for 242-A Evaporator.



LERF Liquid Effluent Retention Facility

* To treatment facility after October 1994

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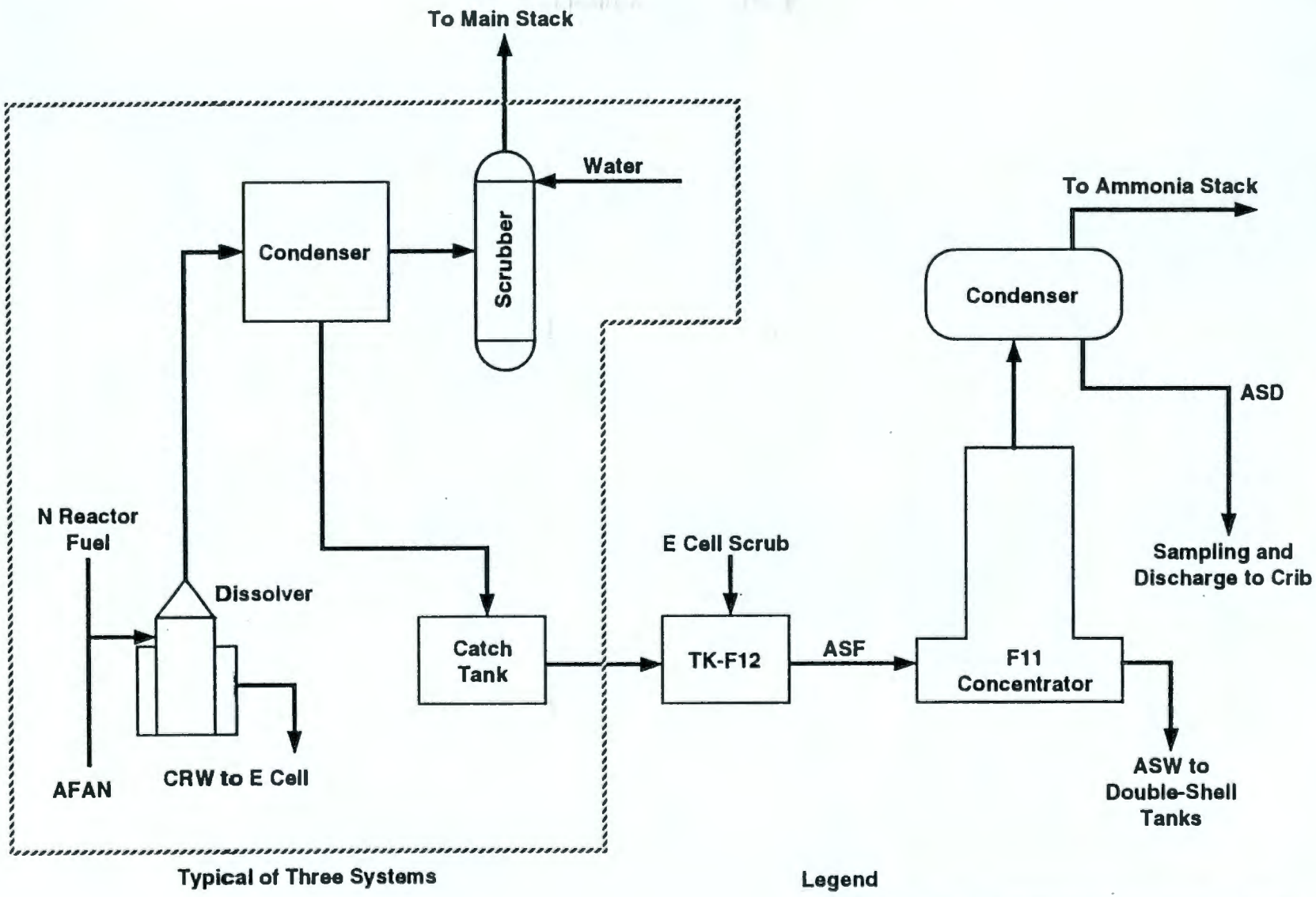

Legend

AFAN	ammonium fluoride/ammonium nitrate
ASD	ammonia scrubber discharge
ASF	ammonia scrubber feed
ASW	ammonia scrubber waste
CRW	cladding removal waste

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Figure 3-9. Historical Process Flow Diagram for PUREX Ammonia Scrubber Waste Generation.

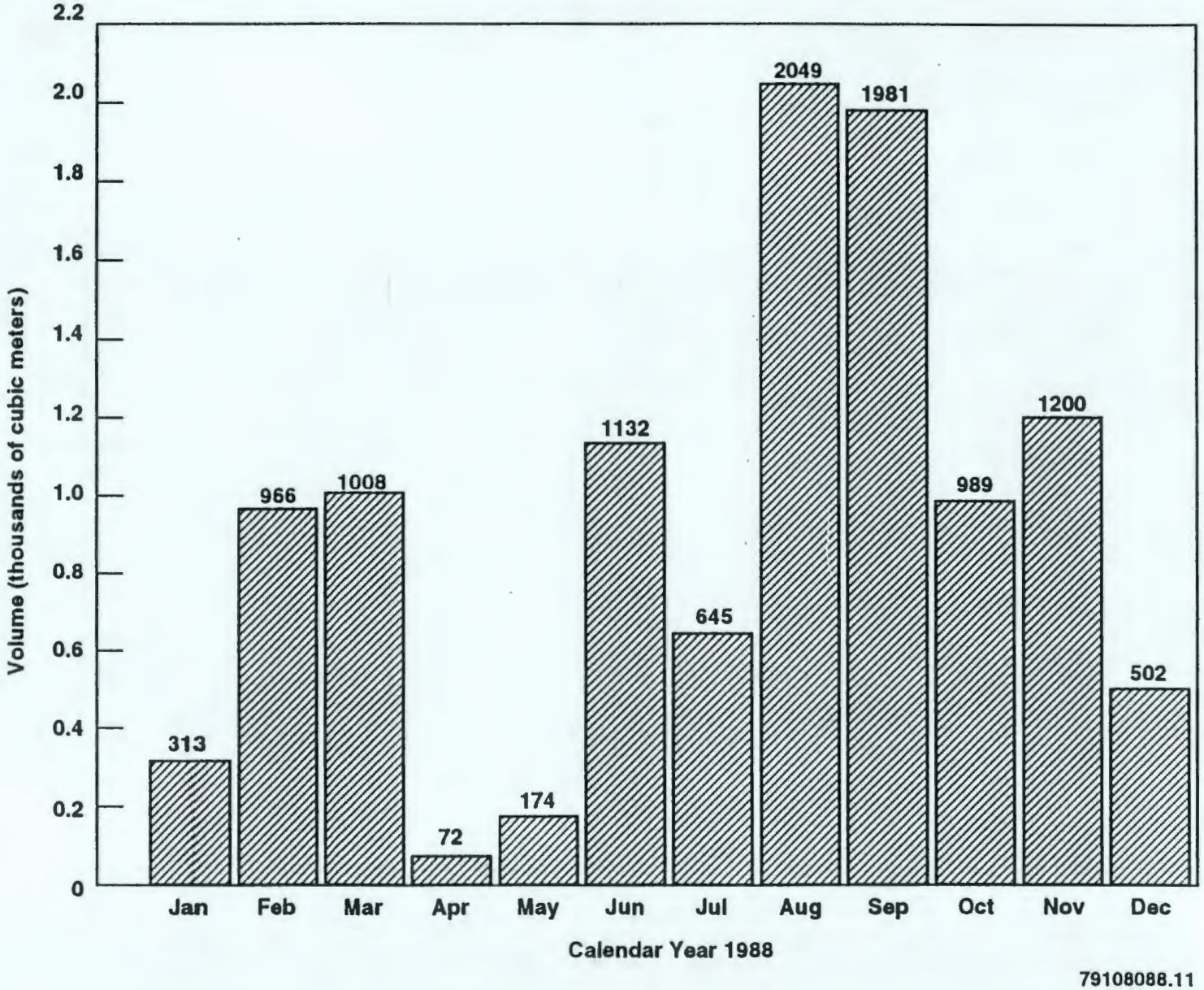


Figure 3-10. Ammonia Scrubber Waste Transfers to Double-Shell Tanks.

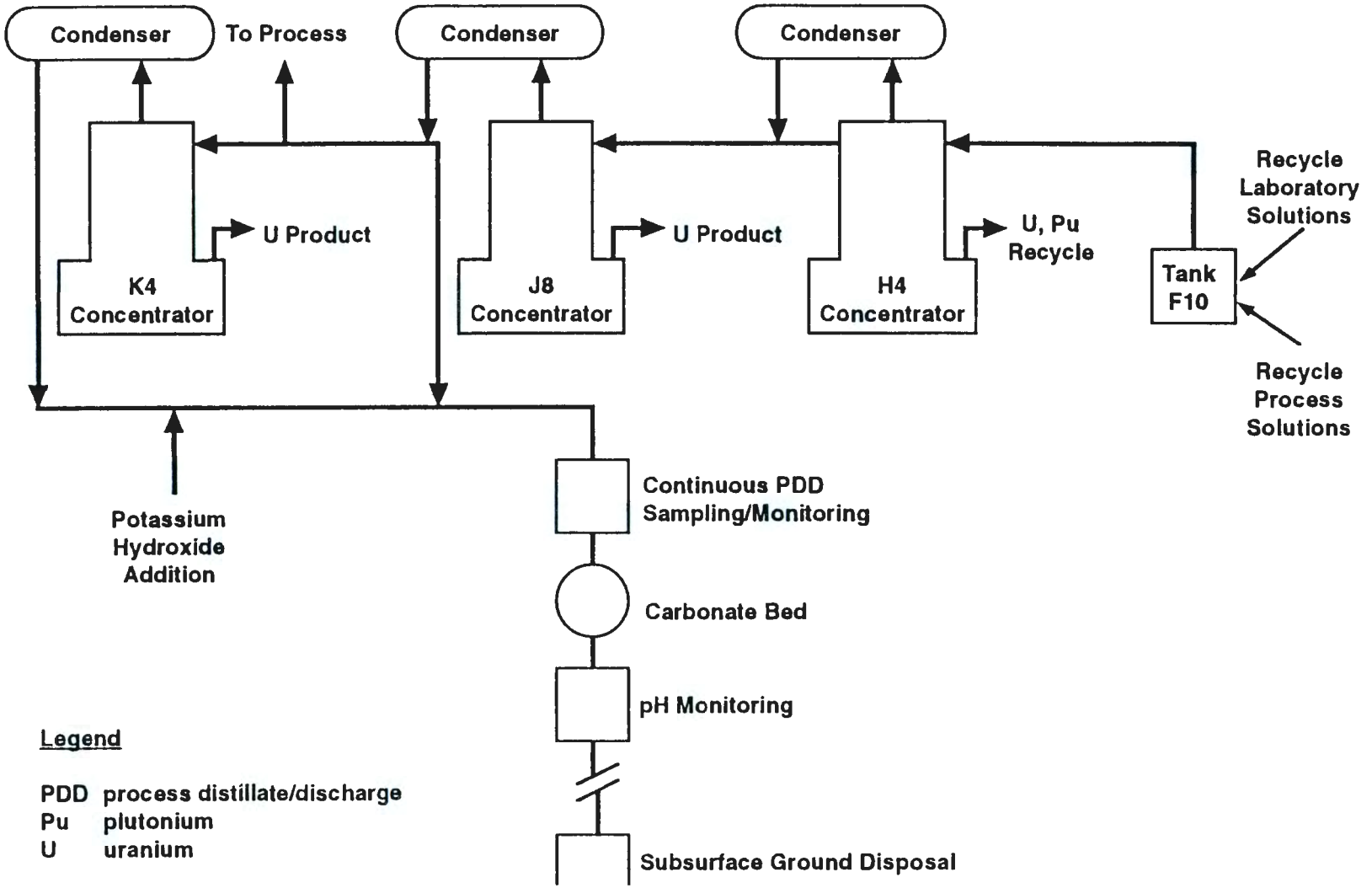


Figure 3-11. Historical Process Flow Diagram for PUREX Process Condensate.

Figure 3-12. Process Flow Diagram for Hexone Waste Processing and Disposal.

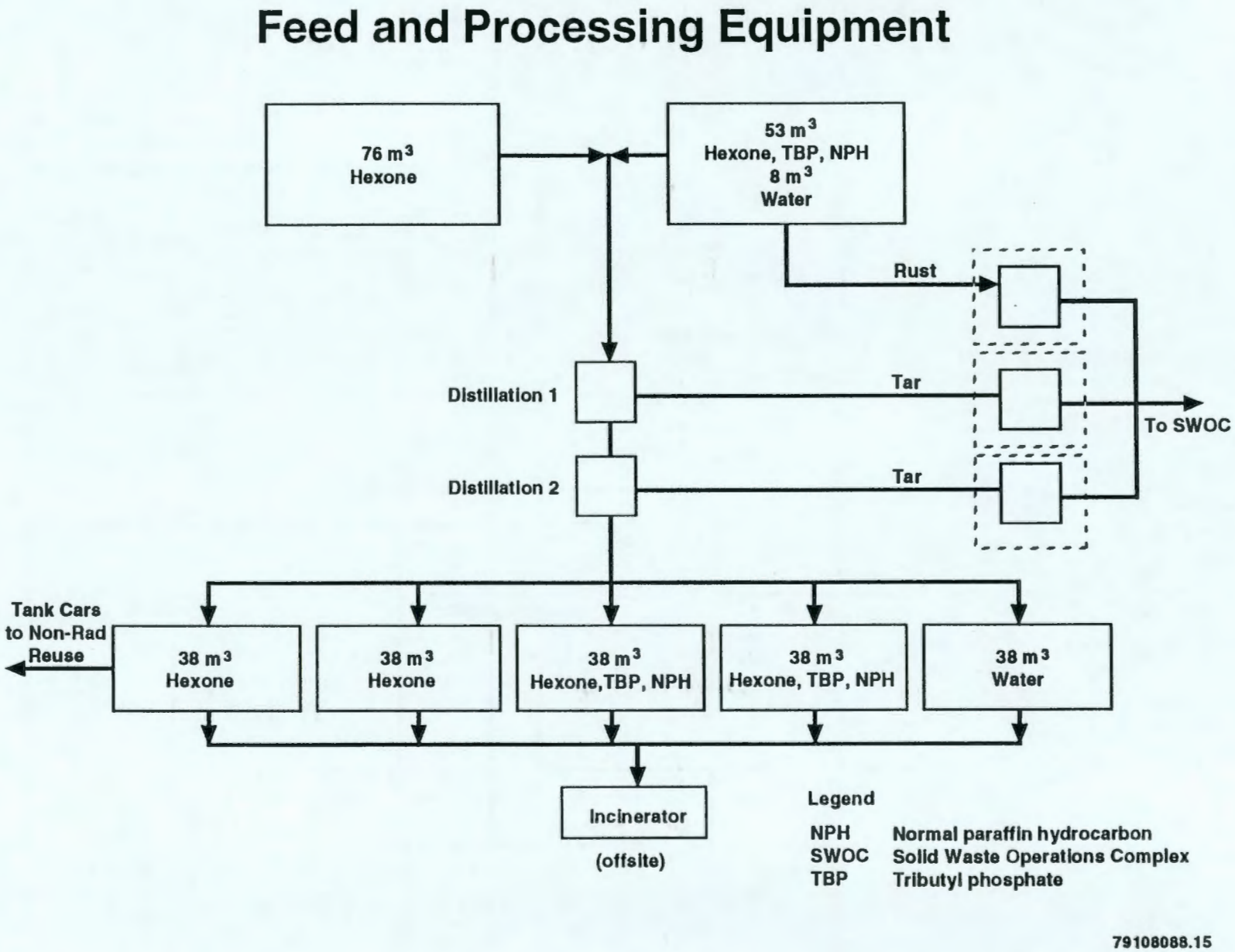
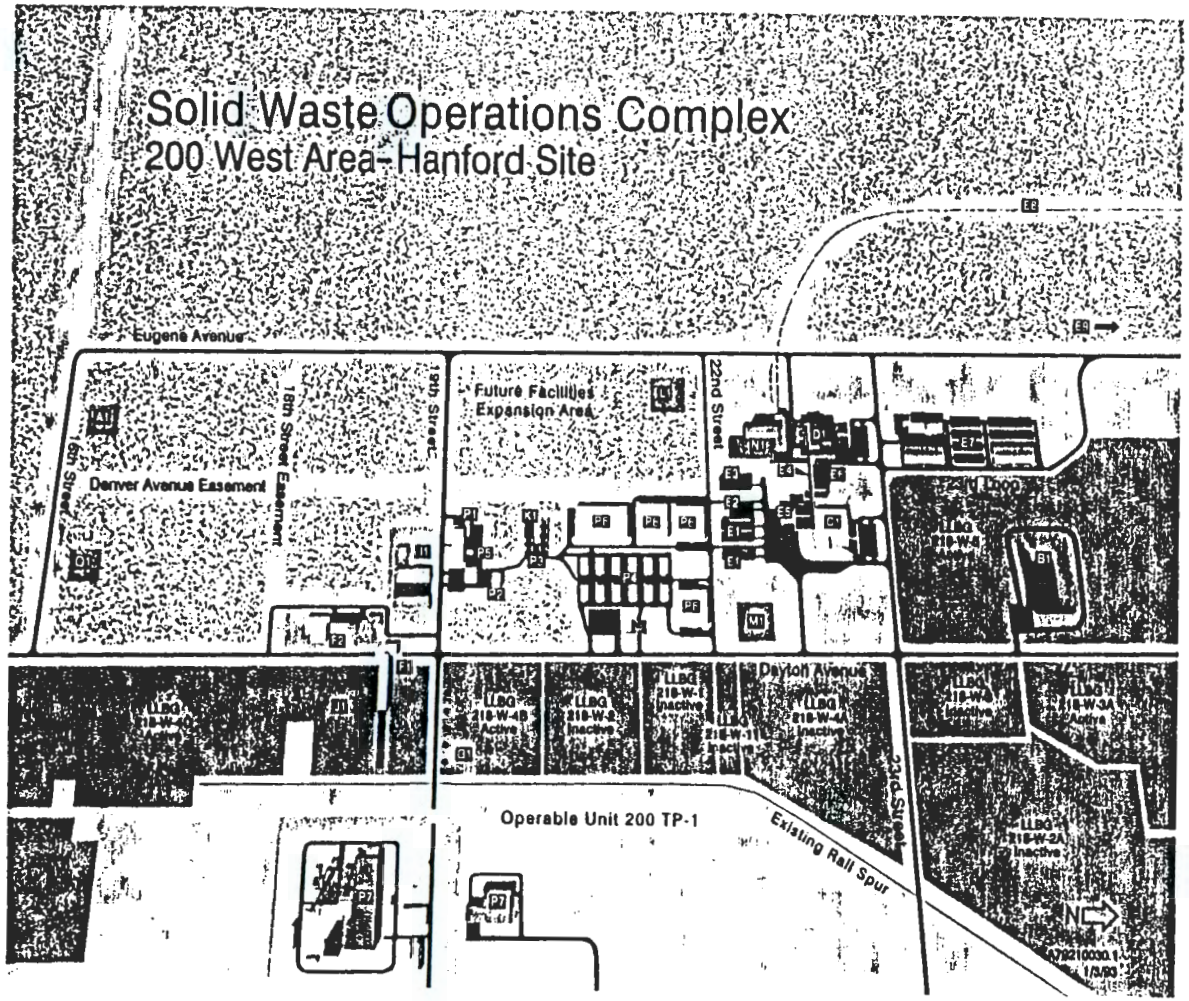


Figure 3-13. Plan View of Solid Waste Operations Complex.



Project W-272 (Capital Work Order)
- A1 Special Case Waste Storage Facility

Project W-025 (Expense Funded)
- O B1 Radioactive Mixed Waste Disposal Facility (218-W-5/T31)

Project W-026 (91 LI)
- C1 Waste Receiving and Processing (WRAP) Module 1

Project W-100 (94 LI)
- + D1 WRAP Module 2A

Project W-112 (94 LI)
- + E1 Long-Term Drum Storage
- + E2 Ignitable Drum Storage
- + E3 Box Storage
- + E4 Transfer Corridor
- + E5 Shipping and Receiving
- + E6 Automated Stacker Retriever System (AS/RS)
- + E7 Hanford Central Waste Support Complex
- + E8 Railroad Extension
- + E9 North Perimeter Gate, Guard Station, and Road to Route 11-A (not depicted)
- + E10 Infrastructure (not depicted)

Project W-113 (94 LI)
- O + F1 Solid Waste Retrieval Facility (218-W-4C/T04)
- + F2 NDE/NDA Building

Project W-156 (97 LI)
- O G1 Alpha Caisson Retrieval

Project W-174 (TBD)
- O H1 Enhanced Solid Low-Level Radioactive and Mixed Waste Disposal (not sited)

Project W-219 (Expense Funded)
- I1 Temporary Office and Change Rooms

Project W-221 (97 LI)
- O J1 Solid Waste Retrieval Phase II

Project W-241 (Minor Project)
- K1 Tempory Sodium Storage Units

Project W-242 (97 LI)
- L1 Thermal Treatment Facility

Project W-247 (97 LI)
- M1 Waste Reduction and Reclamation Facility

Project W-255 (97 LI)
- N1 WRAP Module 2B

Project W-312 (94 GPP)
- O1 Mixed Waste Storage

Existing Facilities
- P1 272-WA
- □ P2 2401-W PCB and Mixed Waste Storage
- □ P3 Low Flash-Point Mixed Waste Storage Units
- □ P4 Radioactive Mixed Waste (RMW) Storage Buildings (2402-W series)
- P5 213-W Compactor Building
- □ P6 Mixed Waste Storage Phase I-IV (2403-W series)
- P7 Z Plant Operations (Non-solid Waste Facilities)

LI = Line Item
GPP = General Plant Project
TBD = To Be Determined

O LLBG = Low Level Burial Ground
□ CWC = Central Waste Complex
+ SWOC1 = Solid Waste Operations Complex Phase I MSA

79203003.25

Figure 3-14. Process Flow Diagram for Proposed Waste Receiving and Processing Facility Module 2.

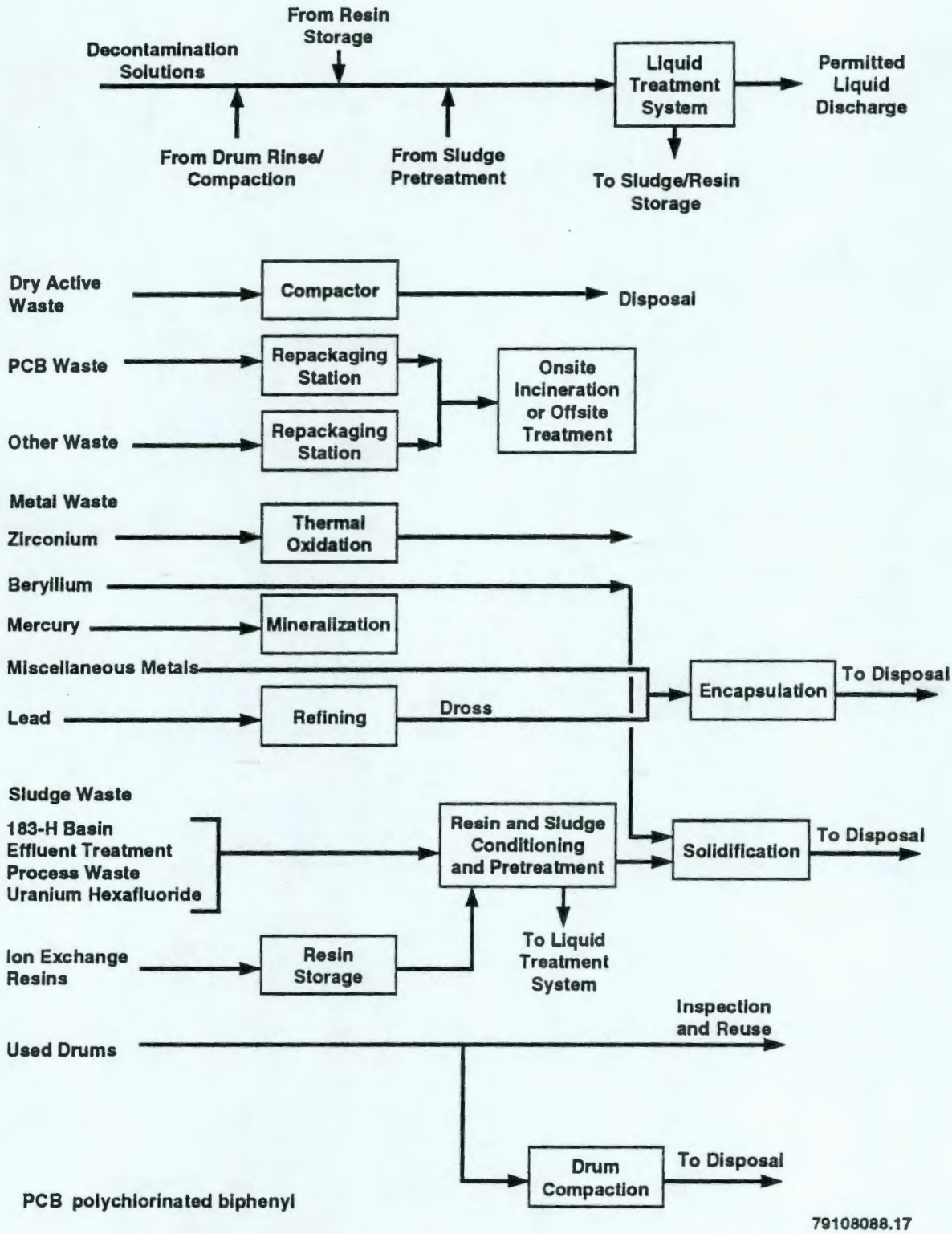
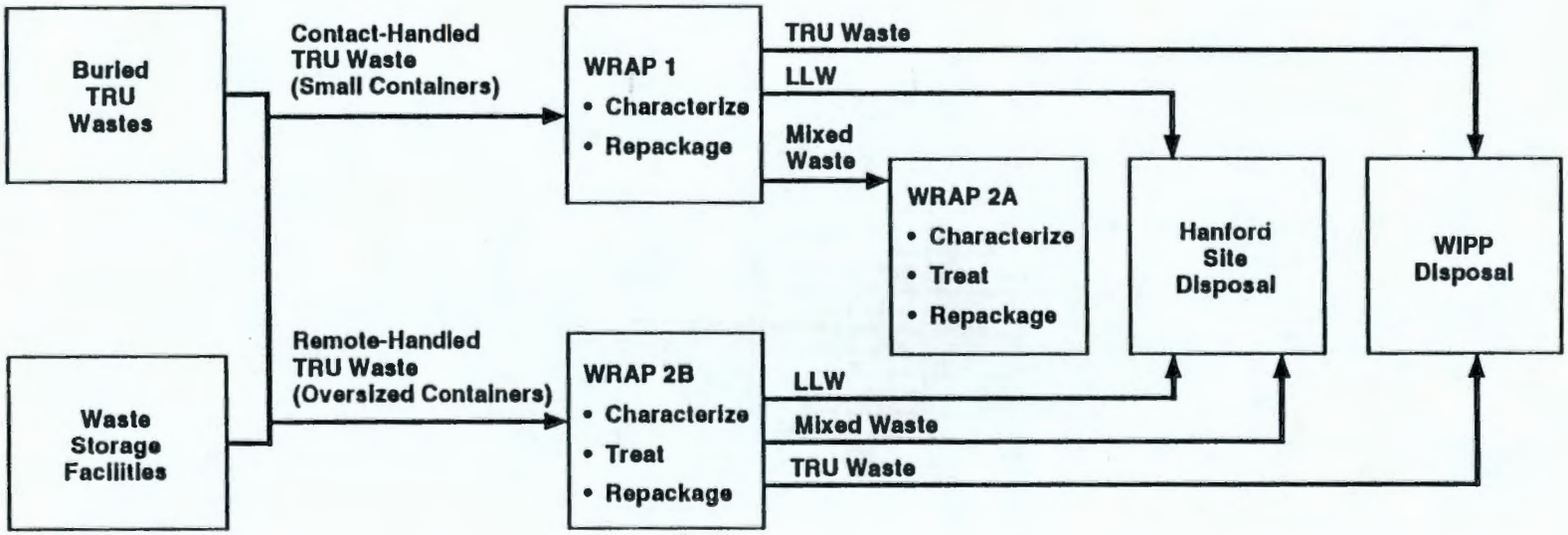


Figure 3-15. Waste Receiving and Processing Modules 1, 2A, and 2B.



LLW Low-Level Waste
TRU Transuranic
WIPP Waste Isolation Pilot Plant
WRAP Waste Receiving and Processing

79303126

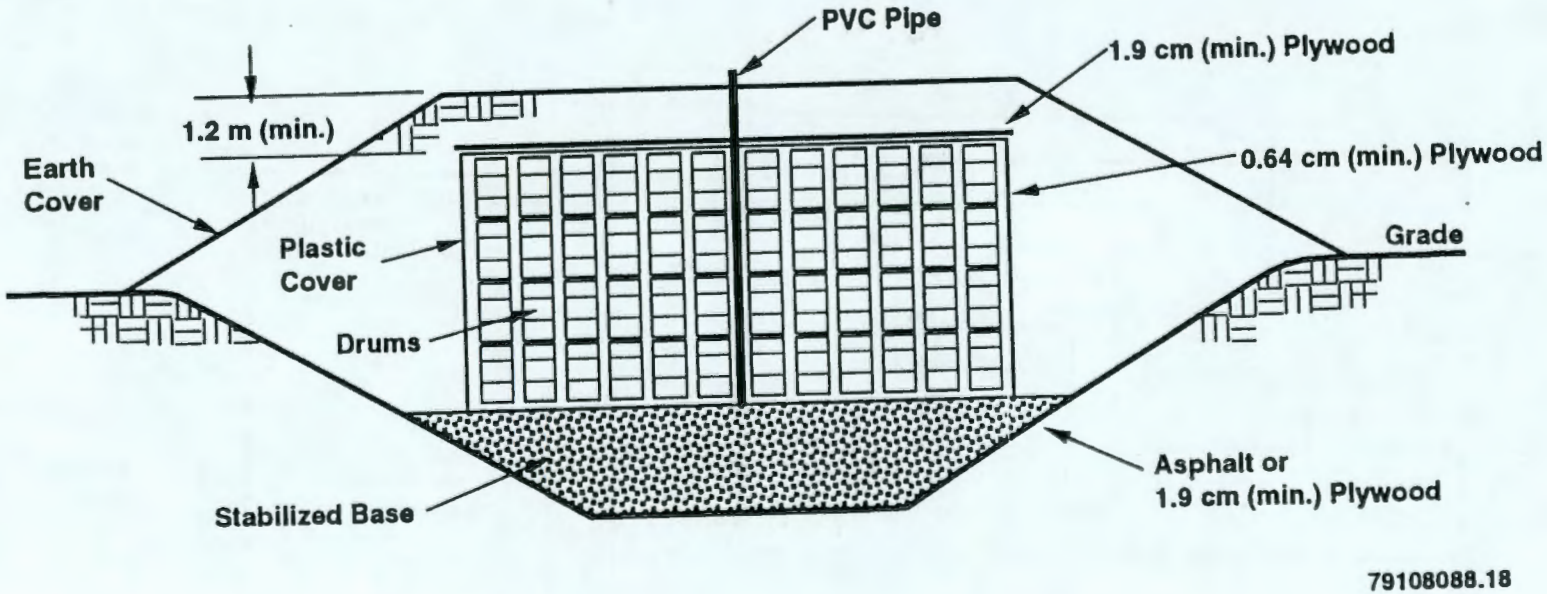
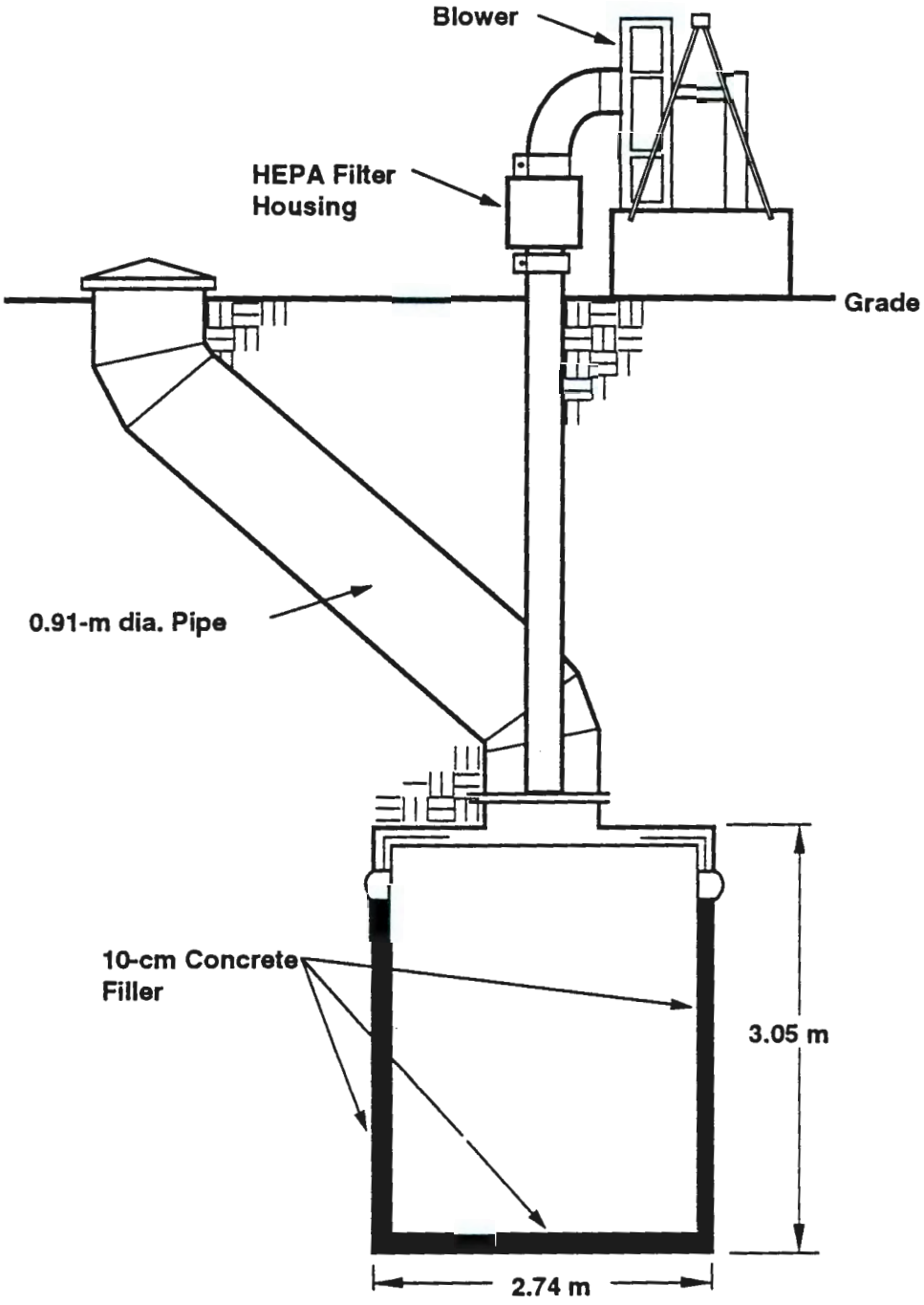


Figure 3-16. Typical Configuration of Retrievable Storage Unit for Contact-Handled Waste.

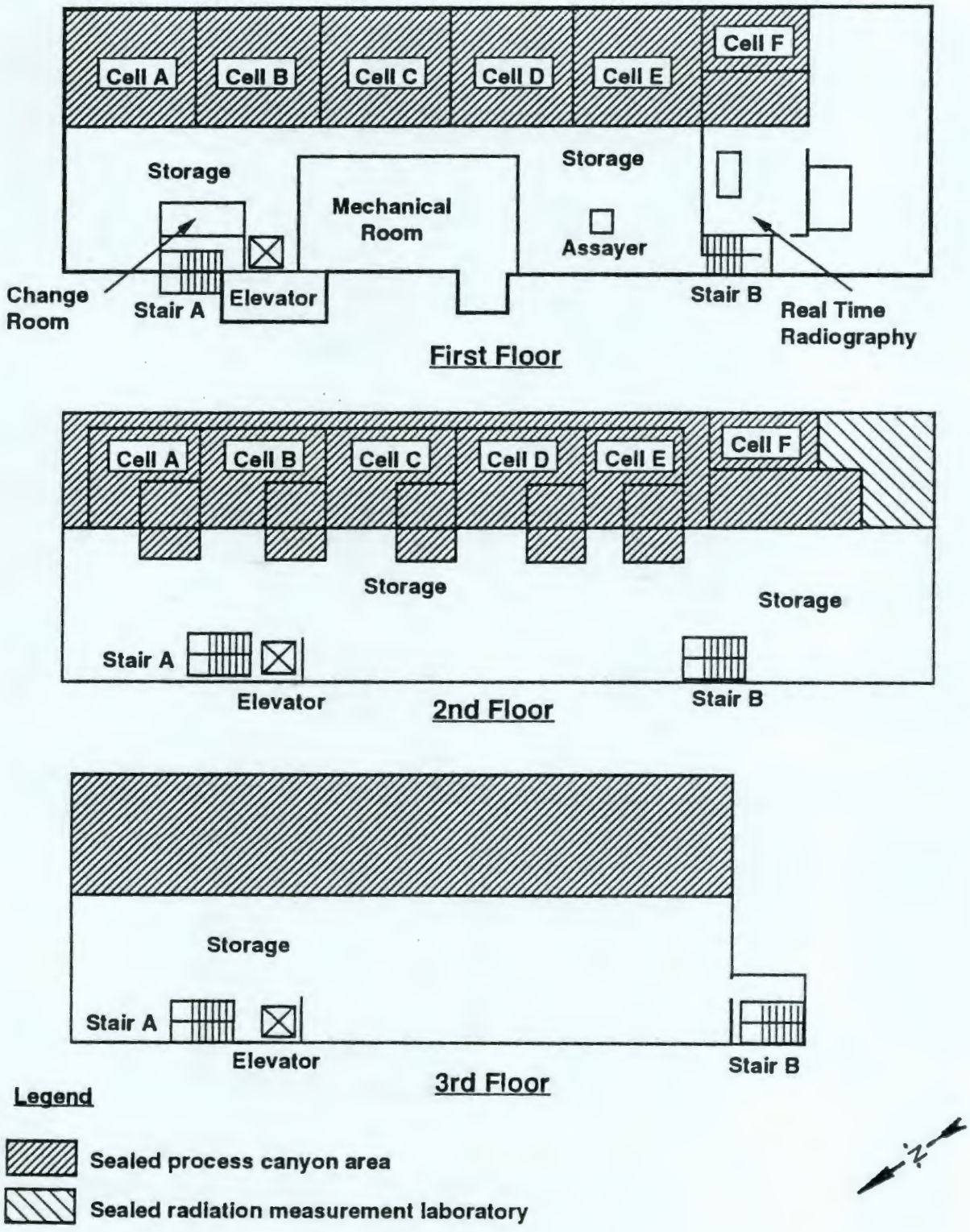
Figure 3-17. Typical Configuration of a Retrievable Storage Unit for Remote-Handled Waste.



HEPA high-efficiency particulate air

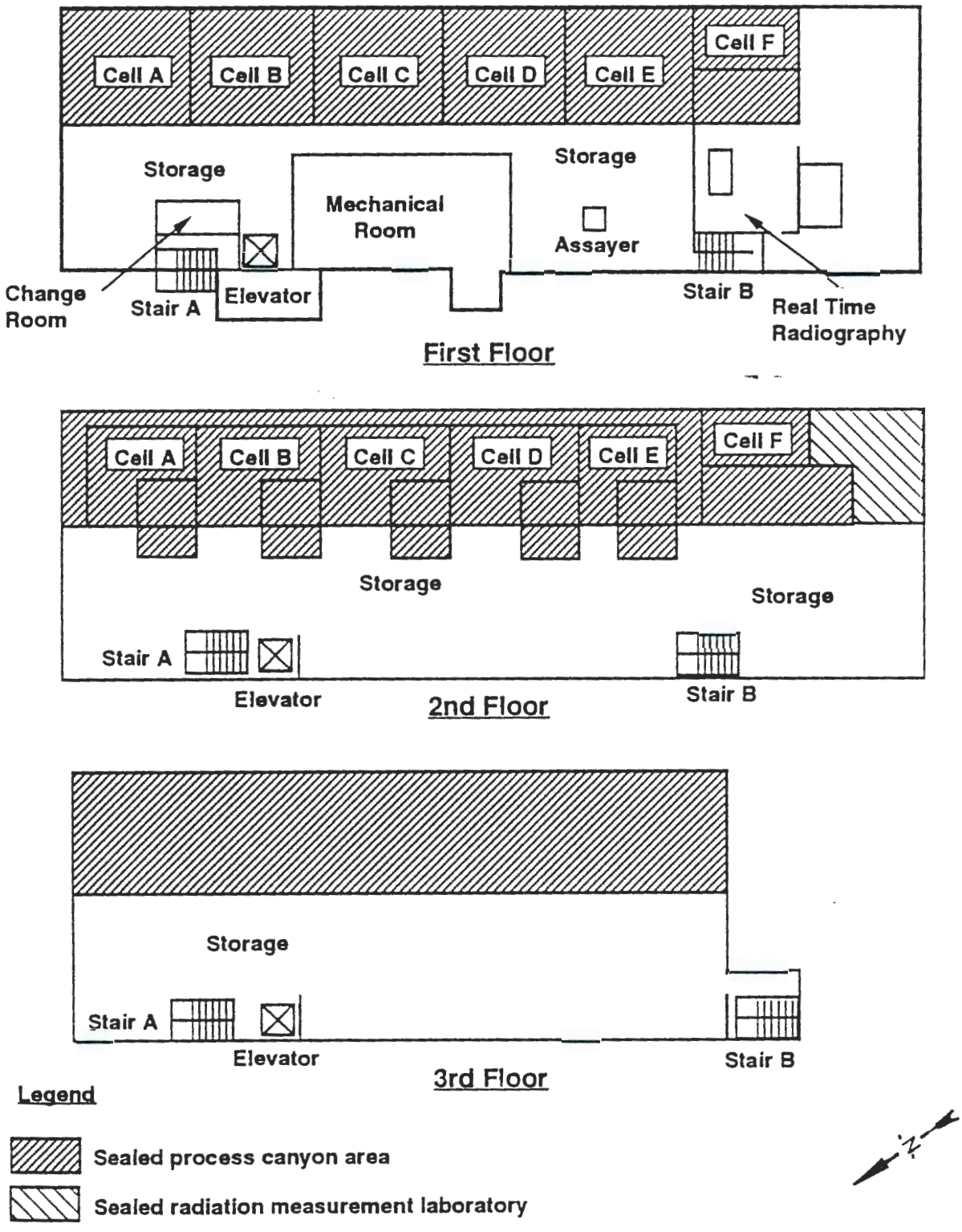
79108088.19

Figure 3-18. Transuranic Storage and Assay Facility Floor Plan.



9 3 1 2 9 3 7 1 0 0 0

Figure 3-18. Transuranic Storage and Assay Facility Floor Plan.



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4.0 REFERENCES

4.1 DOCUMENTS

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