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1994 Report on Hanford Site Land Disposal Restrictions for Mixed Waste

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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-26-01D.

The U.S. Department of Energy, its predecessors, and contractors at the Hanford Site were involved in the production and purification of nuclear defense materials from the early 1940s to the late 1980s. These production activities have generated large quantities of liquid and solid radioactive mixed waste. This waste is subject to regulation under authority of both the *Resource Conservation and Recovery Act of 1976*[2] and *Atomic Energy Act of 1954*.[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 radioactive mixed waste. This report is the fourth update of the plan first issued in 1990.

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Tri-Party Agreement negotiations completed in 1993 and approved in January 1994 changed and added many new milestones. Most of the changes were related to the Tank Waste Remediation System and these changes are incorporated into this report.

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 *Resource Conservation and Recovery Act of 1976* dangerous waste code(s), process information necessary to identify the waste and make LDR determinations, quantities stored, generation rates, location and

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[1]Ecology, EPA, and DOE, 1992, *Hanford Federal Facility Agreement and Consent Order*, Vol. 1 and 2, as updated by the fourth amendment dated January 25, 1994, 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.

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 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.

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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. 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 26,749 cubic meters per year to approximately 46,868 cubic meters per year. These rates are in the years 1998 and 1995, respectively.

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, 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, 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 574,000 cubic meters. About 366,000 cubic meters of this capacity is in units such as SSTs that no longer actively receive waste. Approximately 243,830 cubic meters of waste are currently in storage. The DSTs currently available are essentially filled to capacity. To alleviate the space shortage, up to six new DSTs are planned. The Liquid Effluent Retention Facility basins dedicated to 242-A Evaporator process condensate will be filled in mid 1995 and the storage space currently available at the Central Waste Complex is anticipated to be filled in 1999; however, additional buildings will be constructed as required to store waste generated in the future.

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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 pH adjustment and corrosion inhibitors and using 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 Module 2), separation of tank waste (pretreatment) into a low-level waste fraction and a high-level fraction which will both be vitrified, and development of an organic destruction process (the Treated Effluent Disposal Facility).

The Hanford Site 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.

The continued storage of land disposal restricted wastes until sufficient treatment and disposal capacity is available was negotiated as part of the Tri-Party 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

ALARA	as low as reasonably achievable
BDAT	best demonstrated available technology
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 of 1980*
CFR	*Code of Federal Regulations*
CUU	CU Column Aqueous Waste Stream
CWC	Central Waste Complex
CXP	CX Column Aqueous Waste Stream
D&AL	Development and Analytical Laboratories
D&D	Deactivation and Decommissioning
DBP	Di-Butyl Phosphate
DOE	U.S. Department of Energy
DOE-HQ	U.S. Department of Energy-Headquarters
DSS	Double-Shell Slurry
DSSF	Double-Shell Slurry Feed
DST	double-shell tank
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ETF	Effluent Treatment Facility
FFCA	Federal Facilities Compliance Act
FFTF	Fast Flux Test Facility
FR	*Federal Register*
FY	fiscal year
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
INEL	Idaho National Engineering Laboratory
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 Wastes and Treatment Options* (DOE 1990)
NCAW	neutralized current acid waste
NCRW	neutralized cladding removal waste
NEPA	*National Environmental Policy Act of 1969*
ORNL	Oak Ridge National Laboratory
PCB	polychlorinated biphenyl
PFP	Plutonium Finishing Plant

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ACRONYMS AND ABBREVIATIONS (cont)

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 Operations Office
RMC	Remote Mechanical "C" Line
RMW	radioactive mixed waste
SALDS	state-approved land disposal structure
SRS	Savannah River Site
SST	single-shell tank
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
TSCA	*Toxic Substances Control Act of 1976*
WAC	*Washington Administrative Code*
WDOE	Washington State Department of Energy
WERF	Waste Experimental Reduction Facility
WIPP	Waste Isolation Pilot Plant
WRAP	Waste Receiving and Processing (Facility)

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1.0 INTRODUCTION

The baseline land disposal restrictions (LDR) 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. 1992). 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 at 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.

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The original plan was published in October 1990. This is the fourth 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, 1993, to March 31, 1994.

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 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, 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 the National Report to the EPA. 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 DOE to identify any additional waste that was restricted from land disposal as a result of this Thirds rule.

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In 1994, revised WAC 173-303 regulations incorporated federal LDR standards by reference.

This report describes 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 are frequently 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 report combine several of the waste streams identified in the National Report and the case-by-case extension petition. 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.

Discussions with the regulators were completed in 1993 regarding major modifications to the Tri-Party Agreement milestones, particularly those that address the Tank Waste Remediation System. Included were key areas of this report, such as modifying concepts of single-shell tank (SST) and double-shell tank (DST) waste retrieval and characterization, changes to the Hanford Waste Vitrification Plant (HWVP) schedule, and replacement of the grout treatment system with a new low-level waste (LLW) vitrification facility. These changes were approved on January 25, 1994, and the new milestones are incorporated into this report. In many ways, these changes simplify LDR compliance,

because both low-level and high-level tank wastes will now be subjected to vitrification at temperatures high enough to extract or destroy regulated organics to levels below treatment standards in the final treated waste form.

1.2 ASSUMPTIONS

This section lists key milestones and assumptions used to prepare this plan.

The most significant Tri-Party Agreement (Ecology et al. 1992) milestones related to the management of LDR waste are identified below, including approved change requests.

- Complete separation of tank waste into low-activity and high-activity fractions by December 2028 (M-50-00). This milestone includes initiation of operations by December 2004 (M-50-02) to support operation of LLW treatment facility.

- Complete vitrification of LLW by December 2028 (M-60-00). The waste treatment facility (vitrification) will begin operations in June 2005 (M-60-05). This facility replaces the former LLW disposal method (grout), which has been canceled because of negative public opinion.

- Complete vitrification of high-level waste (HLW) by December 2028 (M-51-00). Operation of the HLW Vitrification Plant will be delayed until December 2009 (M-51-03).

- Construct two new DSTs by December 1997 and up to four additional DSTs by December 1998 (M-42-00).

- Complete SST interim stabilization by September 2000 (M-41-00).

- Complete closure of all SST farms by September 2004 (M-45-00). This milestone includes a requirement to initiate tank waste retrieval from one SST by December 2003 (M-45-05T1).

- Issue Tank Characterization Reports for all SSTs and DSTs by September 1999 (M-44-00).

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

- An initial commitment was to complete construction and initiate operation of a low-level mixed waste laboratory by January 1992 (M-14-00). U.S. Department of Energy, Richland Operations Office (RL) has decided to use offsite laboratory support for low-level mixed waste analysis and thereby did not meet this milestone. As a participant in the dispute resolution process on Milestone M-14-00, RL agreed to a $100,000 penalty. It was also determined that it must be demonstrated that analysis needs can be satisfied using a combination of commercial offsite laboratory capacity and a downsized onsite laboratory that has been built. The new M-14-00

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requires compliance with the senior executive committee agreement on resolution of the M-14-00 change request dispute by October 1995. 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 Effluent Treatment Facility (ETF) by June 1995 (M-17-14).

- Issue tank characterization reports for 177 HLW tanks by September 1999 (M-44-00).

- 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).

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The following are key assumptions that have been used to develop the treatment plans and schedules for DST waste (WHC 1990a) and assumptions related to the use of tank space.

- The pretreatment methods to be developed will include acceptable technology to separate the waste into LLW and HLW so that the bulk of chemical waste is in the LLW, and the bulk of radionuclides are in the HLW.

- Pretreated waste from all DSTs and SSTs will be provided to the LLW and HLW vitrification facilities, using selective blending if necessary.

- The level of organics in DST and SST waste received from pretreatment will be treatable by vitrification, and the glass waste forms will fully comply with leachability requirements.

- Space in DSTs, including six proposed new tanks, will be available to support DST and SST waste disposal activities.

- The 242-A Evaporator will restart in March 1994. A treatment unit for 242-A Evaporator process condensate will be available in June 1995.

- The Plutonium-Uranium Extraction (PUREX) Plant was notified to begin shutdown activities in September 1992. 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 new 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. As part of the cleanup activities in PUREX and B Plant, waste may be sent to aging waste tank storage. (In CY 1993, 27,000 gallons were transferred to aging waste DSTs.)

- Liquid waste from SSTs will continue to be transferred to DSTs as part of the stabilization program for the SSTs.

- The HLW and LLW vitrification processes will recycle all liquid effluent streams (i.e., they will not produce waste streams subject to the LDRs that require tank storage).

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. 1992) 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 will be consistent with the work schedules contained in Appendix D of the Tri-Party Agreement (Ecology et al. 1992) 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, will be implemented via the Change Control System process defined in Section 12.0 of the Tri-Party Agreement.

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Tri-Party Agreement Milestone M-26-01 (Ecology et al. 1992) also requires that appropriate new milestones be proposed through this annual report. No new milestones are proposed for this reporting period. The recent Tri-Party Agreement renegotiation added a significant number of milestones (Amendment 4 approved January 25, 1994), including many regarding SST and DST retrieval and treatment.

The LDR milestone planning process exercised by DOE and its contractors also involves consideration of 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 will 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 will be included, as appropriate, in Tri-Party Agreement quarterly progress reports, and summarized each year, as required by Milestone M-26-01.

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1.5 ACTIVITIES AND ACHIEVEMENTS

This section summarizes major activities and accomplishments related to compliance with LDRs from about April 1, 1993, through March 31, 1994.

- The renegotiations to the Tri-Party Agreement were signed into action on January 25, 1994, substantially changing the projected future of the Hanford Site cleanup.
- Successfully tested a Rotary Mode Core Sampling Drill on simulated waste.
- Completed research, development, and installation of the Hard Salt Cake Sampler and the Hydrostatic Balance System per Tri-Party Agreement Milestone M-10-13-T2.
- Continued construction of the laboratory hot cell complex, which is scheduled to be operational in June 1994 for analysis of high-level radioactive mixed waste.
- Submitted selection criteria, retrieval approach, and recommendation for Tank 106-C as the first SST to be retrieved.
- Issued the Pretreatment Technology Plan, defining the long-range integrated program for Tank Waste Remediation System pretreatment development, and completed the Waste Pretreatment Feed Optimization study.
- Obtained 20 core samples and issued safety screening analyses for 14 SSTs.
- Obtained 10 auger samples and issued safety screening analyses results for 7 samples.

- Completed characterization of three DST tanks (102-AP, 105-AP, and 106-AN).

- Issued the approved Multifunction Waste Tank Facility advanced Conceptual Design Report.

- Initiated settling test for neutralized current acid waste (NCAW) in-tank solids washing, completing Milestone M-02-00-T07.

- In the process of completing the paperwork and obtaining shipping containers to remove all waste from the 4843 Sodium Storage Facility. Per current planning, waste will be moved in summer 1994 to the Solid Waste Operations Complex.

- Several activities related to the *Federal Facilities Compliance Act* (FFCA) of 1992 were completed in 1993. The Mixed Waste Inventory Report for Hanford Site mixed wastes was submitted to U.S. Department of Energy-Headquarters (DOE-HQ). The chief financial officer's report questionnaire was completed and forwarded to DOE-HQ, and Conceptual Site Treatment Plan Tables 8-1 and 8-2 were submitted as requested. Also, a data call for all mixed waste inventory data was completed and submitted to compile a national database for submittal to the states. It will also determine a national treatment strategy for all DOE sites.

- National Treatability groupings established for the FFCA by DOE-HQ have been adopted at the Hanford Site and have been used in all submittals for the FFCA responses.

- Initiated construction of Project W-025, Mixed Waste Disposal Trench. This is a geotextile-lined trench with a leachate collection system that meets LDR requirements and that will dispose of RCRA-compliant low-level mixed waste. The design capacity of the trench is 23,000 m^3 of packaged waste. It is located in the 200 West Area and will be completed in spring 1994.

- Initiated the study of privatization of various Hanford Site solid waste operations. Mixed waste treatment, storage, and disposal; incineration; and burial ground operations have been considered as viable options for privatization. Discussions continue with interested parties, DOE-RL, and the state.

- A backlog of dangerous waste had accumulated in some generating units in excess of the 90-day regulatory limit. An internal assessment completed in June 1992 identified container management problems. A subset of the backlog waste ("unknowns") is at T Plant for opening, sampling, and repackaging. Approximately 201 drums have been processed and are being shipped to the Central Waste Complex (CWC). Repackaging of 58 boxes was completed in 1994. The Waste Analysis Plan for the backlog waste program was negotiated with and approved by Ecology. More than 5,000 containers were managed through this program. Further details are located in Section 3.1.3.1 of this report.

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- A moratorium on offsite shipment of potentially radioactive hazardous and polychlorinated biphenyl (PCB) wastes was placed by DOE-HQ. RCRA LDR wastes that are believed to not be radioactive remain in storage onsite. This is inconsistent with the prohibition on such storage. On September 30, 1993, DOE-HQ approved proposed radioactive determination procedures and conditionally lifted the moratorium. Efforts have begun to sample wastes stored at 616 and CWC for radioactive content. Nonradioactive waste will be released for offsite disposal.

- Six additional submarine reactor compartments were received for storage in the 200 West Area, bringing the total to 36.

- Received approval to initiate construction of WRAP Module 1 (KD3 authorization) project W-026, Tri-Party Agreement Milestone M-18-00, from DOE-HQ on November 4, 1993. Groundbreaking for the construction of WRAP will take place in April 1994.

- Transferred a portion of waste in SSTs BX-110 and BX-111 to DSTs to reduce leakage.

- The spent distillation vessels from hexone waste distillation were overpacked and moved to mixed waste storage. Nine hundred gallons of solvent-saturated water are scheduled to be incinerated offsite in 1994. (The much larger quantities of distilled hexone were incinerated offsite in previous years.)

- The DOE-HQ in December 1993 announced its decision to begin the process of shutting down the Fast Flux Test Facility (FFTF). The facility had been in a hot standby condition since April 1993.

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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 from 1970 to date
2. PUREX Aging Waste (inventory in DSTs)[a]	First extraction column fission products from PUREX Plant
3. SST Waste (inventory)[a]	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)[a]	Waste sodium from FFTF operations
6. PUREX Ammonia Scrubber Waste (inventory in DSTs)[a]	Waste generated from adsorption of gaseous ammonia from fuel processing operations
7. PUREX Process Condensate (generated during PUREX operation, inventory in DST)[a]	Condensed vapors from PUREX Plant operations
8. Hexone Waste (has been treated offsite)[a]	Hexone that had been planned for use in 202-S solvent extraction
9. 183-H Solar Evaporation Basins Waste (inventory)[a]	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 Storage Tunnel 2 Waste (silver)	Lead from discarded equipment and shielding; silver from discarded silver reactors
12. PUREX Containment Building (lead and cadmium)	Discarded lead and cadmium shielding and weights from PUREX
13. Central Waste 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)[a]	Containers of contaminated debris generated onsite and offsite up to 1987.

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

Stream name	Waste source
15. TRUSAF Stored Waste	Transuranic waste from onsite and offsite, packaged for eventual WIPP disposal.
16. 303-K Stored Waste	Temporary storage of 300 Area fuel fabrication solid and liquid wastes.

[a]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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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 Chapter 1.0, Section 1.2. These assumptions are summarized below.

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- The operation of waste pretreatment, treatment and disposal units will proceed as scheduled in the Tri-Party Agreement (Ecology et al. 1992).

- It is assumed that obligations of DOE arising under the Tri-Party Agreement will be fully funded. The DOE will take all necessary steps to obtain timely funding to meet its obligations under the Tri-Party Agreement. Ecology and EPA will assist U.S. Department of Energy, Richland Operations 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 of 1980* (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 1994. 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 develops for these wastes will be incorporated into future revisions of this report.

2.2 WASTE CHARACTERIZATION

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 waste will continue until the waste is disposed. Future characterization plans for the waste are summarized in Table 2-2. Individual waste streams are described in Chapter 3.0.

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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 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.

Using the F001 through F005 (spent halogenated and nonhalogenated solvents) waste codes 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 solvents, but because small quantities of waste discharged to the tanks in the past may have contained spent solvents. The potential for the past discharge of spent solvents to have contaminated essentially all of the waste in the tanks has resulted in the waste being designated F001 through F005. The tank waste does not comprise large quantities of organic solvents, as is typically the case for waste designated F001 through F005. The tank waste primarily is inorganic in nature with trace contamination by F001 through F005 solvents.

The schedule and means for reporting waste characterization data are outlined in the Tri-Party Agreement (Ecology et al. 1992) as amended by new Section 9.6, "Data Reporting Requirements." This section states that DOE will make available to Ecology and 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, 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

or a target compounds list. The time limits for reporting sample analyses are SST analyses, 216 days; hot cell analyses, 176 days; and low-level and mixed waste, 126 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 EPA and Ecology before being used to conduct analyses.

2.3 WASTE STORAGE

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The Hanford Site has 16 units, as defined by this report, that currently store mixed waste. These 16 units can be divided into two groups: (1) eight that are no longer actively 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 are currently receiving or could receive waste for storage to await treatment and disposal (DST waste, Liquid Effluent Retention Facility [for 242-A Evaporator Process Condensate], the three PUREX tunnel streams, CWC, 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 Central Waste Complex (CWC) and up to six new DSTs. After approximately three campaigns, the 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 directly from the 242-A Evaporator. After the Effluent Treatment Facility (ETF) 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 1994, the currently available DSTs are essentially filled to capacity. The latest plans are to design and construct up to six additional tanks. This is in accordance with Tri-Party Agreement (Ecology et al. 1992) Milestone M-42-00, with a completion date of December 1998.

The CWC is projected to reach its capacity in 1999. This projection is based on the individual projections of all generators who ship waste to the CWC and the availability of planned storage and treatment facilities. 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 Permit application submittal date for the mixed waste storage unit 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 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.

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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 as of December 31, 1993, the Hanford Site stores approximately 243,830 cubic meters of radioactive mixed waste. The bulk of this waste (97%) is stored in the SSTs (57.2%) and DSTs (39.8%). The table also indicates how much waste is LLW, TRU waste, or 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 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 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. Additionally, ignitable (D001) and corrosive (D002) wastes must be treated to remove any underlying hazards, in accordance with recently imposed requirements for wastes (58 FR 29860, "Land Disposal Restriction for Ignitable and Corrosive Characteristic Wastes Whose Treatment Standards Were Vacated"). For example, if a waste is ignitable (D001) and

TCLP toxic for chromium (D007), the waste must be treated for the characteristics of ignitability, TCLP toxicity[1], and for the presence of any contaminants listed in the F039 list reasonably expected to be present.

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 Tunnel 2 (silver) (Chapter 3.0, Section 3.11)
- PUREX Containment Building Storage (lead and cadmium) (Chapter 3.0, Section 3.12)
- CWC Stored LLW, TRU Waste, and 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. All of the contributing streams to the DST system are combined as one, because all will be pretreated into HLW and LLW

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[1]Wastes that exceed TCLP standards are not subject to the LDRs because of 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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streams and vitrified similarly (Table 2-6). The schedule for the operation of the treatment units is provided in Figure 2-1.

Applicable treatment alternatives are described in Chapter 3.0. The use of offsite commercial treatment technologies is currently under consideration for some waste streams. (The hexone waste stream, containing very low levels of radioactivity, has previously been incinerated off site.) The use of onsite commercial technologies is also possible. A private firm has proposed to build and operate a high-level vitrification system using French technology. This proposal is under consideration. The use of commercial technologies is likely to play a major role in site remediation work (primarily under CERCLA regulations). Certain solid waste treatment operations, such as WRAP Module IIA, are planned to be privatized.

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 because of chemical content. Further details on accelerated treatment are located in the individual waste stream treatment discussions in Chapter 3.0.

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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 and is evaporated at the 242-A Evaporator to reduce the tank waste volume. Before treatment for disposal, the waste will be separated (i.e., pretreated) into two streams: a LLW stream and a HLW/TRU stream. The HLW stream may undergo additional treatment as necessary to further reduce its volume and increase radionuclide loading.

Before disposal, appropriate testing of the LLW and HLW/TRU products will be conducted to ensure the 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 may be disposed of at WIPP near Carlsbad, New Mexico; and the LLW will be disposed of near surface on the Hanford Site. Figure 2-2 depicts 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, with startup scheduled for December 2004 for the LLW stream and June 2008 for the HLW/TRU waste stream. Startup is scheduled for the LLW vitrification facility in June 2005 and the HLW/TRU waste vitrification facility in 2009; 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. The planning base for SSTs is to retrieve all the waste and transfer it to DSTs where it will then be separated into LLW and HLW/TRU waste fractions (via pretreatment) which will both be vitrified for disposal; the same as for DST waste shown in Figure 2-2.

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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 the Effluent Treatment Facility (ETF) is constructed. The ETF is being designed and will be constructed and operated to destroy organic constituents and to remove radioactive and certain inorganic constituents. The ETF 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 originally scheduled to be issued in October 1992. The permit will allow testing of actual 242-A Evaporator process condensate 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 off site for ultimate disposal by independent contractors. Mixed waste will be transported to the CWC. This is currently planned for summer 1994. 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 was no longer 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.

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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 less than 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.

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 off site for incineration. The treatment reduced the hexone to carbon dioxide and water. Incineration is 97% complete, with the final waste batch to be incinerated in March or April 1994. Spent distillation vessels were sent to the Mixed Waste Storage complex for storage and treatment. Approximately 500 gallons of distillation tars remain in the storage tanks. A closure plan has been submitted to Ecology, and the tanks are awaiting closure.

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 CWC 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 Containment Building (Lead and Cadmium)

The PUREX Plant waste includes lead solids, mercury, and silver waste stored in the PUREX tunnels and lead and cadmium solid waste stored in the PUREX Containment Building. 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 achieves the constituent concentration limits is applicable for the silver waste. Treatments have not been selected yet.

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2.4.11 Central Waste 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 CWC consists of low-level and TRU mixed waste, some of which is co-contaminated with PCBs. 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 CWC 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 to separate the radioactive and hazardous components. Retrievably stored LLW and TRU wastes are primarily 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 is processed/treated at the WRAP Facility so it is acceptable for permanent disposal. The proposed treatments comply with the 55 FR 22520 and WAC 173-303-140 treatment requirements. The specific processes to be used currently are being selected. Also, privatization options are currently under study to determine feasibility and practicability. The PCBs will be stored until treatment capacity is identified. Figure 2-4 depicts the CWC 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 CWC for treatment by the WRAP Facility. The CWC 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. Waste that is generated is characterized to obtain information on quantity generated, hazardous constituents, and their concentration.

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 pollution prevention opportunity assessments. This methodology requires that a pollution prevention opportunity assessment team be formed to evaluate each waste generating process selected.

The key elements for conducting pollution prevention opportunity assessments are to--

- Select a team leader who is familiar with the facility and its processes, waste generation, and waste management operations to head the team.
- Assemble a multidisciplined team and train them in the pollution prevention opportunity assessment process.
- Collect baseline information including process flow diagrams, material balances, waste quantities, and process description.

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- Develop waste minimization options including costs and savings.
- Evaluate options and recommend course of action.
- Document all work on pollution prevention opportunity 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.

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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. 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 Pollution Prevention group of the prime contractor to RL in periodic 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.

2.5.2 Program Objectives

The objectives of the waste minimization program are listed below.

- 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.

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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.

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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% 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 CWC 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.

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 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 because of 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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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. 1992). No variances have been scheduled to date.

The Tri-Party Agreement provides for extension of a schedule or a deadline upon receipt of a timely request for extension and when good cause exists for the requested extension. Any request for extension shall be submitted in writing and shall specify:

- The timetable and deadline or schedule for which the extension is sought
- The length of the extension sought
- The good cause for the extension
- Any related deadline or schedule that would be affected if the extension were granted.

Good causes for an extension include the following:

- An event of force majeure as defined in Article XLVII of the Tri-Party Agreement, subject to Ecology's reservation in Paragraph 147.
- A delay caused by another party's failure to meet any requirement of the Tri-Party Agreement
- A delay caused by invocation of dispute resolution to the extent provided by Paragraph 30(f) and Paragraph 59(I) or judicial order

- A delay caused, or which is likely to be caused, by an extension granted to another deadline or schedule
- Any other event or series of events mutually agreed to by the parties as constituting good cause.

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Table 2-1. Summary of Annual Waste Generation Projections.[a]

Waste stream	Projected generation (m^3)				
	1994	1995	1996	1997	1998
1. DST Waste (before evaporation)	7,800	11,300	11,300	12,100	11,300
2. PUREX Aging Waste	0	0	0	0	0
3. SST Waste	0	0	0	0	0
4. 242-A Evaporator Process Condensate	24,600	31,800	30,600	13,300	12,500
5. 4843 Sodium Storage Facility Waste	0	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)[b]	0	0	0	0	0
11. PUREX Storage Tunnels 1 and 2 Waste (lead) and Tunnel 2 Waste (silver)[b]	0	0	0	0	0
12. PUREX Containment Building (lead and cadmium)[b]	0	0	0	0	0
13. CWC Stored Low-Level, TRU, and PCB Waste	4,273	3,502	3,205	2,877	2,683
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	1	0	0	0	0
Total Projected Generation	36,940	46,868	45,371	28,543	26,749

[a]These generation rates are based on the assumptions of Chapter 1.0, Section 1.2.
[b]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.

CWC = Central Waste Complex.
DST = Double-shell tank.
PCB = Polychlorinated biphenyl.
PUREX = Plutonium-Uranium Extraction (Plant).
SST = Single-shell tank.
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	1994-1999 (M-44-00, Ecology et al. 1992)	• A Tank Waste Analysis Plan is under development using the results of the data quality objective process for characterization of all tanks. • Specific analysis will be determined by the data quality objectives process. • A tank characterization plan will also be developed using the data quality objectives process. The tank characterization plans will integrate the results of the various issue and process efforts into a specific sampling and analysis plan for a given tank.
2. PUREX Aging Waste	1994-1995 (Defense Nuclear Facilities Safety Board Commitment 93-95)	• The number of samples required and sampling methods will be determined by the data quality objectives process.
3. SST Waste	1994-1999 (M-44-00)	• The number of core samples from each SST will be determined by the data quality objectives process. • Samples will be analyzed according to the Tank Waste Analysis Plan.
4. 242-A Evaporator Process Condensate	Waste to be sampled in accordance with 242-A waste analysis plan	• 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. 1992).
7. PUREX Process Condensate	1990-1995, with other DST waste	• Waste analysis plan completed per M-23-03 (Ecology et al. 1992).

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

Waste stream	Schedule	Method, protocol, specific analyses
8. Hexone Waste	Waste characterization and treatment complete	• Distillation residue has been characterized. • Closure plan for hexone storage tanks submitted to Ecology 11/30/92. • Distillation vessels shipped to RMW storage.
9. 183-H Solar Evaporation Basins Waste	Waste characterization complete	• Characterization details contained in DOE/RL-90-39 (RL 1991c).
10. PUREX Storage Tunnel 2 Waste (mercury)	Waste characterization complete	• Characterization details contained in RL (1990b).
11. PUREX Storage Tunnels 1 and 2 Waste (lead) and Tunnel 2 Waste (silver)	Waste characterization complete	• Characterization details contained in RL (1990b).
12. PUREX Containment Building (lead and cadmium)	No further characterization is planned	NA
13. CWC 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. Engineering studies on raman spectroscopy and x-ray fluorescence are planned this year.

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

Waste stream	Schedule	Method, protocol, specific analyses
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.
16. 303-K Stored Waste	Waste characterization complete	NA

CWC = Central Waste Complex.
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 Operations Office.
SST = Single-shell tank.
TRU = Transuranic.
TRUSAF = Transuranic Waste Storage and Assay Facility.
WRAP = Waste Receiving and Processing (Facility).

Table 2-3. Hazardous Waste Designations.[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 (methyl ethyl ketone) 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	F001 (1,1,1-trichlorethane) F002 (methylene chloride) F003 (acetone and hexone) F004 (cresylic acid) F005 (methyl ethyl ketone) WT01 (toxic, extremely hazardous) WT02 (toxic)

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Table 2-3. Hazardous Waste Designations.[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 Containment Building (lead and cadmium)	D006 (TCLP cadmium) D008 (TCLP lead) WT01 (toxic)

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

Waste stream	Designated waste code(s)
13. CWC 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) WC02 (carcinogenic dangerous waste) WP01 (persistent extremely hazardous waste) WP02 (persistent dangerous waste) WT01 (toxic) WT02 (toxic)

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Table 2-3. Hazardous Waste Designations.[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) WC02 (carcinogenic dangerous waste) WP01 (persistent extremely hazardous 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) WC02 (carcinogenic dangerous waste) WP01 (persistent extremely hazardous waste) WT01 (toxic)

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Table 2-3. Hazardous Waste Designations.[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) D039 (perchlorethylene) F001 (spent halogenated degreasing solvents) F002 (spent halogenated solvents) WC02 (carcinogenic) WP01 (persistent) WT01 (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 CWC (waste stream 13 in this report).

CWC = Central Waste Complex.
DST = Double-shell tank.
PCB = Polychlorinated biphenyl.
PUREX = Plutonium-Uranium Extraction (Plant).
SST = Single-shell tank.
TCLP = Toxic characteristic leach procedure.
TRU = Transuranic.
TRUSAF = Transuranic Waste Storage and Assay Facility.

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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	111,800	1994	6/91	none
2. PUREX Aging Waste	DSTs	7,400	1994	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	1995	6/91	none
5. 4843 Sodium Storage Facility Waste	4843 Building	84,000 kg	NA[b]	6/91[c]	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]	6/91[c]	yes (Section 3.9.3)
10. PUREX Storage Tunnel 2 Waste (mercury)	PUREX Tunnel 2	d	NA[e]	12/91[f]	none
11. PUREX Storage Tunnels 1 and 2 Waste (lead) and Tunnel 2 Waste (silver)	PUREX Tunnels 1, 2	d	NA[e]	12/91[f]	none
12. PUREX Containment Building (lead and cadmium)	PUREX canyon	b	NA[e]	Closure Plan TBD	none
13. CWC 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]	12/93[c]	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.
[f]To be changed to a Closure Plan.

CWC = Central Waste Complex.
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	89,756[a]	1975	80	11	9	b	b	b
2. PUREX Aging Waste	DSTs	7,211[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	8	0	92	100	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 Tunnels 1 and 2 Waste (lead)	PUREX Tunnel 1 PUREX Tunnel 2	0.26[d]	1960	0	100	0	100	0	0
11b. PUREX Storage Tunnel 2 Waste (silver)	PUREX Tunnel 2	0.17[d]	1971	0	100	0	100	0	0
12. PUREX Containment Building (lead and cadmium)	PUREX Plant	0.29[d]	1987	0	100	0	100	0	0
13. CWC Stored Low-Level, TRU, and PCB Wastes	Various	5,118	1988	0	100	0	95	5	0
14. Retrievably Stored Low-Level and TRU Wastes	Various	2,184	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	5.5	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 96,967 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 Central Waste 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).

CWC = Central Waste Complex.
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 10)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
1. DST Waste (includes NCAW, NCRW, complex concentrate, and PFP waste)[b] (low-level fraction)						
F001	CCW	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
F002	CCW	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
F003	CCW	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
F004	CCW	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
F005	CCW	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
D001	deactivation	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
D002	deactivation	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
D003	deactivation	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
D004	CCWE	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
D005	CCWE	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
D006	CCWE	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
D007	CCWE	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
D008	CCWE	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
D009	CCWE	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
D010	CCWE	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
D011	CCWE	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
WT01	reduction	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
WT02	none	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
WC02	none	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
WP01	reduction	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
WP02	none	vitrification	TBD[c]	TBD[d]	TBD(onsite)	2005
Pretreated Complexed Concentrate Waste (high-level fraction)						
F001	CCW	vitrification	TBD[c]	TBD	repository	2009
F002	CCW	vitrification	TBD[c]	TBD	repository	2009
F003	CCW	vitrification	TBD[c]	TBD	repository	2009
F004	CCW	vitrification	TBD[c]	TBD	repository	2009
F005	CCW	vitrification	TBD[c]	TBD	repository	2009

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

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
D001	deactivation	vitrification	TBD[c]	TBD	repository	2009
D002	deactivation	vitrification	TBD[c]	TBD	repository	2009
D003	deactivation	vitrification	TBD[c]	TBD	repository	2009
D004	CCWE	vitrification	TBD[c]	TBD	repository	2009
D005	CCWE	vitrification	TBD[c]	TBD	repository	2009
D006	CCWE	vitrification	TBD[c]	TBD	repository	2009
D007	CCWE	vitrification	TBD[c]	TBD	repository	2009
D008	CCWE	vitrification	TBD[c]	TBD	repository	2009
D009	CCWE	vitrification	TBD[c]	TBD	repository	2009
D010	CCWE	vitrification	TBD[c]	TBD	repository	2009
D011	CCWE	vitrification	TBD[c]	TBD	repository	2009
WT01	reduction	vitrification	TBD[c]	TBD	repository	2009
WT02	none	vitrification	TBD[c]	TBD	repository	2009
WC02	none	vitrification	TBD[c]	TBD	repository	2009
WP01	reduction	vitrification	TBD[c]	TBD	repository	2009
WP02	none	vitrification	TBD[c]	TBD	repository	2009
2. PUREX Aging Waste High-level fraction						
D001	deactivation	vitrification	TBD[c]	TBD	repository	2009
D002	vitrification	vitrification	TBD[c]	TBD	repository	2009
D006	vitrification	vitrification	TBD[c]	TBD	repository	2009
D007	vitrification	vitrification	TBD[c]	TBD	repository	2009
D008	vitrification	vitrification	TBD[c]	TBD	repository	2009
Low-level fraction						
D001	deactivation	Vitrification	TBD[c]	TBD[d]	TBD (onsite)	2009
D002	deactivation	Vitrification	TBD[c]	TBD[d]	TBD (onsite)	2009
D006	CCWE	Vitrification	TBD[c]	TBD[d]	TBD (onsite)	2009
D007	CCWE	Vitrification	TBD[c]	TBD[d]	TBD (onsite)	2009
D008	CCWE	Vitrification	TBD[c]	TBD[d]	TBD (onsite)	2009

Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 3 of 10)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
3. SST Waste[e] High-level fraction						
F003	CCW	vitrification	TBD[c]	TBD	repository	2009
F005	CCW	vitrification	TBD[c]	TBD	repository	2009
D001	deactivation	vitrification	TBD[c]	TBD	repository	2009
D002	deactivation	vitrification	TBD[c]	TBD	repository	2009
D005	CCWE	vitrification	TBD[c]	TBD	repository	2009
D006	CCWE	vitrification	TBD[c]	TBD	repository	2009
D007	CCWE	vitrification	TBD[c]	TBD	repository	2009
D008	CCWE	vitrification	TBD[c]	TBD	repository	2009
D009	CCWE	vitrification	TBD[c]	TBD	repository	2009
D010	CCWE	vitrification	TBD[c]	TBD	repository	2009
D011	CCWE	vitrification	TBD[c]	TBD	repository	2009
Low-level fraction						
F003	CCW	vitrification	TBD[c]	TBD[d]	TBD (onsite)	2005
F005	CCW	vitrification	TBD[c]	TBD[d]	TBD (onsite)	2005
D001	deactivation	vitrification	TBD[c]	TBD[d]	TBD (onsite)	2005
D002	deactivation	vitrification	TBD[c]	TBD[d]	TBD (onsite)	2005
D005	CCWE	vitrification	TBD[c]	TBD[d]	TBD (onsite)	2005
D006	CCWE	vitrification	TBD[c]	TBD[d]	TBD (onsite)	2005
D007	CCWE	vitrification	TBD[c]	TBD[d]	TBD (onsite)	2005
D008	CCWE	vitrification	TBD[c]	TBD[d]	TBD (onsite)	2005
D009	CCWE	vitrification	TBD[c]	TBD[d]	TBD (onsite)	2005
D010	CCWE	vitrification	TBD[c]	TBD[d]	TBD (onsite)	2005
D011	CCWE	vitrification	TBD[c]	TBD[d]	TBD (onsite)	2005
4. 242-A Evaporator Process Condensate						
F001	CCW	destruction	ETF	TBD	SALDS	1995
F002	CCW	destruction	ETF	TBD	SALDS	1995
F003	CCW	destruction	ETF	TBD	SALDS	1995

Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 4 of 10)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
F005	CCW	destruction	ETF	TBD	SALDS	1995
WT02	none	removal	ETF	TBD	SALDS	1995
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 5 of 10)

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	TBD	TBD	TBD	TBD	TBD
P030	CCWE	TBD	WRAP	TBD	TBD	1999[f]
P120	stabilization	TBD	WRAP	TBD	TBD	1999[f]
P029	CCWE	TBD	WRAP	TBD	TBD	1999[f]
P106	CCWE	TBD	WRAP	TBD	TBD	1999[f]
P098	CCWE	TBD	WRAP	TBD	TBD	1999[f]
D007	CCWE	TBD	WRAP	TBD	TBD	1999[f]
WT01	reduction	TBD	WRAP	TBD	TBD	1999[f]
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.a PUREX Storage Tunnels 1 and 2 Waste (lead)						
D008	macro-encapsulation	TBD	TBD	TBD	TBD	TBD
WT01	reduction	TBD	TBD	TBD	TBD	TBD
11.b PUREX Storage Tunnel 2 Waste (silver)						
D001	deactivation	TBD	TBD	TBD	TBD	TBD
D011	CCWE	TBD	TBD	TBD	TBD	TBD
WT01	reduction	TBD	TBD	TBD	TBD	TBD
12. PUREX Containment Building (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

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

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
13. CWC Stored Low-Level, Transuranic, and PCB Wastes Low-level waste[h]						
F001	CCW	Incineration	TBD	TBD	TBD	1999[f]
F002	CCW	Incineration	TBD	TBD	TBD	1999[f]
F003	CCW	Incineration	TBD	TBD	TBD	1999[f]
F004	CCW	Incineration	TBD	TBD	TBD	1999[f]
F005	CCW	Incineration	TBD	TBD	TBD	1999[f]
D001	deactivation	TBD	WRAP	TBD	TBD	1999[f]
D002	deactivation	TBD	WRAP	TBD	TBD	1999[f]
D003	deactivation	TBD	WRAP	TBD	TBD	1999[f]
D004	CCWE	TBD	WRAP	TBD	TBD	1999[f]
D005	CCWE	TBD	WRAP	TBD	TBD	1999[f]
D006	CCWE	TBD	WRAP	TBD	TBD	1999[f]
D007	CCWE	TBD	WRAP	TBD	TBD	1999[f]
D008	macro-encapsulation	TBD	WRAP	TBD	TBD	1999[f]
D009	amalgamation	TBD	WRAP	TBD	TBD	1999[f]
D010	CCWE	TBD	WRAP	TBD	TBD	1999[f]
D011	CCWE	TBD	WRAP	TBD	TBD	1999[f]
D012	CCWE	TBD	WRAP	TBD	TBD	1999[f]
D016	CCWE	TBD	WRAP	TBD	TBD	1999[f]
WT01	reduction	TBD	WRAP	TBD	TBD	1999[f]
WT02	none	TBD	WRAP	TBD	TBD	1999[f]
WC02	none	TBD	WRAP	TBD	TBD	1999[f]
WP01	reduction	TBD	WRAP	TBD	TBD	1999[f]
WP02	none	TBD	WRAP	TBD	TBD	1999[f]
U080	CCWE	TBD	WRAP	TBD	TBD	1999[f]
U123	incineration	TBD	TBD	TBD	TBD	TBD
U161	CCWE	TBD	WRAP	TBD	TBD	1999[f]

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Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 7 of 10)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
P029	CCWE	TBD	WRAP	TBD	TBD	1999[f]
P030	CCWE	TBD	WRAP	TBD	TBD	1999[f]
P098	CCWE	TBD	WRAP	TBD	TBD	1999[f]
P106	CCWE	TBD	WRAP	TBD	TBD	1999[f]
P120	stabilization	TBD	WRAP	TBD	TBD	1999[f]
PCBs	incineration	TBD	TBD	TBD	TBD	TBD
Transuranic waste						
F003	None[g]	TBD	WRAP	TBD	WIPP	1999[f]
F005	None[g]	TBD	WRAP	TBD	WIPP	1999[f]
D001	None[g]	TBD	WRAP	TBD	WIPP	1999[f]
D002	None[g]	TBD	WRAP	TBD	WIPP	1999[f]
D006	None[g]	TBD	WRAP	TBD	WIPP	1999[f]
D007	None[g]	TBD	WRAP	TBD	WIPP	1999[f]
D008	None[g]	TBD	WRAP	TBD	WIPP	1999[f]
D009	None[g]	TBD	WRAP	TBD	WIPP	1999[f]
WT01	None[g]	TBD	WRAP	TBD	WIPP	1999[f]
WT02	None[g]	TBD	WRAP	TBD	WIPP	1999[f]
WC02	None[g]	TBD	WRAP	TBD	WIPP	1999[f]
PCBs	None[g]	TBD	TBD	TBD	WIPP	TBD
14. Retrievably Stored Low-Level and Transuranic Wastes Low-level waste						
F001	CCW	TBD	WRAP	TBD	TBD	1999[f]
F003	CCW	TBD	WRAP	TBD	TBD	1999[f]
F005	CCW	TBD	WRAP	TBD	TBD	1999[f]
D001	deactivation	TBD	WRAP	TBD	TBD	1999[f]
D003	deactivation	TBD	WRAP	TBD	TBD	1999[f]
D005	CCWE	TBD	WRAP	TBD	TBD	1999[f]
D006	CCWE	TBD	WRAP	TBD	TBD	1999[f]
D007	CCWE	TBD	WRAP	TBD	TBD	1999[f]

Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 8 of 10)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treat-ment date
D008	macro-encapsulation	TBD	WRAP	TBD	TBD	1999[f]
D009	amalgamation	TBD	WRAP	TBD	TBD	1999[f]
D011	CCWE	TBD	WRAP	TBD	TBD	1999[f]
WT01	reduction	TBD	WRAP	TBD	TBD	1999[f]
WT02	none	TBD	WRAP	TBD	TBD	1999[f]
WC02	none	TBD	WRAP	TBD	TBD	1999[f]
WP01	reduction	TBD	WRAP	TBD	TBD	1999[f]
PCBs	incineration	TBD	TBD	TBD	TBD	TBD
Transuranic waste						
D006	None[g]	TBD	WRAP	TBD	WIPP	1999[f]
D008	None[g]	TBD	WRAP	TBD	WIPP	1999[f]
WT01	None[g]	TBD	WRAP	TBD	WIPP	1999[f]
P015	None[g]	TBD	WRAP	TBD	WIPP	1999[f]
15. TRUSAF Stored Waste						
D002	none[g]	none	--	--	WIPP	--
D005	none[g]	none	--	--	WIPP	--
D006	none[g]	none	--	--	WIPP	--
D007	none[g]	none	--	--	WIPP	--
D008	none[g]	none	--	--	WIPP	--
D009	none[g]	none	--	--	WIPP	--
WC02	none[g]	none	--	--	WIPP	--
WP01	none[g]	none	--	--	WIPP	--
WT01	none[g]	none	--	--	WIPP	--
16. 303-K Stored Waste						
F001	CCW	TBD	WRAP	TBD	TBD	1999[f,i]
F002	CCW	TBD	WRAP	TBD	TBD	1999[f,i]
D001	deactivation	TBD	WRAP	TBD	TBD	1999[f]
D006	CCWE	TBD	WRAP	TBD	TBD	1999[f]

Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 9 of 10)

Wastes codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treatment date
D007	CCWE	TBD	WRAP	TBD	TBD	1999[f]
D008	macro-encapsulation	TBD	WRAP	TBD	TBD	1999[f]
D039	none currently promulgated	TBD	WRAP	TBD	TBD	1999[f]
WT01	none	TBD	WRAP	TBD	TBD	1999[f]
WC02	reduction	TBD	WRAP	TBD	TBD	1999[f]
WP01	reduction	TBD	WRAP	TBD	TBD	1999[f]

[a]Treatment required by 40 CFR 268. Nonwastewater category assumed for this table. Deactivation treatment standards (e.g. D001 waste) were affected by the May 24, 1993 emergency rule. These wastes must also be treated to meet F039 concentration standards.

[b]The new Tri-Party Agreement strategy calls for pretreatment of essentially all wastes within DSTs and SSTs, the resulting streams being processed through either a HLW or LLW vitrification facility. Therefore, the individual streams such as NCAW and NCRW have been combined to simplify the table.

[c]Vitrification facilities for both the LLW and HLW fractions resulting from pretreatment have yet to be designed.

[d]Treatment capacity for the LLW and HLW facilities have not been established. The LLW facility, however, will have a minimum capacity of 100 metric tons per day.

[e]Wastes will be retrieved from the SSTs to the extent needed for closure.

[f]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 2A, is approved, some activities will occur after 1999.

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

[h]Only a partial list of waste codes is given (see note for this stream in Table 2-3).

[i]These degreaser solvent wastes are to be sent off site for treatment.

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

CCW = Constituent concentrations in waste.
CWC = Central Waste Complex.
CCWE = Constituent concentrations in waste extract.
DST = Double-shell tank.
ETF = Effluent Treatment Facility.
LLBG = Low-level burial grounds.
LLW = Low-level waste.
LWVP = Low-level waste vitrification plant.
PCB = Polychlorinated biphenyl.
PUREX = Plutonium-Uranium Extraction (Facility).
SALDS = State-approved land disposal structure.
TBD = To be determined.
TRUSAF = Transuranic Waste Storage and Assay Facility.
WIPP = Waste Isolation Pilot Plant.
WRAP = Waste Receiving and Processing (Facility).

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	1995	>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 to be completed in 1994	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 (lead) and Tunnel 2 Waste (silver)	• 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 Containment Building (lead and cadmium)	• Reduce use of lead counterweights	ongoing	variable
13. CWC, 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 1994 (1 cubic meter). 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 because of a September 24, 1992 Secretarial decision to eliminate PUREX Operation as an option for processing N Reactor fuel.

[d]Assumes that the WRAP Facility, Module 2, will be included in the M-33-00 change package.

CWC = Central Waste Complex.
DST = Double-shell tank.
NA = Not applicable.
PCB = Polychlorinated biphenyl.
PUREX = Plutonium-Uranium Extraction (Facility).
SST = Single-shell tank.
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 17)

MILESTONE LEGEND
MAJOR ○M TARGET DATE ○T
INTERIM ○I INTEGRATION ▭

	CY 1994												CY 1995				1996	1997	1998	1999	2000
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1 QTR	2 QTR	3 QTR	4 QTR					
M-01-00 COMPLETE M GROUT CAMPAIGNS OF DOUBLE-SHELL TANK WASTE (DECEMBER 1996)	DELETED BY AMENDMENT FOUR DATED 01/25/94 - REPLACED BY M-60 MILESTONES																				
M-02-00 INITIATE PRETREATMENT OF DOUBLE-SHELL TANK WASTE (TBD)	DELETED BY AMENDMENT FOUR DATED 01/25/94 - REPLACED BY M-60 MILESTONES																				
M-03-00 INITIATE HANFORD WASTE VITRIFICATION PLANT OPERATIONS (DECEMBER 1999)	DELETED BY AMENDMENT FOUR DATED 01/31/94 - REPLACED BY M-61 MILESTONES																				
M-04-00 PROVIDE ANNUAL REPORTS OF TANK-WASTE TREATABILITY STUDIES (ANNUALLY)	DELETED BY AMENDMENT FOUR DATED 01/25/94																				
M-05-00 COMPLETE SINGLE-SHELL TANK INTERIM STABILIZATION (SEPTEMBER 1995)	DELETED BY AMENDMENT FOUR DATED 01/25/94 - REPLACED BY M-41 MILESTONES																				
M-06-00 DEVELOP SINGLE-SHELL TANK WASTE RETRIEVAL TECHNOLOGY AND COMPLETE SCALE MODEL TESTING (JUNE 1994)	DELETED BY AMENDMENT FOUR DATED 01/25/94 - REPLACED BY M-46 MILESTONES																				
M-07-00 INITIATE FULL-SCALE DEMONSTRATION OF WASTE RETRIEVAL TECHNOLOGY (OCTOBER 1997)	DELETED BY AMENDMENT FOUR DATED 01/25/94 - REPLACED BY M-45 MILESTONES																				
M-08-00 INITIATE FULL-SCALE TANK FARM CLOSURE DEMONSTRATION PROJECT (JUNE 2004)	DELETED BY AMENDMENT FOUR DATED 01/25/94 - REPLACED BY M-45 MILESTONES																				

NOTE: THIS SCHEDULE PROVIDES A 7 YEAR GRAPHIC PRESENTATION OF THE MILESTONES AND TARGET DATES CONTAINED WITHIN THE HANFORD FEDERAL FACILITY AND CONSENT ORDER

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Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 2 of 17)

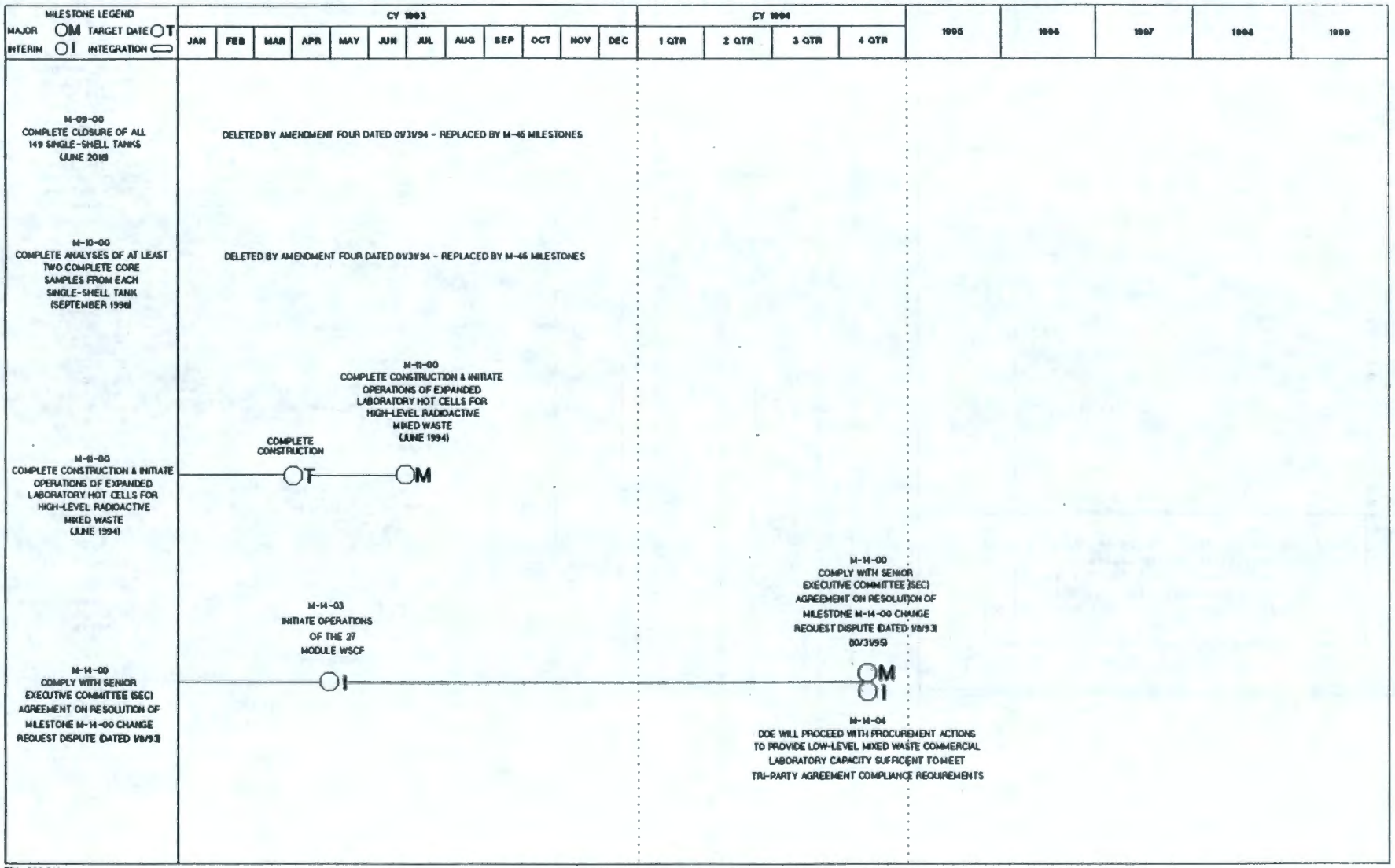

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Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 3 of 17)

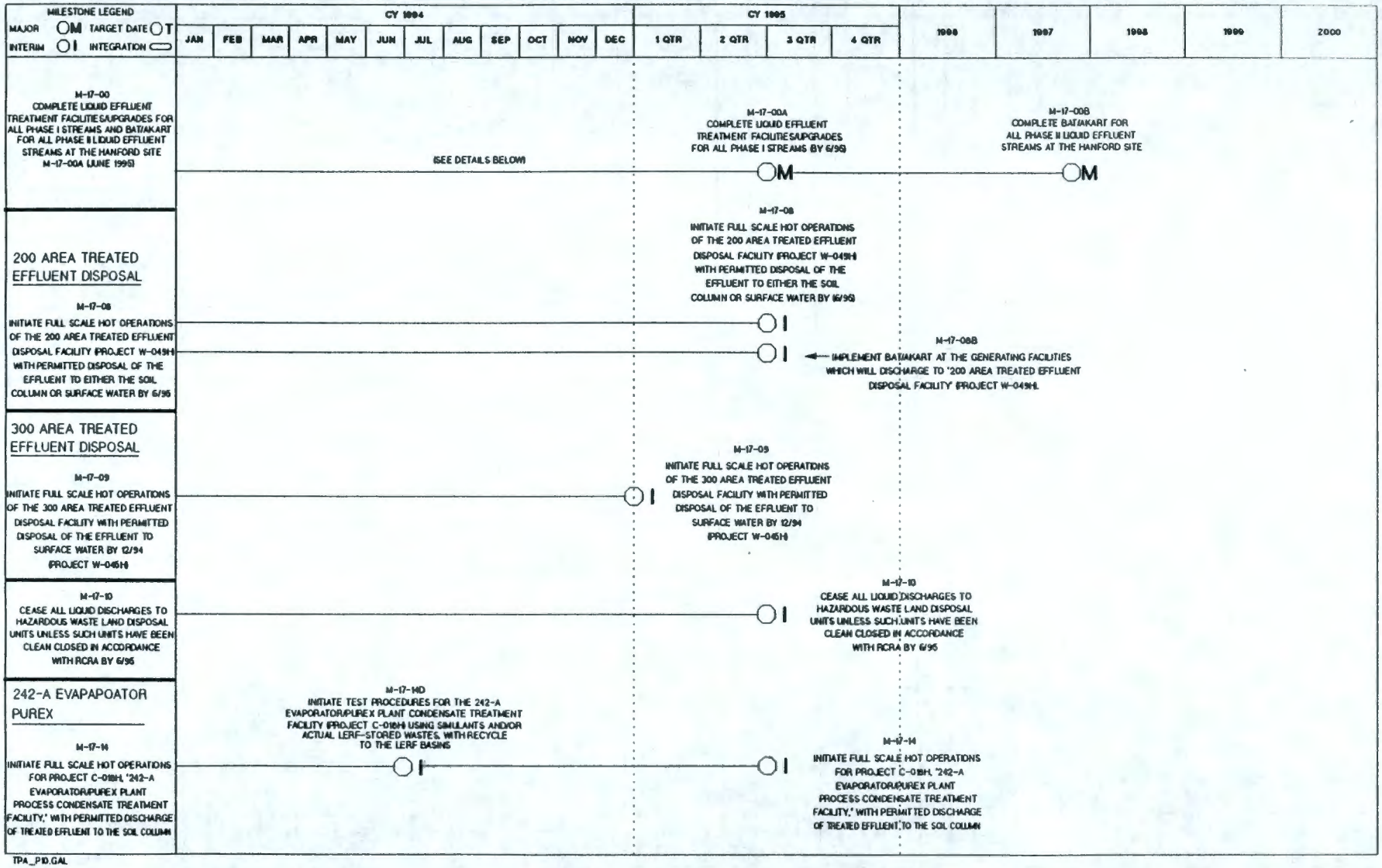
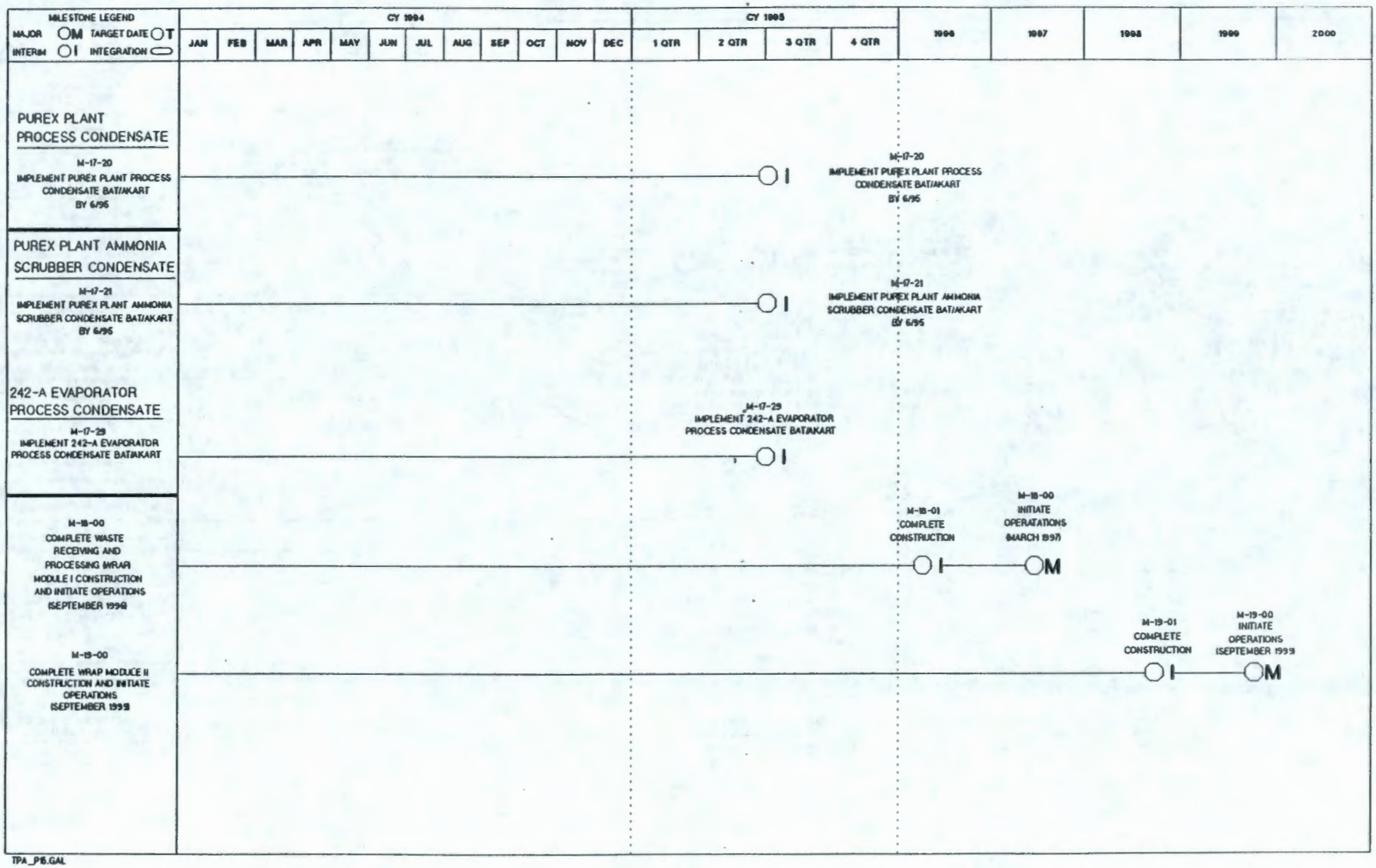


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 4 of 17)



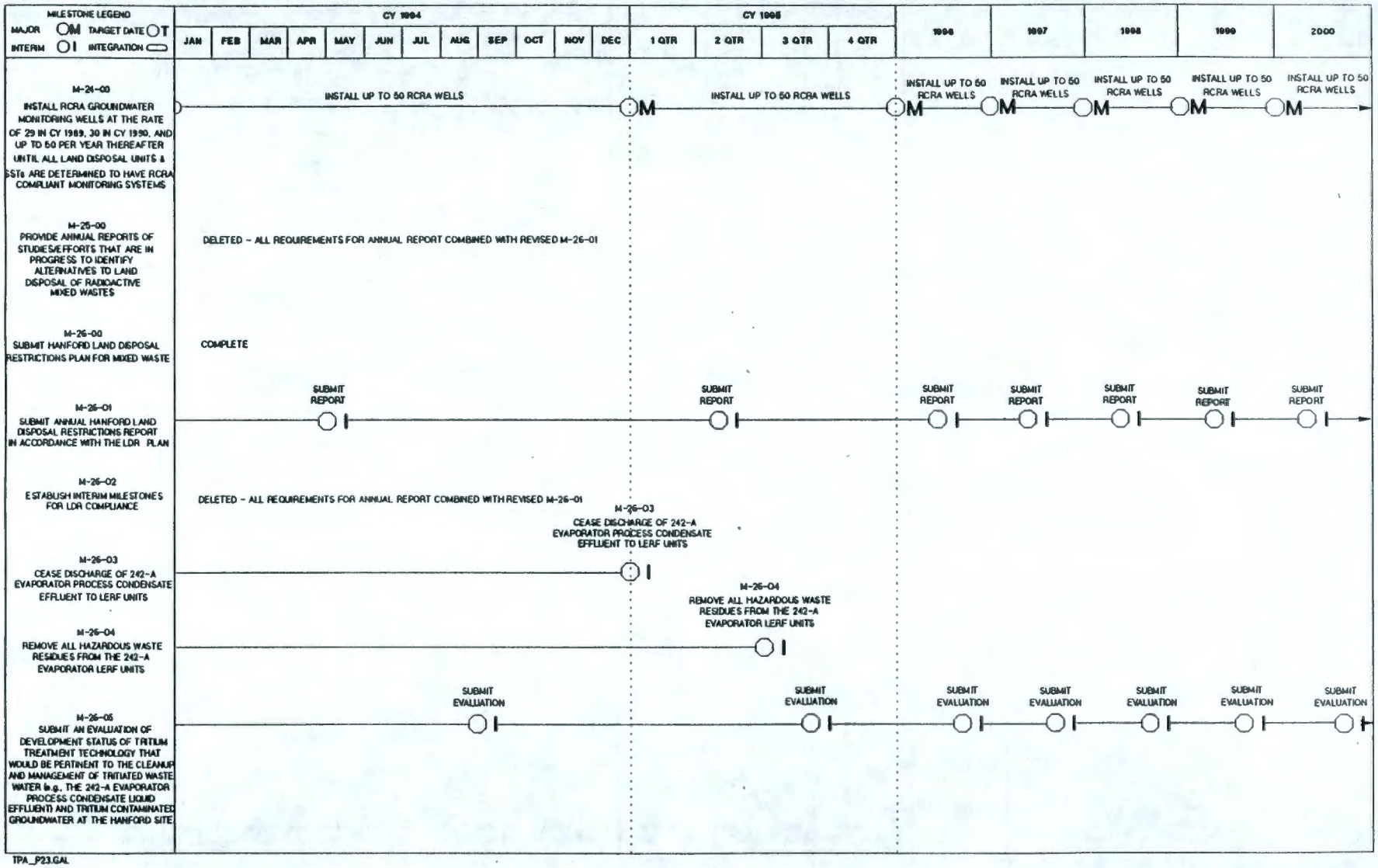


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 5 of 17)

Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 6 of 17)

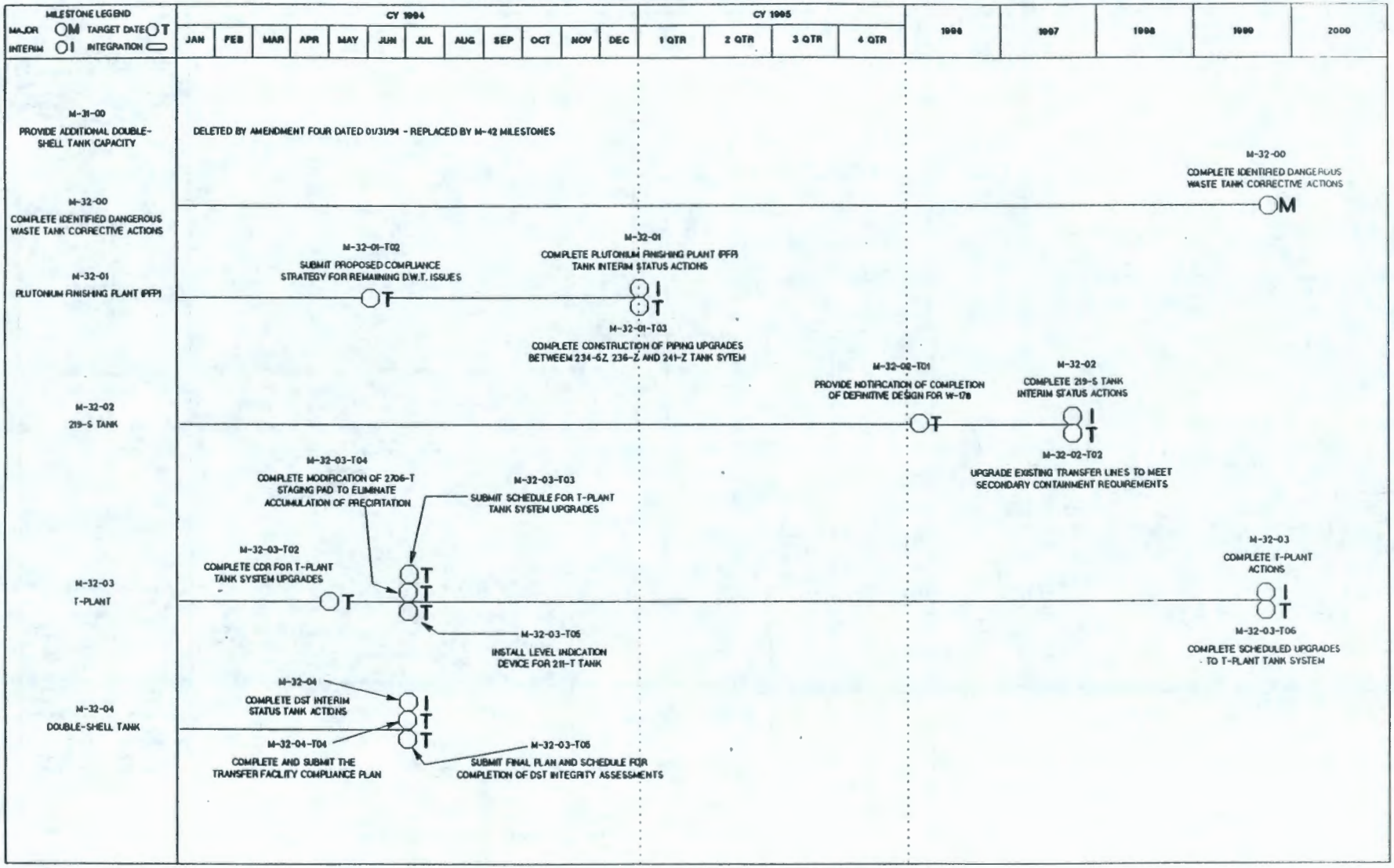


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Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 7 of 17)

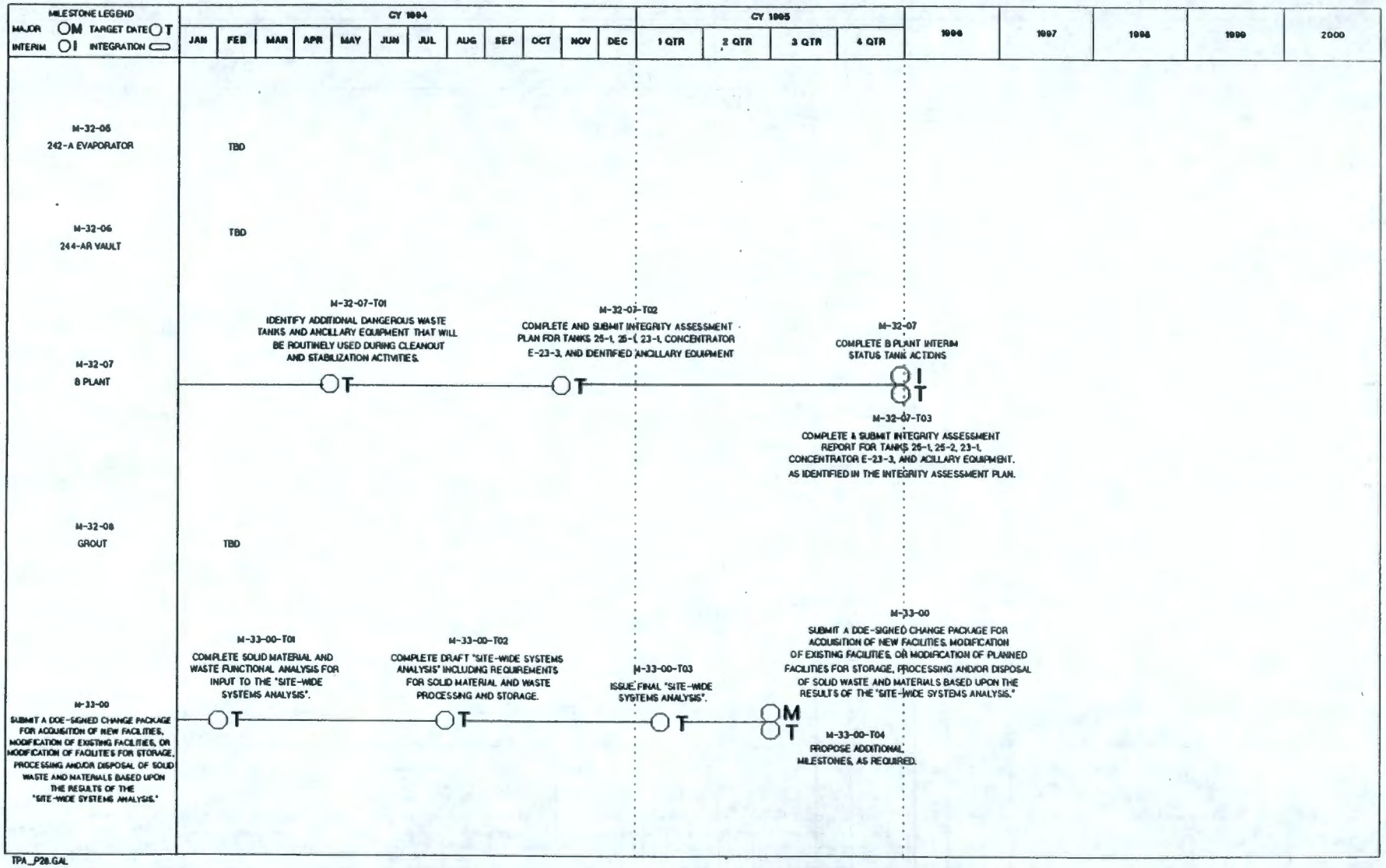

Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 8 of 17)

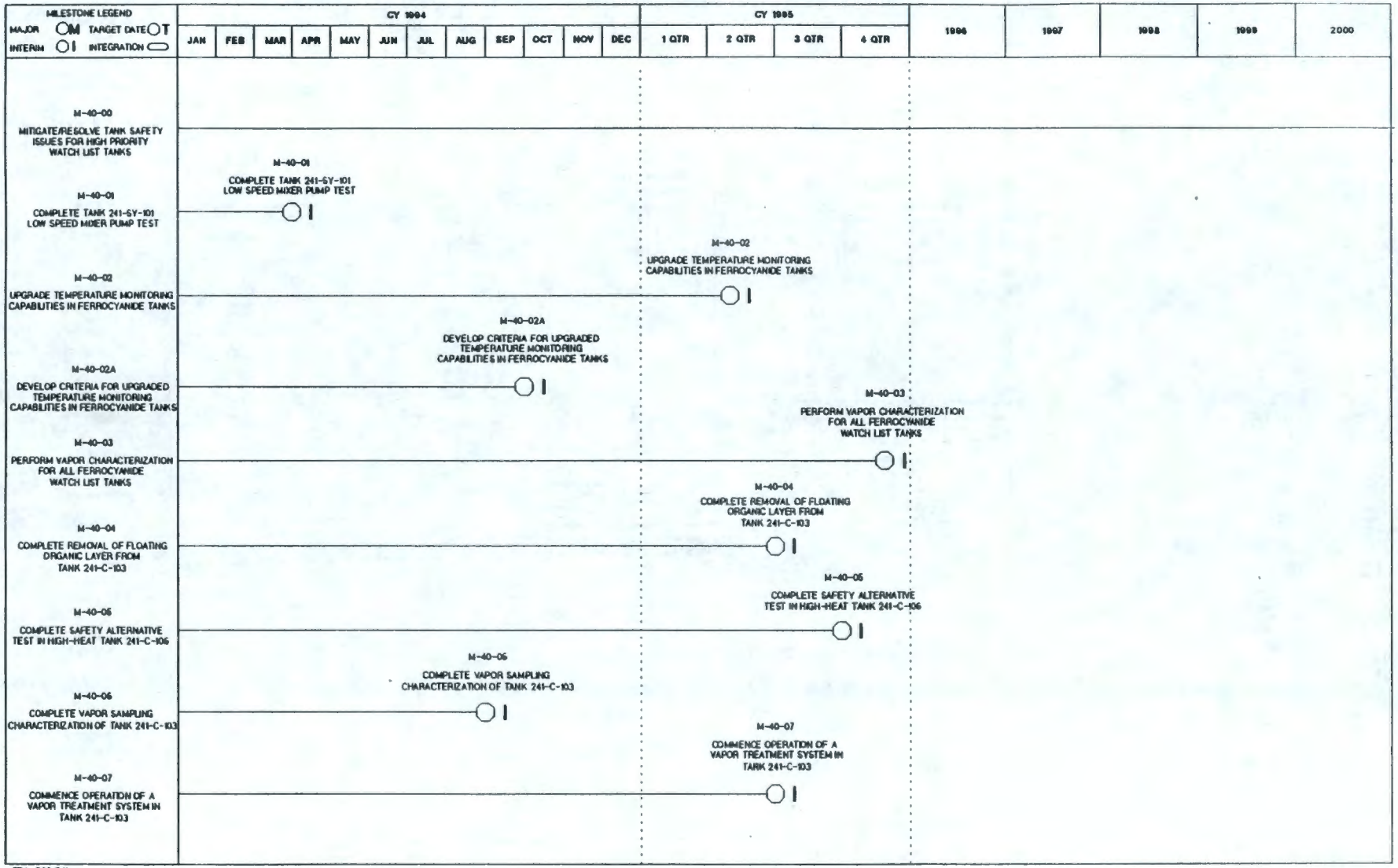

Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 9 of 17)

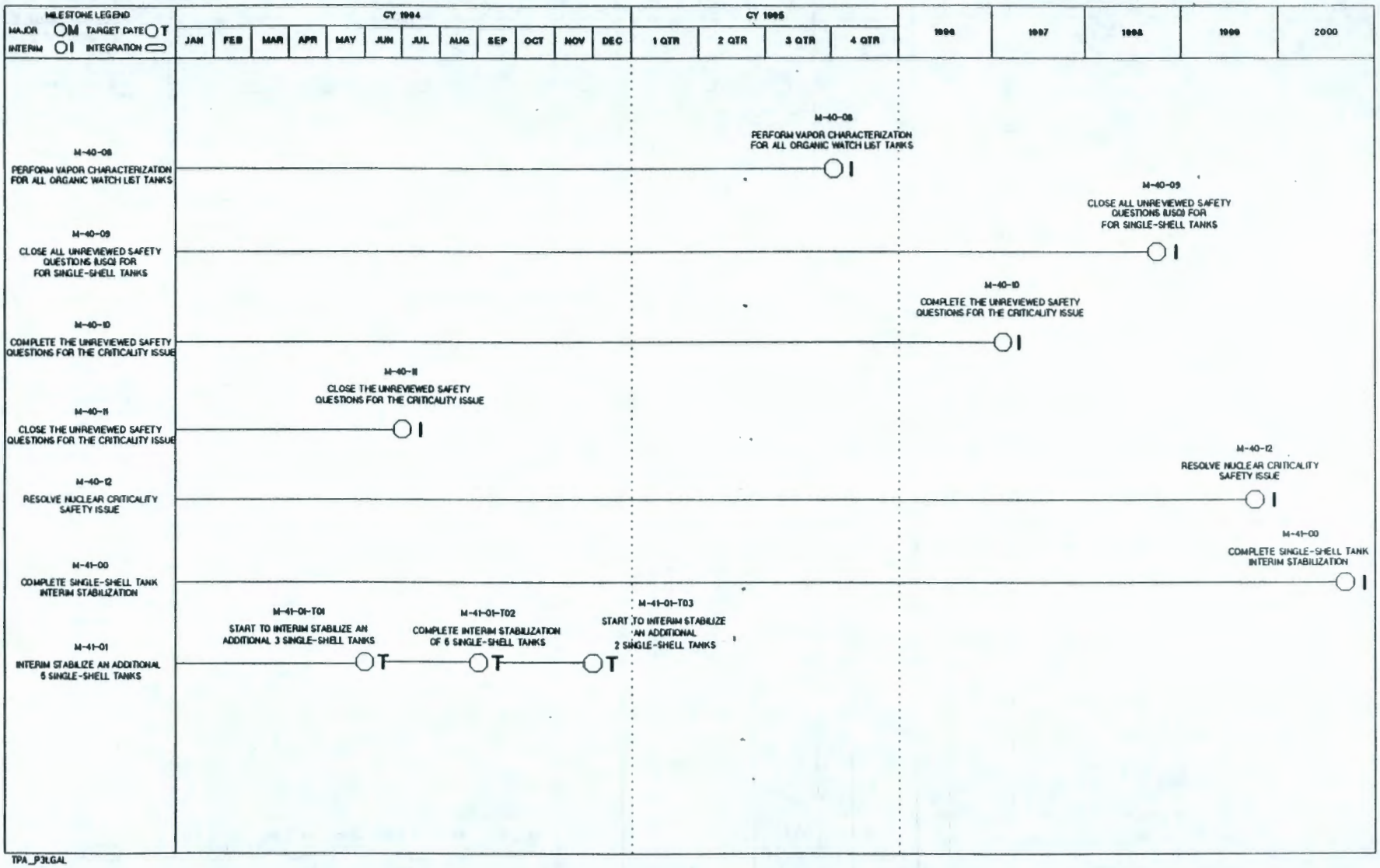

Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 10 of 17)

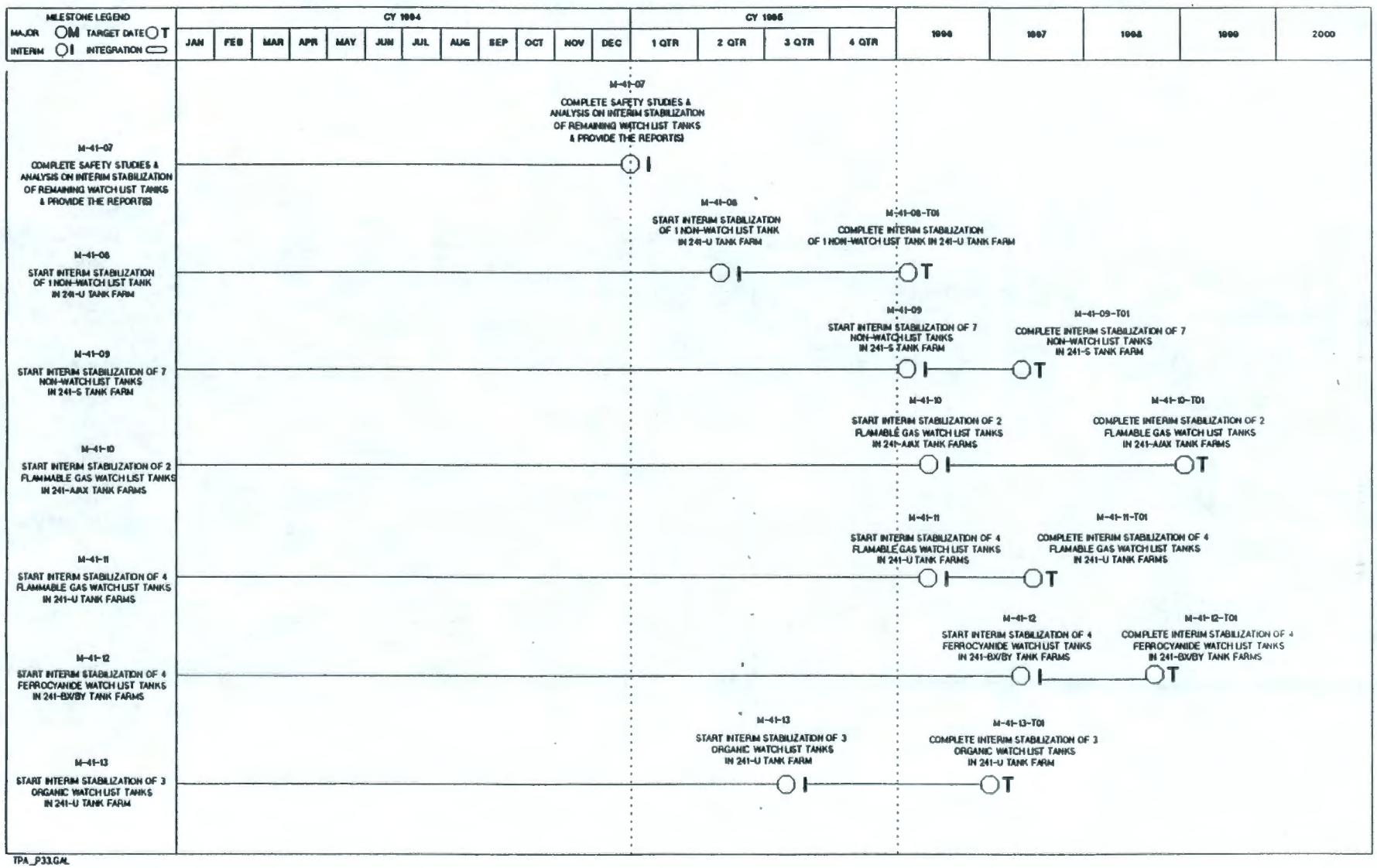

Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 11 of 17)

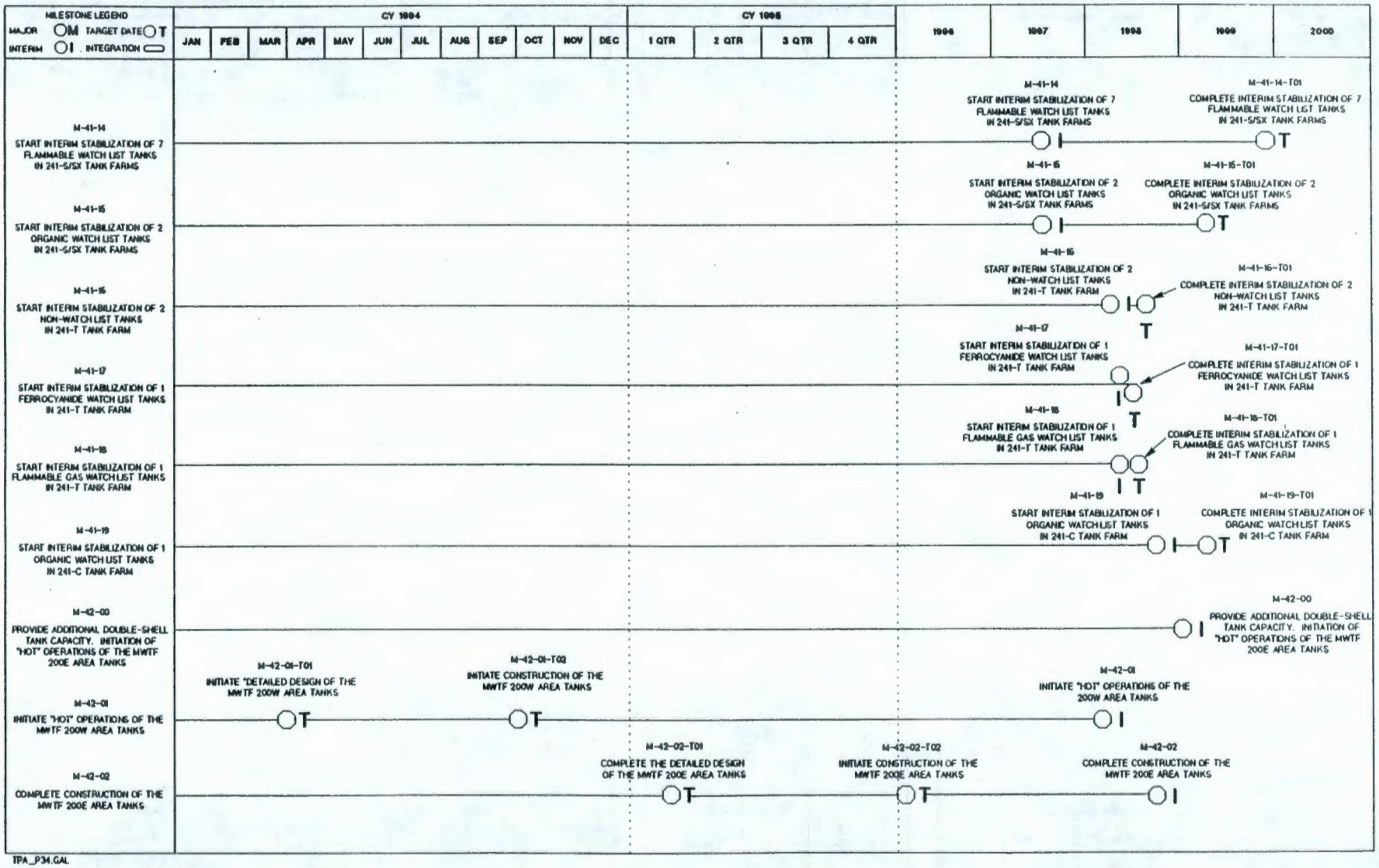

Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 12 of 17)

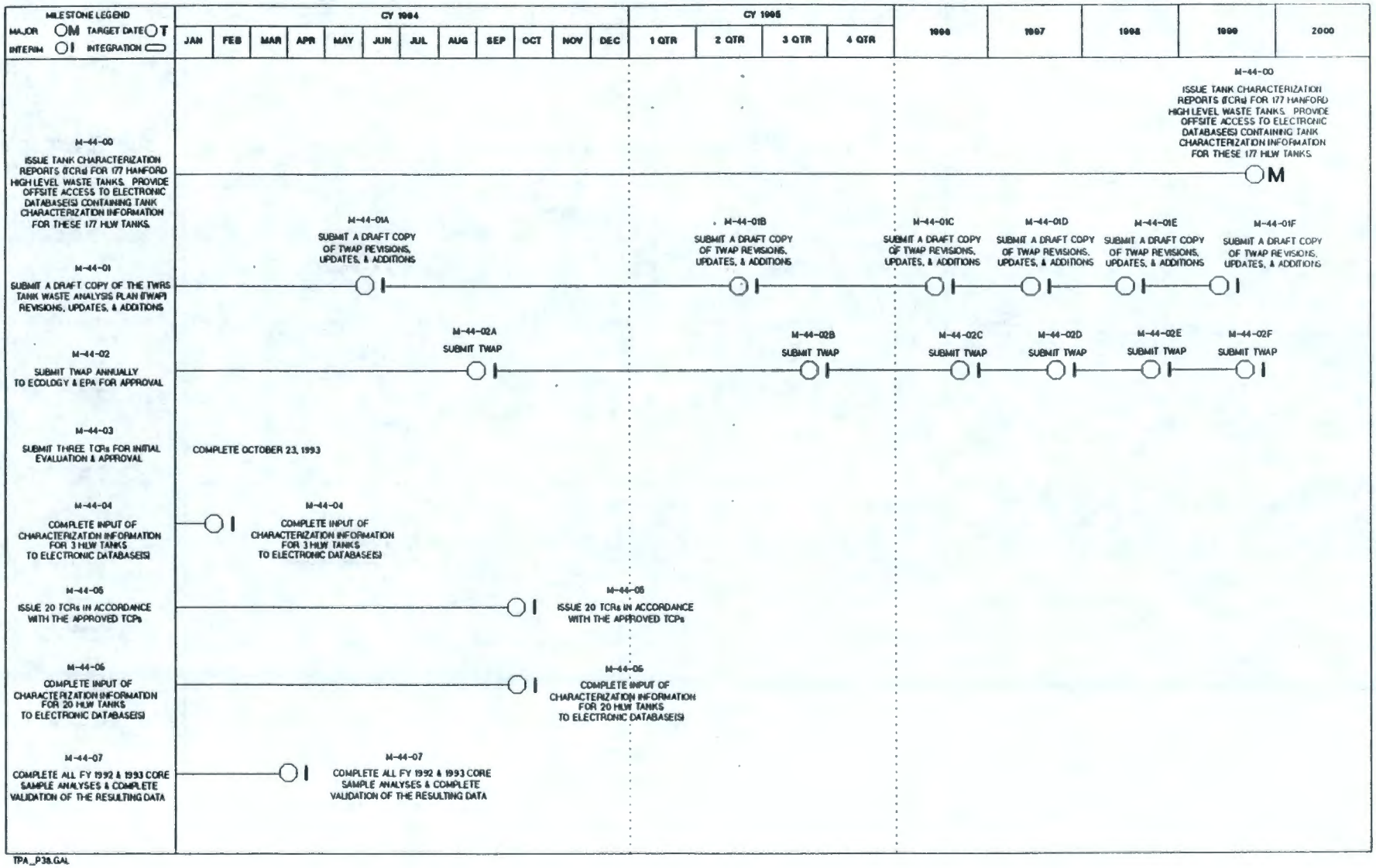

Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 13 of 17)

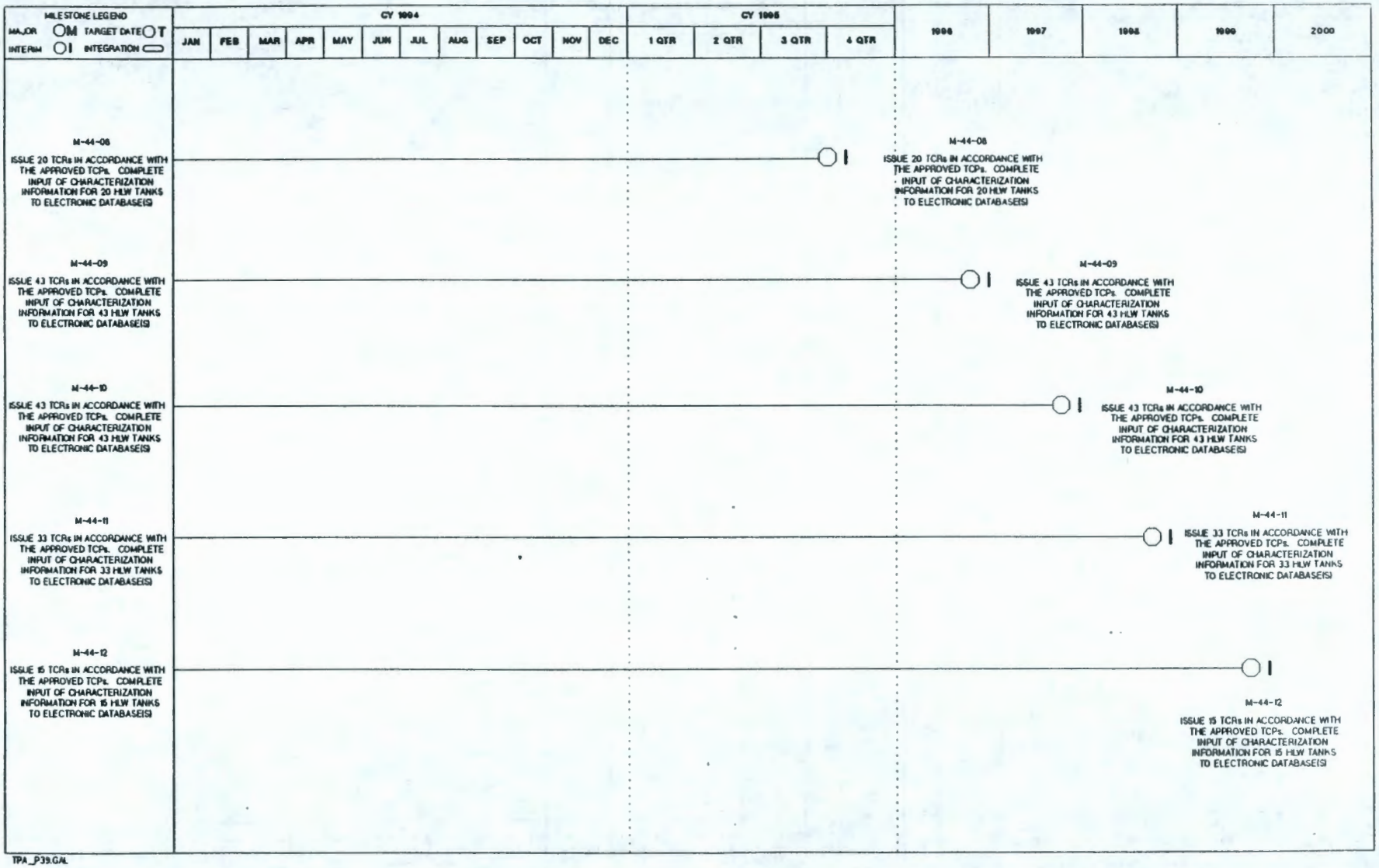

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Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 14 of 17)

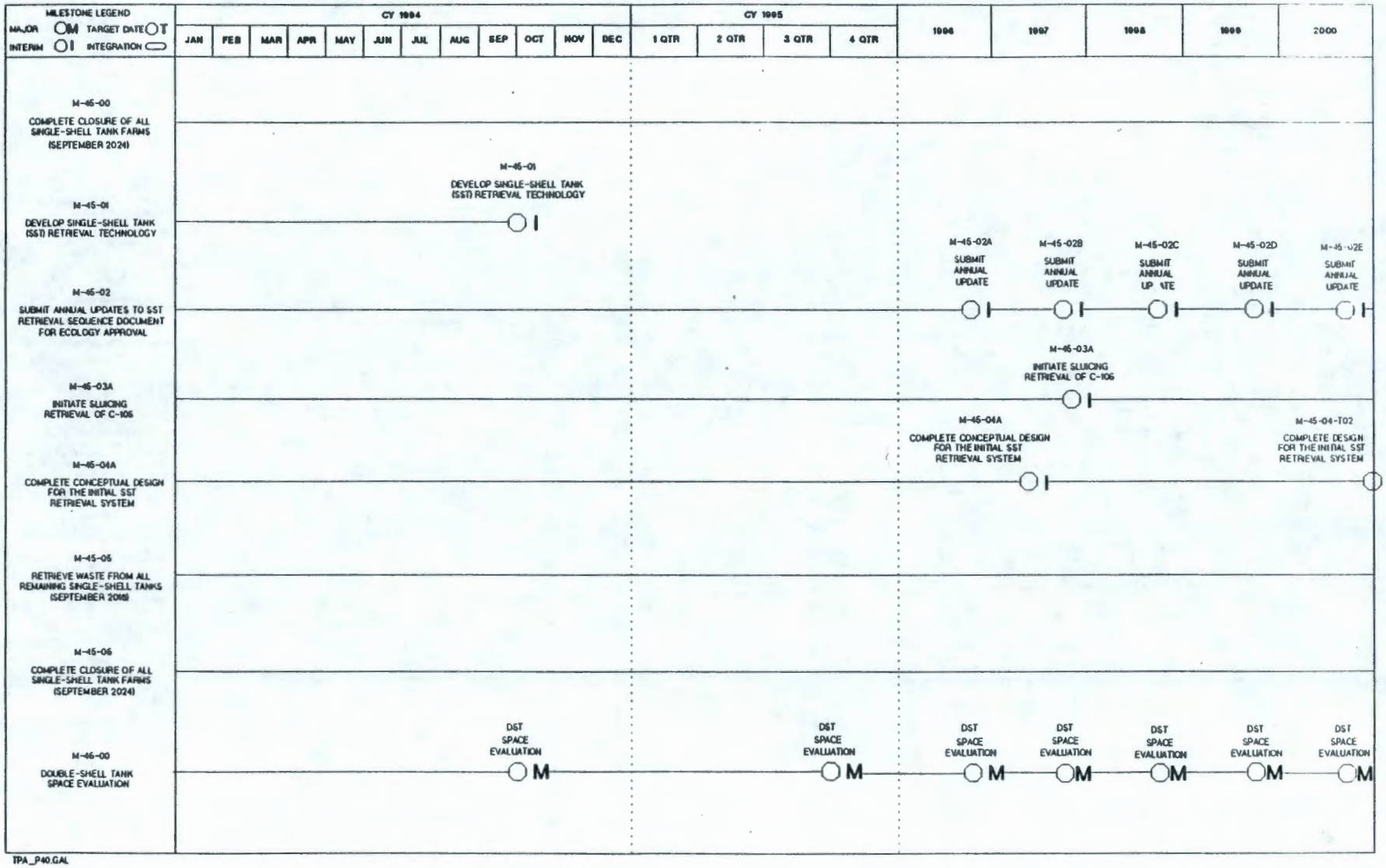

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Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 15 of 17)

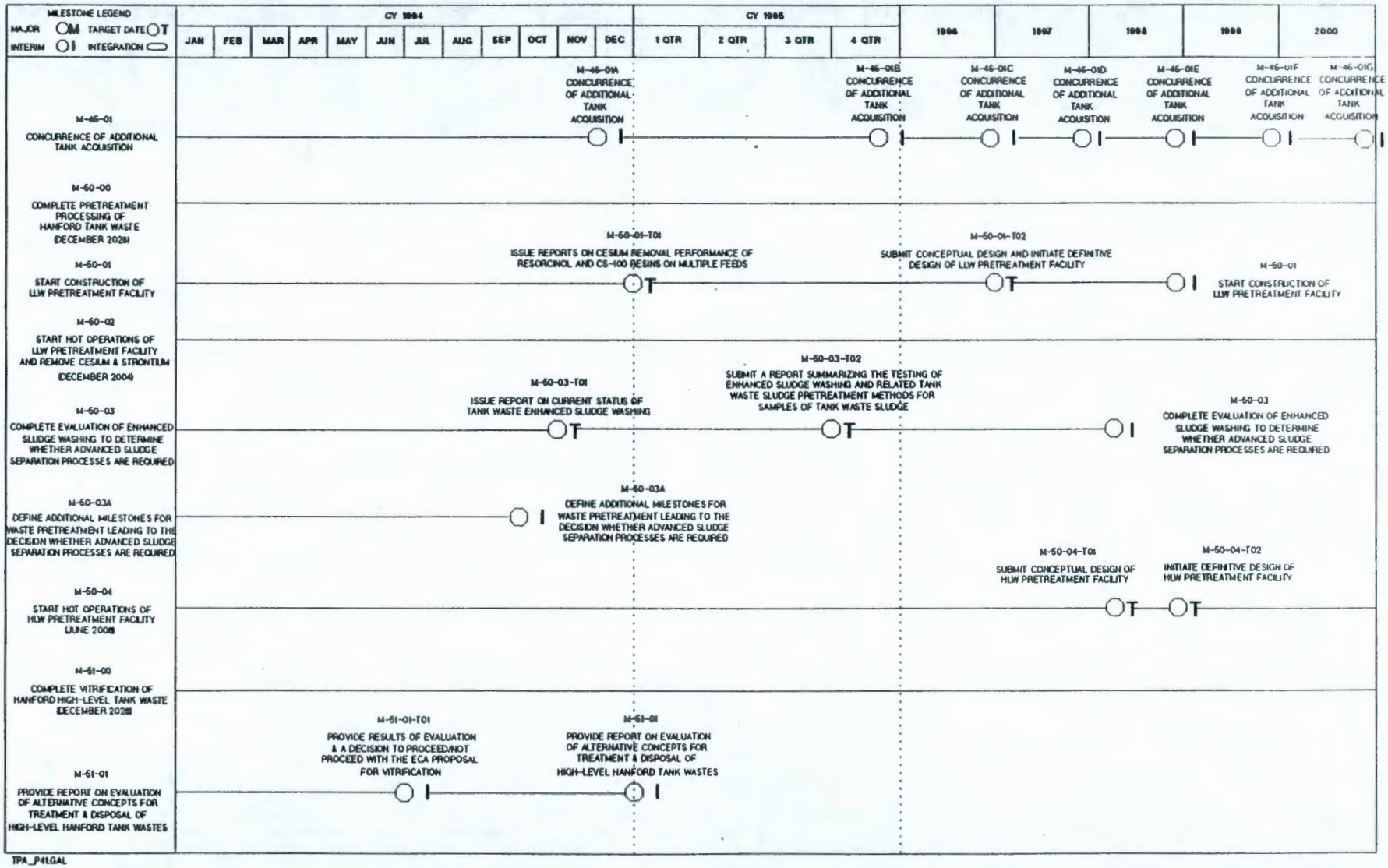
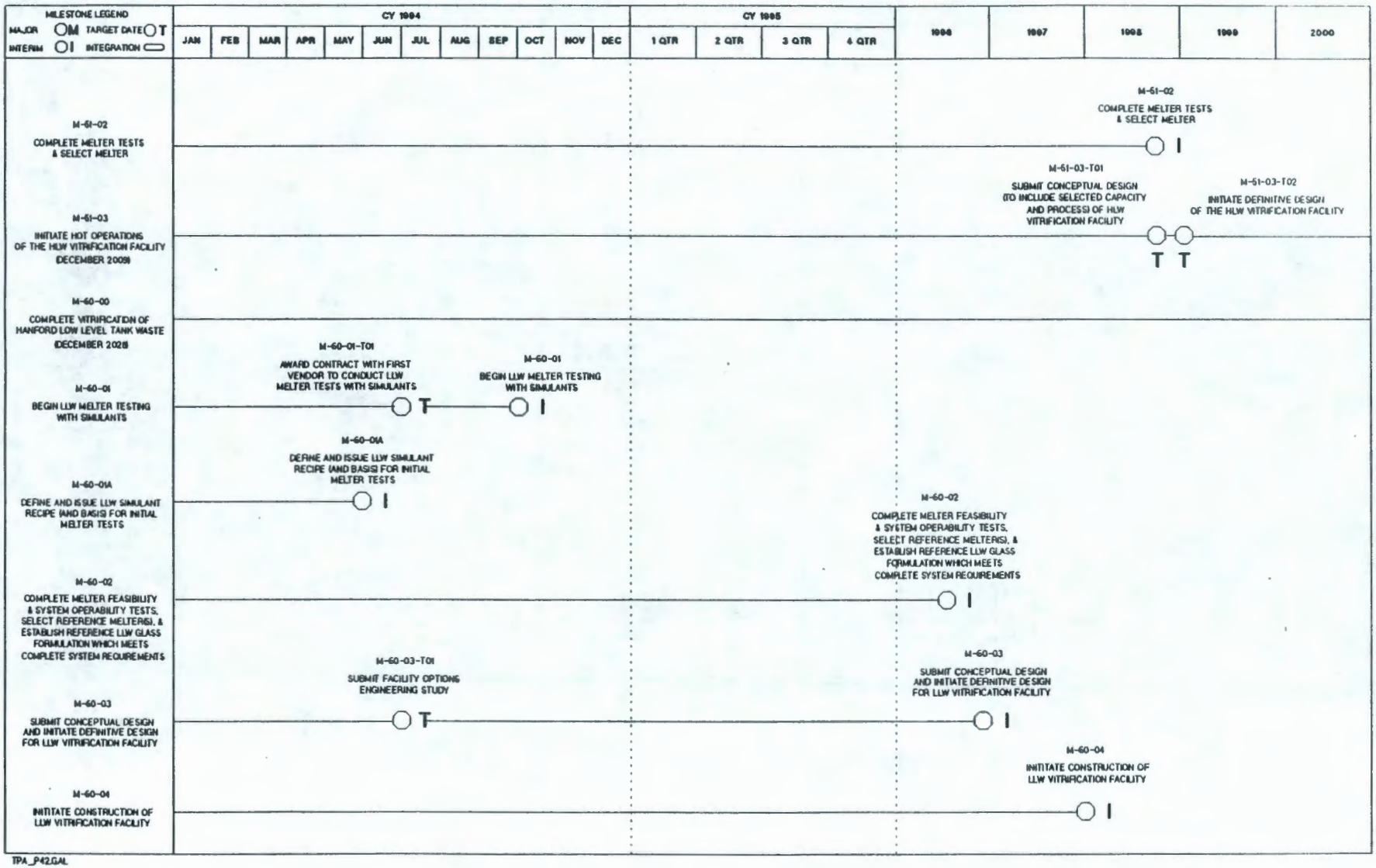


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 16 of 17)



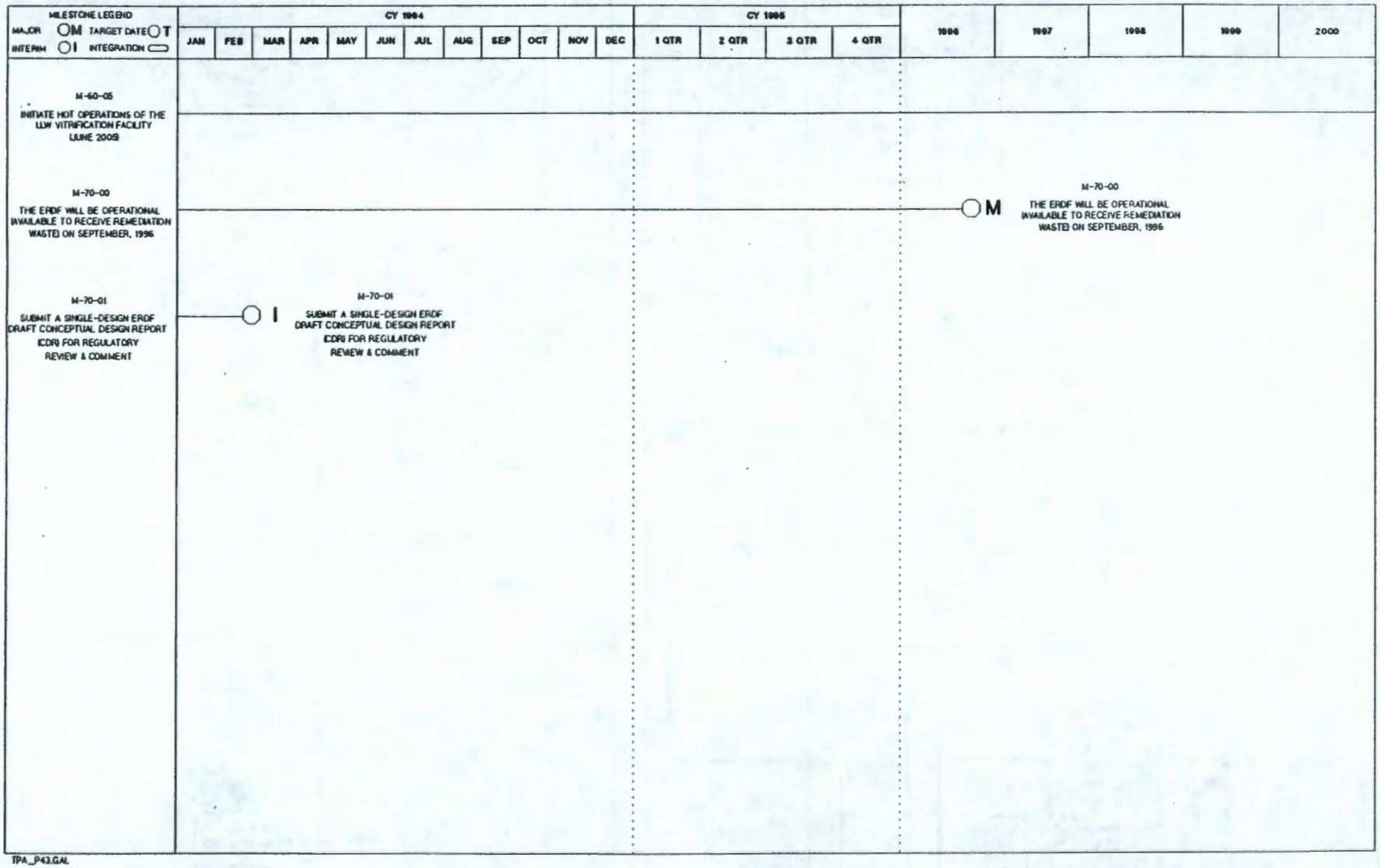


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Wastes. (sheet 17 of 17)

Figure 2-2. Hanford Tank Waste Remediation System.

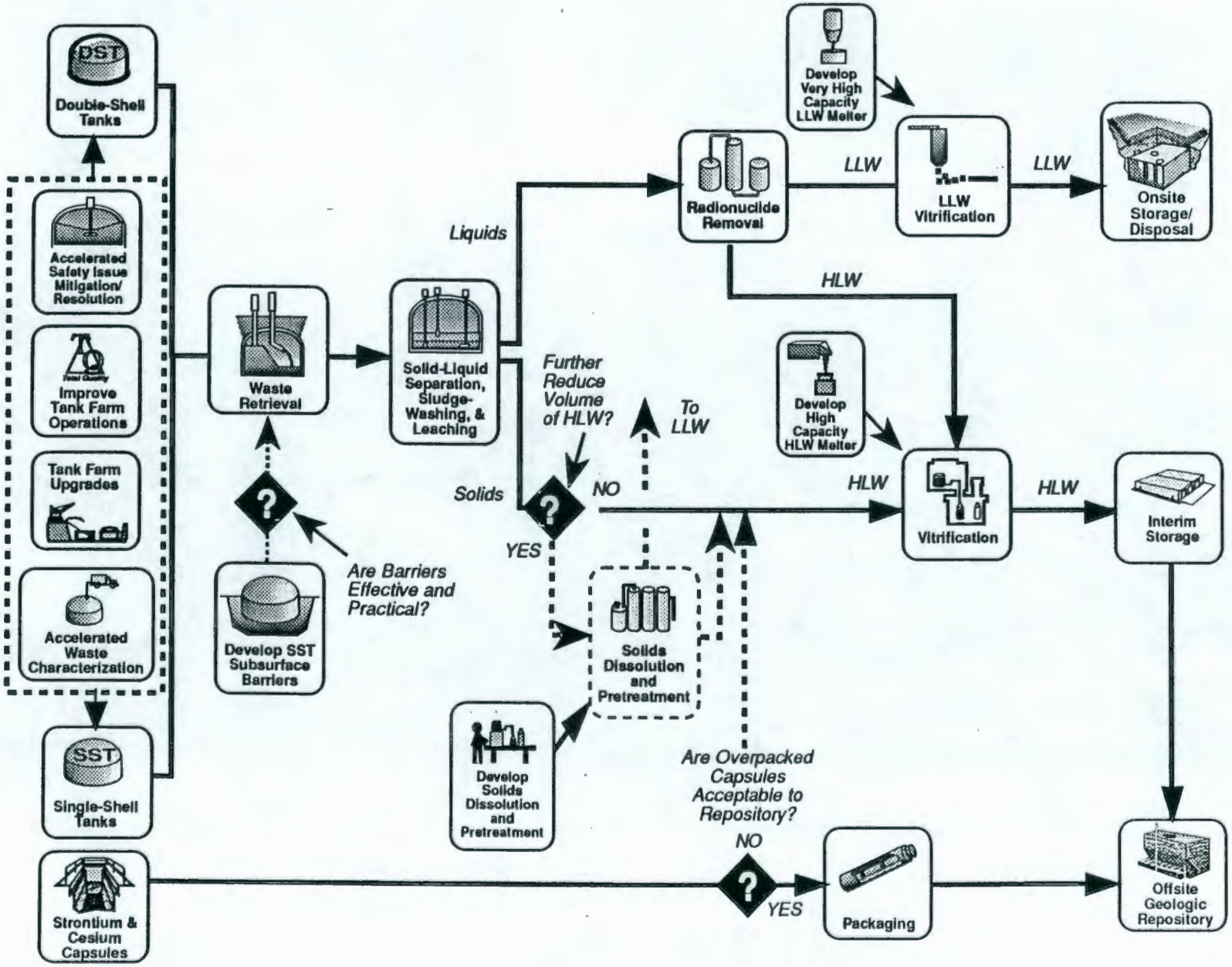


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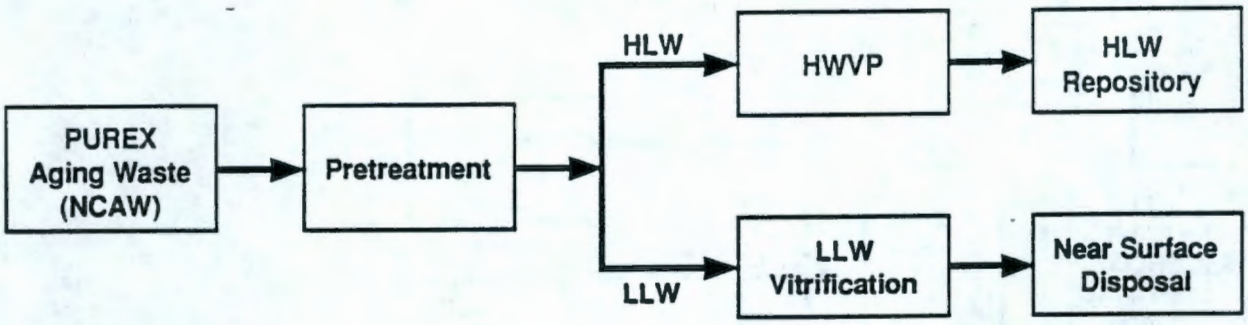
Figure 2-3. Plutonium-Uranium Extraction Aging Waste Treatment Flow Diagram.



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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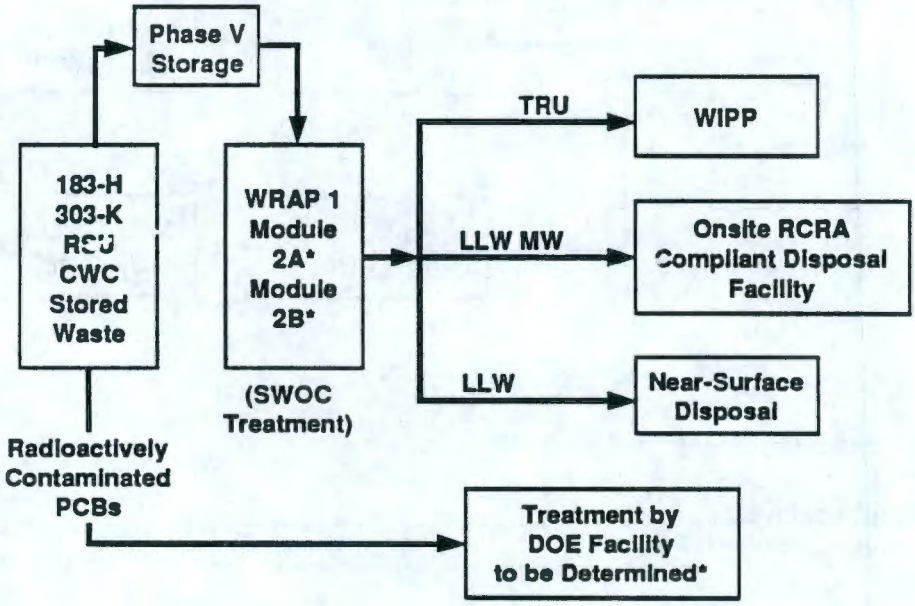
Figure 2-4. Central Waste Complex Stored Waste, Retrievably Stored Waste, 183-H Solar Basin Waste, and 303-K Waste Treatment Flow Diagram.



Legend

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

* Onsite or private vendor supplied treatment.

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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 Areas of the Hanford Site. Twenty-eight DSTs store 96,967 cubic meters of waste as of December 31, 1993 (WHC 1993e). 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, the PFP, research and development programs, laboratories, and decontamination of plants and equipment. Liquid supernatant and interstitial liquids 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 a geologic repository; the low activity fraction will be vitrified for disposal near-surface onsite.

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

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, the PFP, 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.

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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% solids are sent to DSTs and average about 15 L/h. Similar liquid wastes, when the facility is operating, from plutonium reclamation average about 270 L/h.

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. Characterization by analysis of PFP liquid waste that is to be transferred to DSTs is a requirement based on comments provided by EPA.

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 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.

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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 FFTF operations in the 400 Area.

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

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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 supernate and interstitial liquids pumped from SSTs, laboratory wastes, and waste from inactive facilities. Outflows include evaporation and future pretreatment and vitrification processes. Evaporation decreases the DST waste volume; pretreatment and vitrification remove DST waste and prepare 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 10,800 cubic meters per year before evaporation. This generation rate is based on waste generation projections through 1998 (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.

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.

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In addition, DST waste may be categorized into several types which each have a specific history and character. These wastes types, defined below, include:

- Double-Shell Slurry/Double-Shell Slurry Feed (DSS/DSSF)
- Neutralized Current Acid Waste
- Neutralized Cladding Removal Solids Waste
- Plutonium Finishing Plant Waste
- Complexant Concentrate Waste.

3.1.2.1.1 Definition 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 DSSF.

Double-shell slurry feed and DSS are concentrated waste types generated by the evaporation of dilute noncomplexed waste streams to conserve tank space. The DSSF 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 DSSF 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 3,607 cubic meters of DSS and 15,702 cubic meters of DSSF.

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

3.1.2.1.3 Definition 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 neutralized cladding removal waste (NCRW).

3.1.2.1.4 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. 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.

3.1.2.1.5 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.

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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. In accordance with Tri-Party Agreement Milestone M-44-00, the data quality objectives process will be used to establish the necessary sampling and analyses for designation, as well as to establish if all applicable treatment standards for waste are being met. The process will also determine for ignitable and corrosive wastes which underlying hazardous constituents must be quantitized to determine compliance (per 58 FR 29860). The DST waste also is suspected to contain spent solvents including 1,1,1-trichloroethane, hexone, acetone, and oresylic acid (waste codes F001 through F005 are assigned). 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 will continue based on prioritization through the Systems Engineering approach.

There are two types of samples: cores and bottles-on-a-string. The analytical procedures used by the two onsite laboratories to characterize the DST waste samples are based on methods and techniques found in the *EPA Test 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 analyses, radionuclides, and physical measurements to be included in the DST characterization effort will be found in the Tank Waste Analysis Plan.

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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 Areas of the Hanford Site.

3.1.3.2 Amount in Storage. As of December 31, 1993, the tanks held 89,756 cubic meters of waste (WHC 1993e). This does not include PUREX aging waste (Chapter 3.0, Section 3.2). Projections indicate that the DSTs could be filled to capacity in 1994 based on current expected generation rates. The construction of up to six 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. 1992) Milestone M-21-00. The assessment for compliance with interim status regulations noted the following areas of noncompliance:

- 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
- 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. In addition to those wastes currently being generated for DST storage (supernate and interstitial liquids pumped from SSTs, laboratory wastes, and waste from inactive facilities), wastes currently stored in the DSTs will be treated and disposed by means of the same processes and facilities recently adopted by the Tri-Party Agreement. The DST waste will be retrieved, pretreated, and solidified for disposal. Pictorial flow diagrams are shown in Figures 2-2 and 3-2.

Pretreatment separates the DST waste into a LLW and HLW/TRU fraction so that the bulk of the radionuclides are in the HLW. The HLW stream will then be additionally treated to reduce its volume and increase radionuclide loading if necessary. The LLW will have enough radionuclides removed so that it will meet the Nuclear Regulatory Commission's "incidental waste" classification and the DOE's as low as reasonably achievable (ALARA) policy.

Processes requiring limited development will be used to the extent practical to accomplish the pretreatment function and reduce the HLW volume to be vitrified. For the LLW pretreatment, these technologies will focus primarily on removing cesium and strontium from the waste streams to be treated. For the HLW pretreatment, technologies will focus on producing a stream that will create a low-volume, high loading glass. Development of enhanced technologies, which are expected to include sludge washing, selective leaching, and blending, will continue to be pursed. Organic destruction and waste specific pretreatment technologies will continue to be developed until implemented or determined unnecessary.

In respective facilities, both the LLW and HLW fractions will be vitrified, a process that will destroy or extract organic constituents to below treatment standards, neutralize or deactivate dangerous characteristics, and immobilize toxic metals. The LLW fraction will be disposed near-surface

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onsite in a retrievable form. The vitrified HLW stream will be stored onsite until the Geologic Repository Program is available to receive the waste for disposal.

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-50-00 (pretreatment), M-60-00 (pretreatment) and M-51-00 (HLW vitrification). (Refer to Figure 2-1 for details.) Because of budget limitations, accelerating treatment beyond these milestone dates is not realistic.

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3.1.5 Waste Reduction

Currently 11 major plants or programs generate DST waste. Annual waste generation for FY 1990 through 1993 is listed in Table 3-3. Total waste generation was reduced by 60% from 1990 to 1991, 54% from 1991 to 1992, and 26% from 1992 to 1993. (The latter figure does not include water additions used in evaporator tests: see Table 3-3 for details.) The caption labeled "SST to DST Pumping" refers to pumping liquid waste from SSTs to meet Tri-Party Agreement milestone M-41-00 requiring all SSTs to be stabilized by the end of FY 2000. Waste reduction activities (current and planned) are outlined for each unit in the *Annual Report of Tank Waste Treatability* (WHC 1993d). 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 to 95%. In an average year, projected volumes of dilute waste will be reduced by approximately 71%.

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), California List waste (40 CFR 268.32), and 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 because of 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; 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 by vitrification as soon as sufficient quantities are available to facilitate proper treatment and disposal, in accordance with the schedule defined in the Tri-Party Agreement that requires all LLW contained in DSTs and SSTs to be vitrified by 2028.

- **Transuranic Waste**--Treatment schedules for TRU waste stored in the DSTs (and SSTs) coincide with those for the treatment of HLW, discussed below.

- **High-Level Waste**--Treatment of waste will begin as soon as the HLW vitrification facility has been constructed and sufficient quantities of pretreated waste are available (scheduled for 2009 per the Tri-Party Agreement). Disposal is intended for a national HLW geologic repository, with an uncertain start-up date.

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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.

3.2 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 HLW (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, 1993, a total of 7,211 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 to separate the HLW from the LLW in the DST pretreatment facility. The low-level fraction will be vitrified and disposed onsite and the high-level fraction will be vitrified and stored until a repository is available.

3.2.1 Generation

This section describes the waste generation process. The PUREX Plant received official notification to begin shutdown on September 24, 1992. Aging waste will not be generated in the future. Deactivation planning for the PUREX plant is underway. When estimated future volumes of other waste types are generated, the information will be added to this report.

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.

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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; one supernate sample is planned for FY 1994.

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 7,211 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. 1992) 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 to remove and concentrate as many radionuclides as possible into a HLW stream and produce a LLW byproduct stream. The LLW fraction will be vitrified and disposed onsite. The HLW fraction, which may require additional pretreatment in the HLW vitrification facility to reduce its volume, will incorporate TRU waste and HLW into a glass matrix for long-term storage and ultimate disposal.

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

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3.2.4.4 Accelerated Treatment. Treatment of aging waste is on a schedule based primarily on Tri-Party Agreement Milestones M-50-00 (pretreatment), M-60-00 (LLW vitrification), and M-51-00 (HLW vitrification). (Refer to Figure 2-1 for details.) Because of 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 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 3-3.

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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. 1992) 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:

- Initiate pretreatment options by December 2004
- Initiate enhanced HLW pretreatment by June 2008
- Initiate LLW vitrification operations by June 2005
- Initiate HLW vitrification operations by December 2009
- 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 because of 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

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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.

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 Areas. The amount of waste contained in the tanks varies from 5 to 95% of each tank's capacity and varies in consistency from pumpable liquid to sludge to hard salt cake.

The SSTs have released an estimated 2,600 m^3 of liquid to the soil column. However, 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 for this additional water release ranged from 190 to 3,000 cubic meters. The past practice was to exclude the cooling water from the leak volume estimate.

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 Areas 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. Table 3-6 details the current estimates of releases.

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

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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.

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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 3-4 (WHC 1993e). 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%. 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, 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 *State of Washington Hazardous Waste Management Act of 1976*, the *National Environmental Policy Act of 1969* (NEPA), and the *Atomic Energy Act of 1954* 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). A new remote operated method for those SSTs with hard saltcake will be deployed in April 1994.

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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 (RHO 1985).

Twenty-two of the SSTs contain cyanides, introduced as ferrocyanides in a process to precipitate cesium. Approximately 90% 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 and 28 DSTs is scheduled to be completed by September 1999 according to Tri-Party Agreement (Ecology et al. 1992) Milestone M-44-00. 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. A commitment has been made to accelerate the characterization of the Hanford Site waste tanks, to expedite the resolution of identified tank safety issues, and to identify tanks that may have safety issues. The current goal is to sample and analyze all tanks within the next three years.

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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 3-5 (WHC 1993e). 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 will be closed in accordance with schedules negotiated in the Tri-Party Agreement (Ecology et al. 1992). 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.

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. Although the selection of the specific alternative will be documented through the NEPA process, the Tri-Party Agreement specifies that SST waste will be treated and disposed by means of the DST pretreatment and disposal facilities. Closure options, which will identify the level of retrieval necessary, will be documented in a comprehensive tank waste remediation system supplemental environmental impact statement, planned to be prepared.

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 desisted 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-41-00 (interim stabilization) and M-45-00 (retrieval technology and closure). (Refer to Figure 2-1 for details.) Because of 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. Further efforts to reduce the potential for leakage include the transfer of waste materials from the SSTs to DSTs. During 1993, portions of tanks BX-110 and -111 were transferred to DSTs.

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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. 1992) provides for development of treatment and disposal units for the SST waste as follows:

- Complete SST interim stabilization by September 2000
- Develop SST waste retrieval technology and complete scale-model testing by September 1994
- Initiate full-scale tank demonstration of SST waste retrieval technology by October 1997
- Initiate full-scale farm closure demonstration project by December 2003
- Complete closure of all 149 SSTs by September 2024.

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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.

3.4 242-A EVAPORATOR PROCESS CONDENSATE

The 242-A Evaporator concentrates the low-level liquid waste that is stored 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 1994. At this time, the process condensate will be discharged to the LERF and ultimately treated for disposal at the 200 Areas Effluent Treatment Facility.

3.4.1 Generation

The 242-A Evaporator concentrates liquid LLW by evaporation. The evaporation process also separates a large part of 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 3-6.

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 diverted back to the 242-A Evaporator feed tank for reprocessing. The remaining 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 17 million liters of process condensate per campaign until the LERF (Section 3.4.3) is full. Three campaigns are scheduled through mid-1995, which are expected to fill the LERF to capacity. The 242-A Evaporator will then be shut down. The 242-A Evaporator will restart when the 200 East Area Effluent Treatment Facility becomes operational.

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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 potential presence of spent halogenated and nonhalogenated solvents, such as 1,1,1-trichlorethane, acetone, and methyl isobutyl ketone (hexone) (F001 through F005).

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 it is derived from waste that may contain the spent halogenated and nonhalogenated solvents 1,1,1-trichloromethane, methylene chloride, acetone, methyl isobutyl ketone, cresylic acid, and methyl ethyl ketone. These constituents together comprise the waste codes F001 through F005.

Additionally, the process condensate is designated a State only dangerous waste because of toxicity (WT02), because of the ammonia concentration. 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% higher than the limit of 0.001%; therefore, the process condensate is a State toxic dangerous waste. The dominant contributor to the equivalent concentration sum is ammonia.

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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, which is the volume projected to be generated within the first six to twelve months after start-up.

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. 1992) Milestone M-20-47 detailing the compliance of the LERF with RCRA final status design and operation standards. Tri-Party Agreement Milestone M-26-04 requires that all hazardous waste residues that do not meet LDR treatment standards be removed from the LERF by June 1995. A change request is being prepared to change this milestone to support the 200 Areas Effluent Treatment Facility start-up date.

3.4.4 Treatment

3.4.4.1 Planned Treatment. Planned treatment of the process condensate stored at the LERF is as follows. The 200 Areas Effluent 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

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waste, it will be sent to the CWC 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 June 1995 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 storage at the Central Waste Complex.

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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 because of 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 for this waste to be developed on the following schedule:

- Cessation of discharge of process condensate to the LERF by December 1994. (This may be affected by a change request that has been drafted to change the date to support the 200 Areas Effluent Treatment Facility start-up date of June 1995.)

- Removal of all dangerous waste residues from the LERF by June 1995. (This may be affected by a change request that has been drafted to change the date to support the 200 Areas Effluent Treatment Facility start-up date of 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 200 Areas Effluent Treatment Facility will treat process condensate to meet the LDRs. Additionally, a petition is being prepared to delist the effluent from the 200 Areas Effluent Treatment Facility to allow land disposal of the treated effluent.

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Part B Permit applications will or have been submitted for the 242-A Evaporator (completed June 1991), the LERF (completed June 1991), and the 200 Areas Effluent Treatment Facility (due in August 1993). The delisting petition for the 200 Areas 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 CWC 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 has received a shutdown directive. This eliminates waste generated due to operations.

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.

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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.

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.

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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. 1992) 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.

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 CWC 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 1994. 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 CWC Waste (Section 3.13).

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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 because of 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.

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) because of 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

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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 3-7.

In late 1987, it was determined that the ammonium hydroxide concentration in the ammonia scrubber condensate sometimes exceeded 1%, 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 3-8. 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% 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 3-7)
- 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.

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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 analyses 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 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. Underlying hazardous constituents defined by the emergency third-third rule decision (58 FR 29860) reasonably expected to be present at that time will be quantitized. The tank contents will be concentrated at the 242-A Evaporator to reduce the volume of waste requiring vitrification and disposal. 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 28 4,300 cubic meters tanks, of which 26 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 will decrease when the waste is evaporated before 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. 1992) 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. Refer to DST treatment plans for future treatment information.

3.6.5 Waste Reduction

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

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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 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 because of 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 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.

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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 less than 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

As of December 31, 1993, 0.26 cubic meters 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.

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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 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. Waste from the tunnels will be handled along with the similar materials currently in the PUREX Canyon when PUREX is decontaminated and decommissioned. PUREX decontamination and decommissioning, along with treatment of the Tunnel waste, is contingent on several factors: the Sitewide Land Use Plan, the Sitewide Decontamination and Decommissioning Priority Schedule, the Environmental Impact Statement and public involvement comments must be completed. A basis for the treatment plan for the wastes associated with PUREX storage will be developed after all of the above are implemented.

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 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.

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3.12 PUREX CONTAINMENT BUILDING (LEAD AND CADMIUM)

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 within the containment building 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 31, 1993) is approximately 0.284 cubic meters (approximately 3,226 kilograms) of radioactively contaminated lead (mixed waste). The waste cadmium and lead stored in the containment building currently is untreated. Of this 0.284 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 in the PUREX Containment Building 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 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.

LDR-regulated lead waste may be generated at the PUREX Plant during shutdown, but data are not available to estimate this generation rate. Lead waste may be produced from canyon equipment as the canyon equipment is moved from its current location to the Canyon deck. The amount of lead waste, which will be generated during deactivation when quantified, will be added to the LDR report.

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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 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 containment building 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 because of 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 in the containment building 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.

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3.12.3.2 Amount in Storage. The combined quantity of lead and cadmium waste in storage is 0.31 cubic meters (3,226 kilograms of lead and 5.90 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 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. 1992) 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 because of 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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Removal of the mixed waste stored in the containment building 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 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.

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

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

Waste is received at the CWC 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 CWC 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 CWC vary greatly from waste that is nondangerous LLW to TRU dangerous waste. The CWC currently stores, as of December 31, 1993,

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 CWC 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 CWC 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 185.6 cubic meters of PCB-contaminated LLW and 78.4 cubic meters of PCB-contaminated TRU waste (as of 12/31/93).

An internal assessment completed in July 1992 identified container mismanagement problems at several generating units. A backlog of waste had been accumulating at generating units. The assessment revealed that some of the waste was potentially dangerous and had accumulated in excess of the 90-day regulatory limit. To correct these mismanagement problems, a Backlog Waste Program was initiated in October 1992 to ship the waste to compliant storage or disposal. More than 5,000 containers were managed through this program. These containers were broken down into three subsets.

The first subset of the backlog waste was labeled as "unknowns." These containers did not have enough characterization information to manage the containers at a treatment, storage, or disposal facility. Approximately 259 containers were included under this subset. These containers were shipped to T Plant for opening, sampling, and repackaging. Approximately 201 unknown drums have been processed and were shipped to the CWC in 1993. Repackaging of 58 unknown boxes was completed in February 1994.

The second subset of the backlog waste was waste that was sent to the CWC under a two-stage program. Approximately 2,649 containers were handled under this subset. The first stage was labeled "interim staging." Under this stage, worst case characterization was used for all the waste to ship it to compliant storage. The purpose of the first step was to ship the waste to a central location where it could then be managed under the second phase of the program. The second phase of the program is labeled "confirmation" and is designed to confirm the process knowledge and accept the waste under WHC (1993f).

During the completion of the first phase, Ecology issued a fine and compliance order against DOE-RL and WHC for the management practices in the tank farms that caused the waste to be managed improperly and led to the initiation of the backlog waste program. As part of the compliance order, completion of the second phase of the backlog program was ordered to be completed by September 1, 1994. The criteria of the second phase were negotiated with Ecology and are defined under *Waste Analysis Plan for Confirmation or Completion of Tank Farms Backlog Waste Designation* (RL 1993a).

The remainder of the "interim-staged" containers are being handled in a similar manner to the requirements of RL 1993a and should be completed this year.

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The third and final subset of the waste is containers that had complete characterization information and were shipped to storage or disposal under the requirements of WHC (1993f). No further actions are required for this waste.

3.13.1 Generation

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

3.13.1.1 Mixed Waste Generation. The majority of waste shipped to the CWC 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 process knowledge of the waste placed in the container or sample analysis if sufficient process knowledge is unavailable. The major plants that generate mixed waste that is LDR and the general type of waste they generate are discussed below.

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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 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 CWC.

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 that 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.

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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 of this equipment. 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).

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 CWC, 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 using scintillation cocktails containing ignitable solvents for the analysis of radionuclides.

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The operation and maintenance of the SST and DST tank farms located in the 200 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 CWC 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 185.6 cubic meters of PCB-contaminated LLW and 78.4 cubic meters of PCB-contaminated TRU waste were generated between 1970 and December 1993.

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 CWC, it is characterized and packaged as described in *Hanford Site Solid Waste Acceptance Criteria* (WHC 1993f). 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 CWC 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 CWC 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.

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

3.13.2.3 Waste Designation and Basis. Waste at the CWC 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 1993f), 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 CWC 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

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of the waste, additional characterization needs 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 CWC 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 CWC.

- 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 °C. 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 CWC units is shown in Figure 3-11.

The planned capacity of the CWC 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 CWC to store mixed waste is continually evaluated and additional storage buildings will be constructed if necessary to meet forecast capacity shortfalls.

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3.13.3.2 Amount in Storage. The amount of dangerous waste restricted from land disposal currently in storage at the CWC as of December 1993 is 5,118 cubic meters. This includes 2,627 cubic meters of waste from the 183-H Solar Evaporation Basins (see Section 3.9).

As of December 31, 1993, 185.6 cubic meters of PCB TRU waste has been placed in the CWC for storage. Existing storage capacity is judged to be adequate for any future generation.

As of December 1993, 78.4 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 CWC 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. 1992). Interim status compliance was achieved in June 1990.

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3.13.4 Treatment

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

3.13.4.1 Description of Current Treatment. The waste in the CWC 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.

3.13.4.2 Description of Proposed Treatment. The waste currently stored in the CWC, 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 will also 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. All nonorganic radioactive, mixed LLW will be treated and certified for disposal in accordance with all regulations, including the LDRs.

Low-level mixed waste requiring thermal treatment is expected to be sent to a commercial operation for treatment to LDR requirements if possible. This waste will be returned to the Hanford Site for burial in the RCRA trench.

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.

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A basic schematic showing potential nonthermal treatment of radioactive mixed waste streams with corresponding treatment processes is shown in Figure 3-12 for WRAP Module 2A. Small-scale unit processes include immobilization/stabilization for particulate wastes, including sludges and ion exchange resins, mercury amalgamation, lead encapsulation, debris vibratory grouting, and miscellaneous processes, such as drum handling and treatment of liquids.

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 sorting table, and the inner plastic liner opened. All sorting will be performed automatically, although some manual sorting 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 drum, and transferred to a transfer drum and then to the restricted management waste gloveboxes. 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 sorting table will have a liquid collection tank beneath for liquids that flow freely from the opened waste. Collected liquids will be transferred to the restricted management waste gloveboxes.

In the restricted management waste gloveboxes, 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 or elsewhere 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 limited processing primarily to certify waste for disposal in WIPP. Some mixed waste may be packaged and sent to be processed in Module 2A.

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

- Mixed waste sampling
- Immobilization of particulates
- Absorption of liquids
- HEPA filter immobilization
- Pyrophoric material
- Reactive metal
- Aerosol cans.

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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 dry particulates, sludges, ion exchange resins, some special wastes (mercury and lead), and all types of debris 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, 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 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 3-13.

A significant quantity of Hanford Site RMW will require thermal treatment. Thermal treatment is prescribed in 40 CFR 268, for radioactive RCRA and *Toxic Substances Control Act of 1976* (TSCA) solid wastes. Thermal treatment is required for destruction of alpha-contaminated PCBs currently in storage at the Hanford Site. In addition, the existing and projected mixed waste inventory at the Hanford Site includes a significant quantity of RMW that contains listed, F-Coded, hazardous organics having concentration-based treatment standards for which incineration is the best demonstrated available technology (BDAT).

The thermal treatment alternatives presently being considered for Hanford Site RMW include the following:

- Privatization for offsite thermal treatment
- Hanford Site-specific Project W-242 thermal treatment facility
- Offsite treatment at another DOE site.

During FY 1994, privatized thermal treatment will be given full planning emphasis. However, treatment of all of the RMW requiring thermal treatment by a private company or by another DOE site may not be possible. Based on present assessments of these alternatives, both may prove to have technical and regulatory limitations. Existing thermal treatment technologies are not designed to burn alpha-contaminated wastes. Transport of the RMW to offsite facilities may be subject to prohibitive regulatory requirements. In addition, existing offsite DOE thermal treatment facilities currently have restrictive waste acceptance criteria making thermal treatment of Hanford Site RMW in significant quantities impossible. At the end of FY 1994, a decision will be made regarding the feasibility of privatized thermal treatment. If privatized thermal treatment proves to be feasible, it will continue to be given full planning emphasis. Assessments of the alternative to treat waste at other DOE sites have indicated that the next best alternative to privatized thermal treatment is the installation of the Project W-242 Thermal Treatment Facility.

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Accomplishments related to an onsite thermal treatment facility include the completion of an engineering study that included a review of available thermal technologies and recommended thermal technologies specifically applicable to the treatment of Hanford Site RMW. Using the results of the technology study as basis, a Hanford Site-specific thermal treatment facility study was also conducted. Although the site-specific study has not been completed, conceptual data regarding the scope, configuration, and cost of an onsite thermal treatment facility was generated. The technology study and the site-specific facility study were also the basis for a completed Hazard Classification study that designated the Project W-242 Thermal Treatment Facility as a moderate hazard facility.

Accomplishments related to the treatment of Hanford Site RMW at other DOE sites include completing an assessment of possibly shipping selected streams of Hanford Site RMW to Idaho National Engineering Laboratory (INEL) for thermal treatment in INEL's Waste Experimental Reduction Facility (WERF), which employs rotary kiln waste incineration. The assessment concluded that the WERF startup schedule and limited waste acceptance criteria were unacceptably restrictive to give this option further consideration. A cursory review of the feasibility of shipping Hanford Site RMW to DOE sites other than INEL, such as Oak Ridge National Laboratory (ORNL) and the Savannah River Site (SRS), indicated that restrictive waste acceptance criteria, as well as site-specific schedules for waste treatment, yielded similar conclusions.

The thermal treatment of Hanford Site RMW by a commercial entity is the currently favored alternative by Hanford Site management. Accomplishments related to thermal treatment privatization include an assessment of industrial capability and interest in treating Hanford Site RMW. This assessment

concluded that there was extensive interested capability in the private sector to treat Hanford Site RMW, but no technology is presently available to treat the entire inventory of Hanford Site RMW. Privatization of thermal treatment is being given full planning emphasis during FY 1994. Concerns regarding the implementation of NEPA for the thermal treatment of significant quantities of DOE RMW of considerably variant quality at an offsite commercial facility suggest that the privatization alternative could prove unfeasible. If privatization proves unfeasible, the sum of previous assessment data suggests that the Project W-242 Thermal Treatment Facility should be given full planning emphasis.

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. Because of the large costs involved to design and build this facility, accelerated treatment would not be feasible.

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3.13.5 Waste Reduction

All plants and processes that generate waste that is shipped to the CWC 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 CWC 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 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 because of 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)

- 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 because 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 CWC 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 CWC 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. The definition was then (1982) 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 is also 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 CWC 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 sealed hulls of the compartments.

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As of March 1994, 35 compartments were stored awaiting disposal. Additional reactor compartments will be shipped to the Hanford Site in the future.

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% 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).

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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 3-14 and 3-15).

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 CWC 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 3-15). 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 Areas retrievable storage units. Of this volume, 14.1% 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. Radioactive liquid organic waste was placed in retrievable storage units from 1982 through 1987. 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.

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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. 1992). 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 are currently available. Additionally, two groundwater monitoring wells were installed in 1993 for a total of 81 wells in the low-level burial grounds. Detailed information on these wells, cuttings, purgewater, and characterization data can be found the Borehole Completion Packages for the year in which the wells were completed (WHC 1991f, WHC 1992d).

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 sent offsite for treatment. The WRAP Facility will 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, 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. Module 2B is currently being reviewed as part of the M-33-00 Milestone.

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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 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 because of 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)

- 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 because 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.

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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 received some containers of waste from offsite sources (Battelle Columbus, Ohio; Argonne National Laboratory, Chicago; Rocky Flats Plant, Colorado; and Lawrence Berkeley Laboratories, California). 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. There is a moritorium on TRU waste shipment. The Governor of Washington submitted a letter to the Secretary of Energy stating that no TRU waste shipment into Washington State will be accepted until the WIPP is opened.

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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 1993f). 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 CWC for storage and subsequent processing.

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.

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 was originally 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 3-16). The unit storage capacity is 420 cubic meters (2,000 drums).

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Accumulation of certified TRU waste in 0.21-cubic meter drums that exceeds the capacity of TRUSAF will be stored in the CWC. Future plans for the CWC 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, 1993, 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 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 CWC 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 disposal of these wastes.

3.15.4.4 Accelerated Treatment. Current plans are to ship the waste to WIPP for permanent disposal. 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.

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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 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 because of 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 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. 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 (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

- 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.

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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, D029, D035, D037, D039, D040, F001, F002, F003, F005, WC02, WP01, WP02, WT01, and WT02.

The 303-K Facility has been used since January 1986 to store 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 23 kilograms of spent degreasing solvents (D008, D039, F001, F002, WP01, and WT01). This waste also contains cobalt-60 and uranium. No future generation of waste degreaser solvent is anticipated.
- Approximately 800 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. About 30 kilograms of this waste was generated in FY 1993 and about 40 kilograms are anticipated to be generated in FY 1994.

- 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 because of cadmium, D007 because of chromium, and D008 because of lead. One 55-gallon drum of centrifuge sludge waste is anticipated to be generated in FY 1995.

- One 55-gallon drum containing about 120 kilograms of sandy sludge from the outside process sewer drain sump on the southwest side of the 313 Building. This uranium-contaminated waste is designated D005 because of barium, D006 because of cadmium, D007 because of chromium, and D008 and WC02 because of lead. Two 55-gallon drums of this sump sludge are anticipated to be generated in FY 1994.

- One 55-gallon drum containing about 68 kilograms of uranium-contaminated lead metal designated as D008. No further generation of this lead waste is anticipated.

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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, lead metal, process sewer sump sludge, 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.

Spent degreaser solvents (consisting of perchloroethylene, 1,1,1-trichloroethane, and rinse water from vapor degreasers) were absorbed on pads and placed in steel drums in 1988.

3.16.2.2 Sample Analysis. 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 one drum of absorbed degreaser solvent remaining at 303-K was analyzed for volatile and semivolatile organics, pH, flashpoint, and metals (by inductively coupled plasma), and mercury, selenium, arsenic, and lead. The radioactivity was measured with PNL's barrel assayer.

The one drum of sandy sludge from the process sewer sump was analyzed for pH, metals by inductively coupled plasma, inorganic constituents by ion chromatography, and uranium by activity counting.

The 25 drums of pyrophoric uranium and Zircaloy-2 chips and fines were analyzed for metals by inductively coupled plasma and uranium by laser fluorimetry.

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:

- D008, D039, F001, F002, F003, WP01, and WT01 for spent degreasing solvents
- D001 for Zircaloy-2 and beryllium/Zircaloy-2 chips and fines
- D006, D007, D008, and WC02 for filter press and in-line filter sludge and process sewer sump sludge
- D008 for contaminated lead metal.

3.16.2.4 Uncertainty of Waste Designation. The designations of stored container wastes at the 303-K Facility are considered to be accurate.

3.16.2.5 Schedule for Further Characterization. Currently it is planned to sample in CY 1994 the one drum of pyrophoric fines placed in the 303-K Facility in December 1993 and any other drums of this material generated in CY 1994.

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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 1993) in the 303-K Facility is 2,786 kilograms. This includes 26 0.11-cubic-meter drums, 9 0.21-cubic-meter drums, and 1 0.73 cm^3 metal box.

3.16.3.3 Storage Compliance Assessment. The 303-K Facility is currently scheduled for clean closure with an interim use as a less-than-90-day accumulation unit. The unit is currently 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 metal, and sludge wastes currently stored at the 303-K Facility will be transferred to the CWC 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 CY 1994 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 1994 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.

Fifty-six of the 57 solvent waste containers stored at the 303-K Facility have been transferred to the CWC 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 CWC for storage, as discussed in Section 3.16.3. This waste will be managed with other CWC 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 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 because of 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 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.

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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	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	10,000-18,000	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

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Table 3-1. Plutonium Finishing Plant Radioactive Liquid Waste Stream Composition. (sheet 2 of 2)

		Nominal Composition							
Species	UNITS	PRF CAW	Range	PRF CXP	PRF CUU	RMC HSW	PRF LSW	RMC LSW	D&AL LSW
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.

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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	Total
FY 1990	2,393	6,882	1,226	0	0	53	151	121	193	136	0	11,155
FY 1991	1,317	984	776	859	0	0	140	170	0	208	0	4,454
FY 1992	435	363	155	458	0	136	250	106	0	132	30	2,065
FY 1993	511	291	144	140	0	19	257	38	0	87	45	1,532[a]

[a] In addition to the waste categories in the table, in 1993, approximately 1,336 cubic meters of water was added to DSTs. This water was used to test the upgraded 242-A Evaporator components before restart.

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	1.6 E-03	9.0 E-04	3.4 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[a]	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	--	--
$P_2O_5 \cdot 2H_2O \cdot 44H_2O$	20	--	--
$ZrO_2 \cdot 2H_2O$	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.
[a]Known silica additions are assumed to have reacted with aluminates and hydroxides to form cancrinite (assumed to be $2NaAlSiO_4 \cdot 0.52NaNO_3 \cdot 0.68H_2O$).

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Table 3-7. Hanford Site Single-Shell Tank Releases.[a]
(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.[a]
(sheet 2 of 3)

Tank	Volume (m^3)	Leak Reported
241-T-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[b]	--	1977
241-B-101[b]	--	1974
241-B-103[b]	--	1978
241-B-105[b]	--	1978
241-B-111[b]	--	1978
241-BX-101[b]	--	1972
241-BX-110[b]	--	1976
241-BX-111[b]	--	1984, 1993
241-BY-105[b]	--	1984
241-BY-106[b]	--	1984
241-SX-114[b]	--	1972

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Table 3-7. Hanford Site Single-Shell Tank Releases.[a]
(sheet 3 of 3)

Tank	Volume (m^3)	Leak Reported
241-TX-107[b]	--	1984
241-TX-105[b]	--	1977
241-TX-110[b]	--	1977
241-TX-113[b]	--	1974
241-TX-114[b]	--	1974
241-TX-115[b]	--	1977
241-TX-116[b]	--	1977
241-TX-117[b]	--	1977
Total estimated leakage volume from 67 tanks: 2,840 m^3.		

[a]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.

[b]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.

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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

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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

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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

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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.

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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

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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.

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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.

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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	--	--

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)

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Table 3-14. Plutonium-Uranium Extraction Plant Storage Inventories. (sheet 1 of 2)

Plutonium-Uranium Extraction Plant Tunnels Inventory.

Date transferred to tunnel	Tunnel number	Mass (Kg) of lead transferred	Mass (Kg) of mercury transferred	Mass (Kg) of silver nitrate transferred
06-60	1	113	--	--
12-24-60	1	113	--	--
12-22-71	2	--	45	624
12-26-71	2	--	--	--
09-30-72	2	--	45	--
01-18-86	2	--	38	--
11-18-87	2	2,530	--	--
06-13-88	2	227	--	--
06-13-88	2	--	--	113
Total	N/A	2,983	129	737

Note: 2983 Kg of lead has a volume of 0.263 m^3.
129 Kg of mercury has a volume of 0.0095 m^3 at 23 °C.
737 Kg of silver nitrate has a volume of 0.17 m^3.
N/A = Not applicable.

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Table 3-14. Plutonium-Uranium Extraction Plant Storage Inventories. (sheet 2 of 2)

Plutonium-Uranium Extraction Plant Containment Building Storage Inventory.

Date transferred	Lead mass (Kg)	Cadmium mass (Kg)
12-07-87	23.8	--
12-14-87	114.8	--
02-03-88	66.2	--
02-20-88	34.0	--
04-22-88	113.4	--
10-12-88	9.1	--
12-15-88	56.2	--
07-15-89	34.0	--
07-16-89	29.9	--
07-17-89	27.2	--
08-13-89	201.9	--
08-13-89	201.9	--
01-15-90	267.6	--
06-22-90	91.2	--
06-22-90	582.4	--
06-22-90	1,301.8	--
06-22-90	--	5.9
10-27-90	70.3	--
Total	3,225.8	5.9

Note: 3,225.8 Kg of lead has a volume of 0.284 m^3. 5.9 Kg of cadmium has a volume of 0.0295 m^3.

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Table 3-15. Projected Generation of Solid Waste Operations Complex Stored Low-Level and Transuranic Waste.

Year	Total (cubic meters)
1994	4,273
1995	3,502
1996	3,205
1997	2,877
1998	2,682
1999	2,941
2000	4,031
2001	3,684
2002	3,452
2003	2,662
2004	7,025
2005	10,652
2006	11,243
2007	3,428
2008	3,502
2009	3,289
2010	2,930
2011	2,059
2012	2,525
2013	2,006
2014	2,026
2015	2,309
2016	2,481
2017	2,185
2018	1,983
2019	2,002
2020	2,110
2021	2,081
2022	1,970
Total	101,115

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Table 3-16. Designation of 303-K Facility Stored Waste (December 31, 1993).

	Waste description
Organic Constituents	
Perchloroethylene	Spent halogenated solvent
1,1,1-trichlorethane	Spent halogenated solvent
Organic Degradation Products	
1,1-dichloroethylene	Spent halogenated solvent
cis-1,2-dichloroethylene	Spent halogenated solvent
trans-1,2-dichoroethylene	Spent halogenated solvent
Inorganic Constituents	
5% Beryllium/Zircaloy-2[a]	Metal alloy
Cadmium ion	Sludge
Chromium	Sludge
Zircaloy-2[a]	Metal alloy
Lead	Lead metal 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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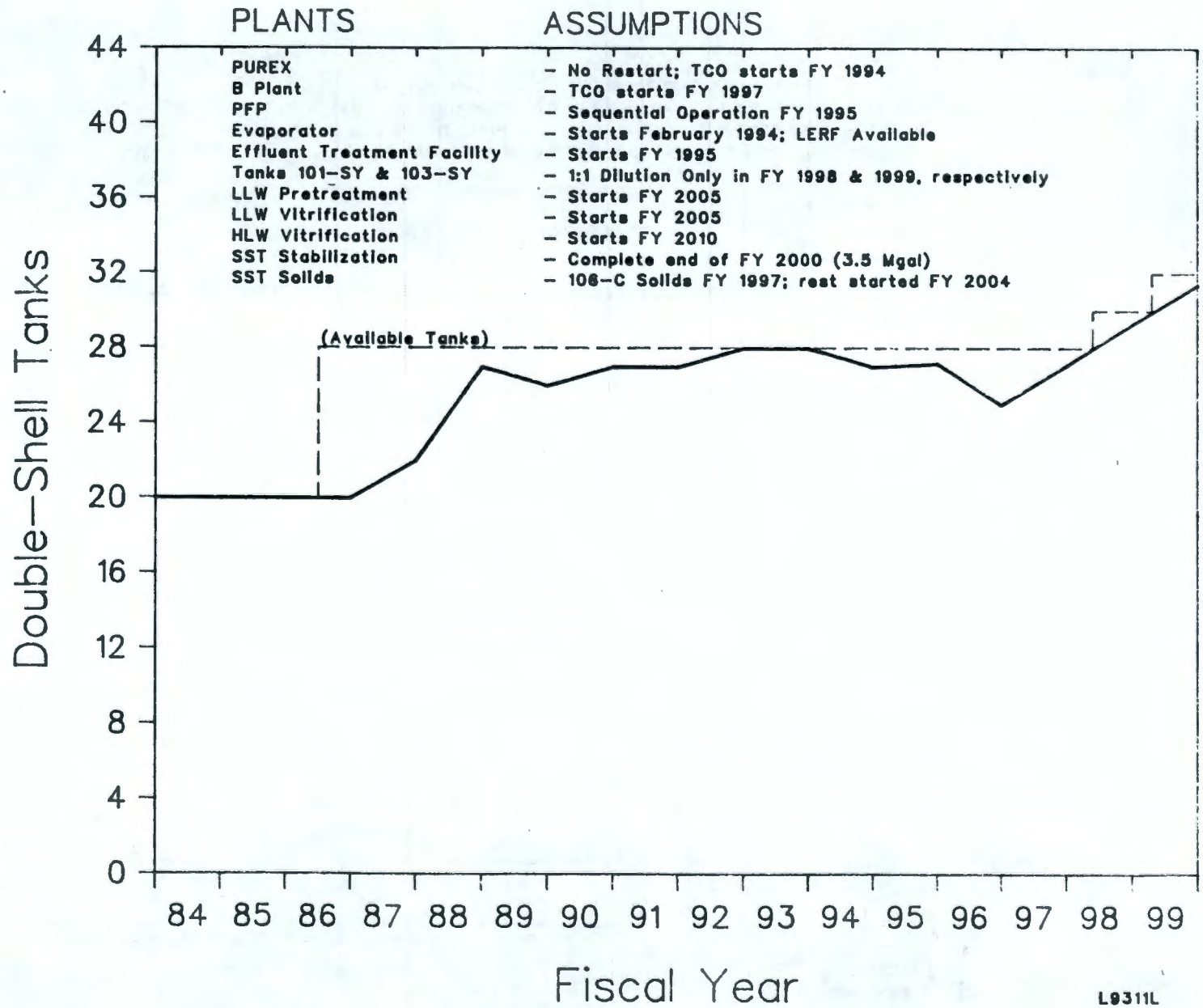

Figure 3-1. Double-Shell Tank Space Summary.

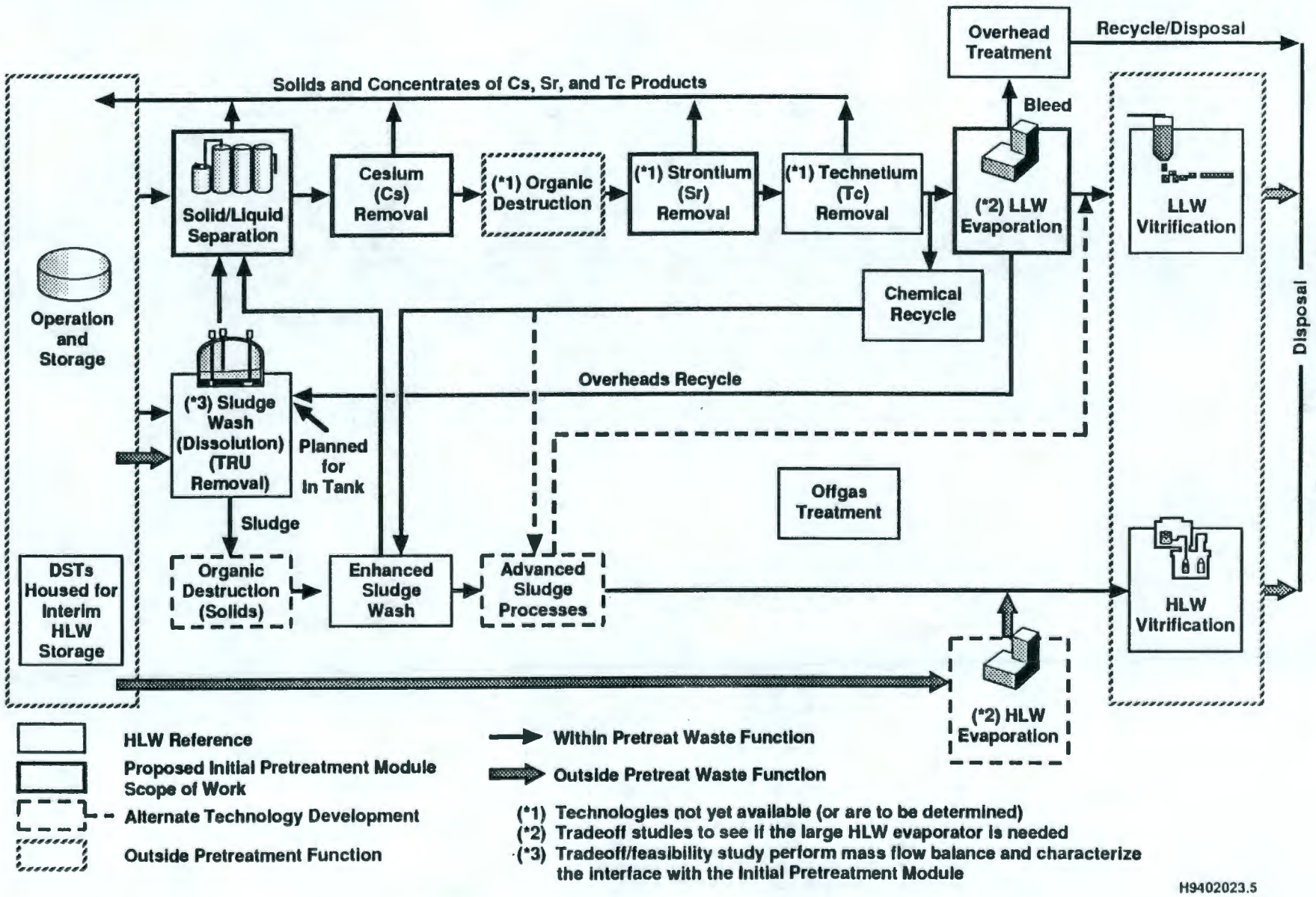

Figure 3-2. Tank Waste Remediation System Treatment Block Diagram.

Figure 3-3. PUREX Aging Waste Transfers to Aging Waste Storage.

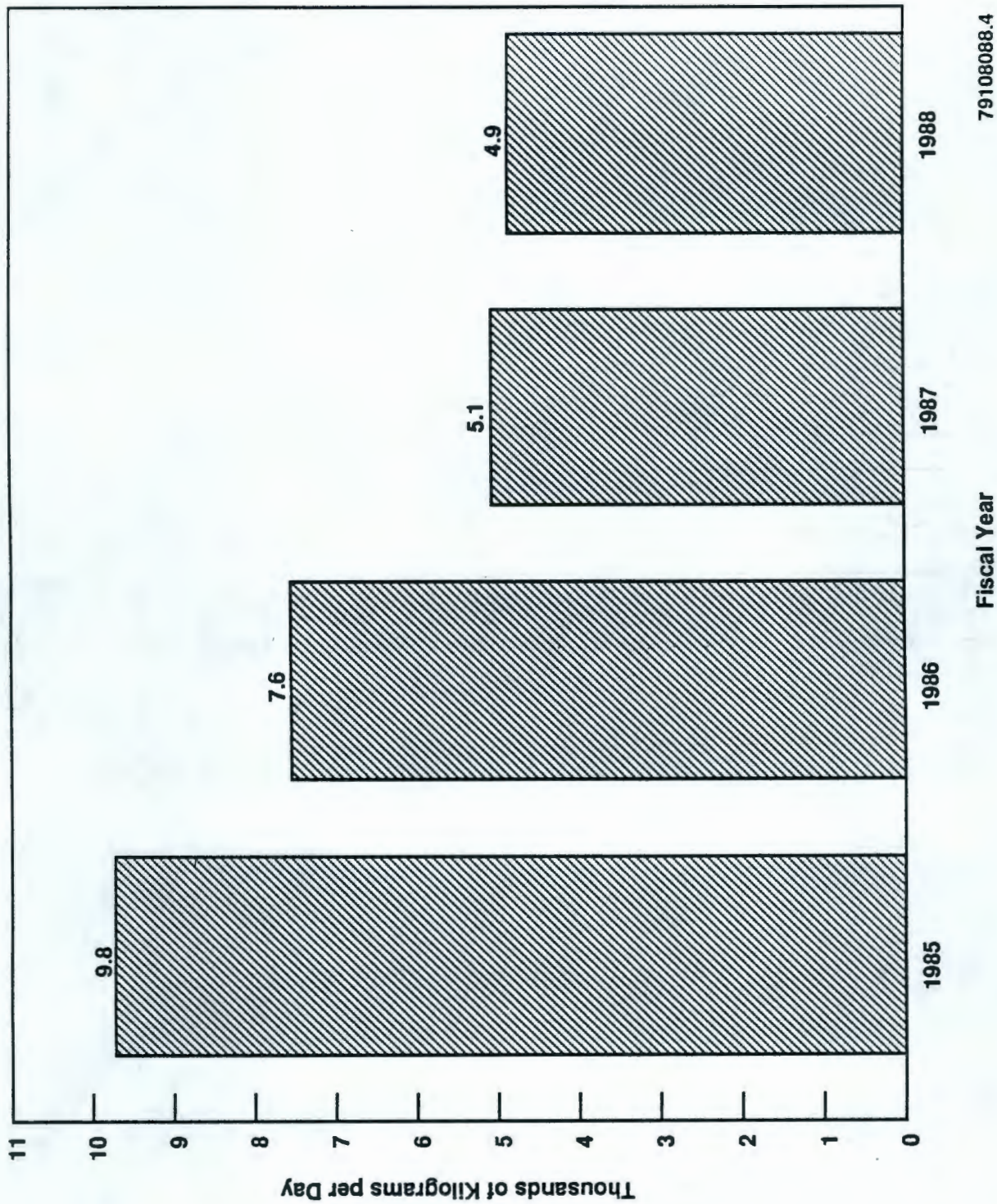

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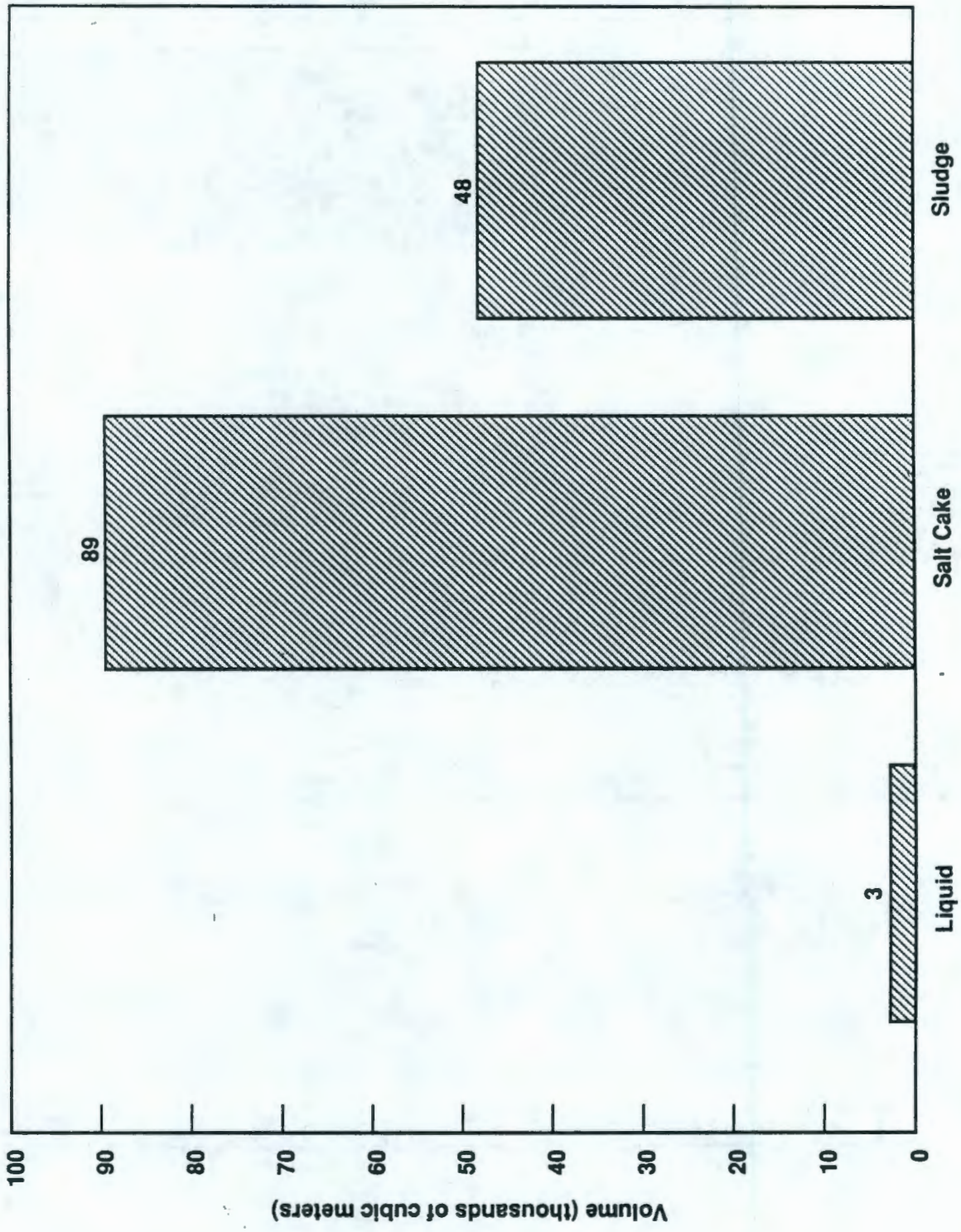
Figure 3-4. Relative Proportions of Supernatant, Sludge, and Salt Cake in Single-Shell Waste.



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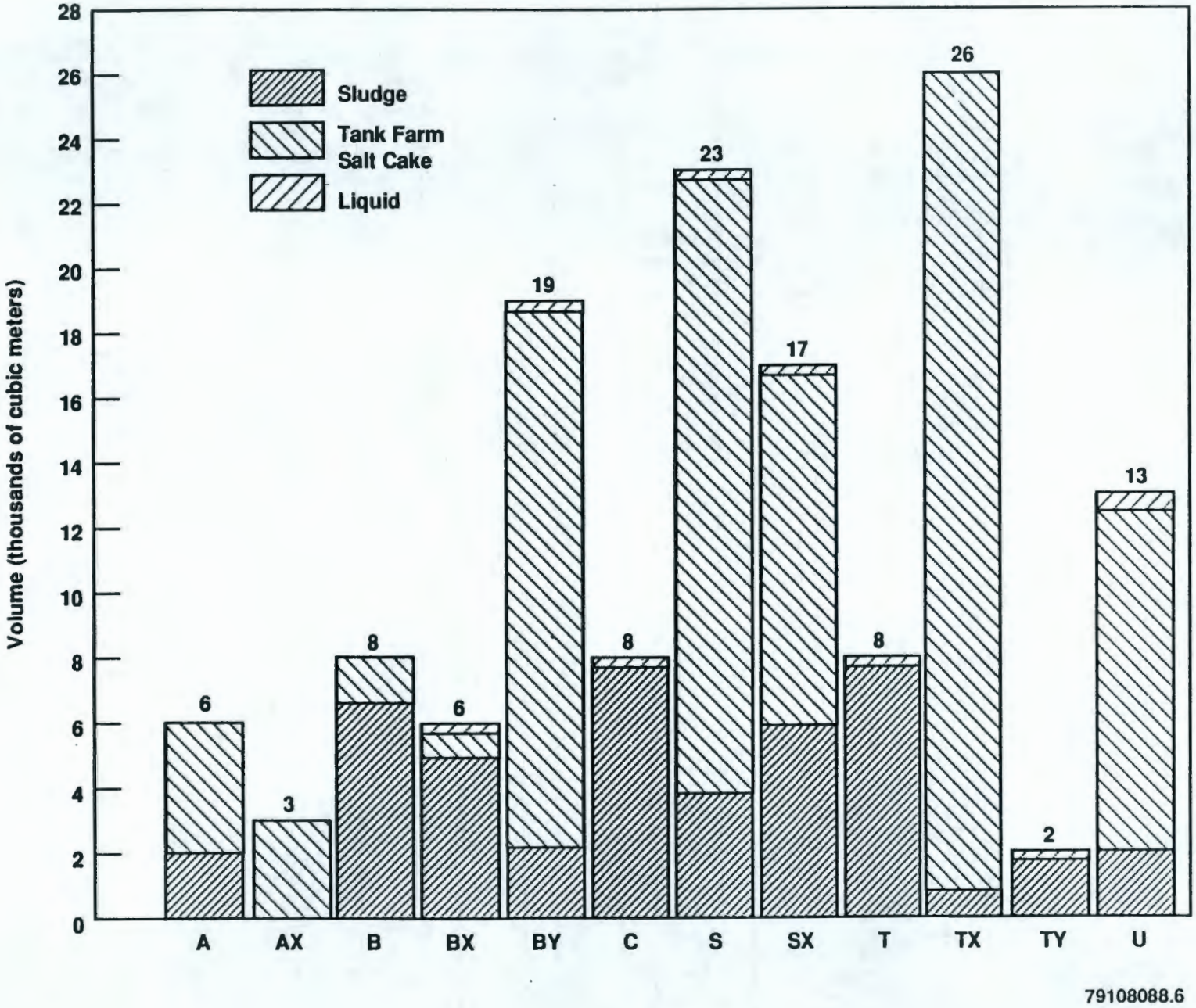
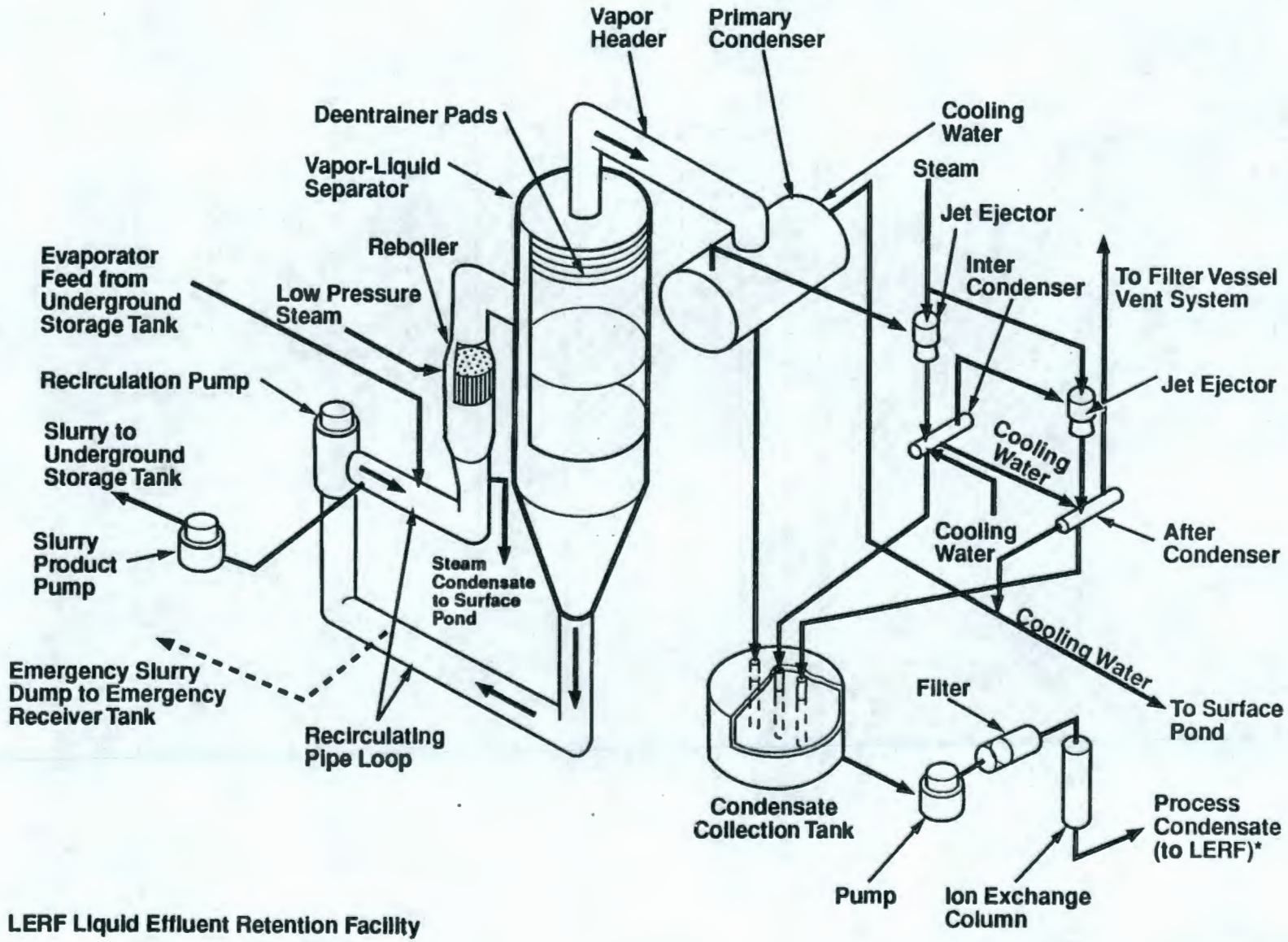


Figure 3-5. Single-Shell Tank Waste Inventory by Tank Farm.



LERF Liquid Effluent Retention Facility

* To treatment facility after June 1995

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Figure 3-6. Process Flow Diagram for 242-A Evaporator.

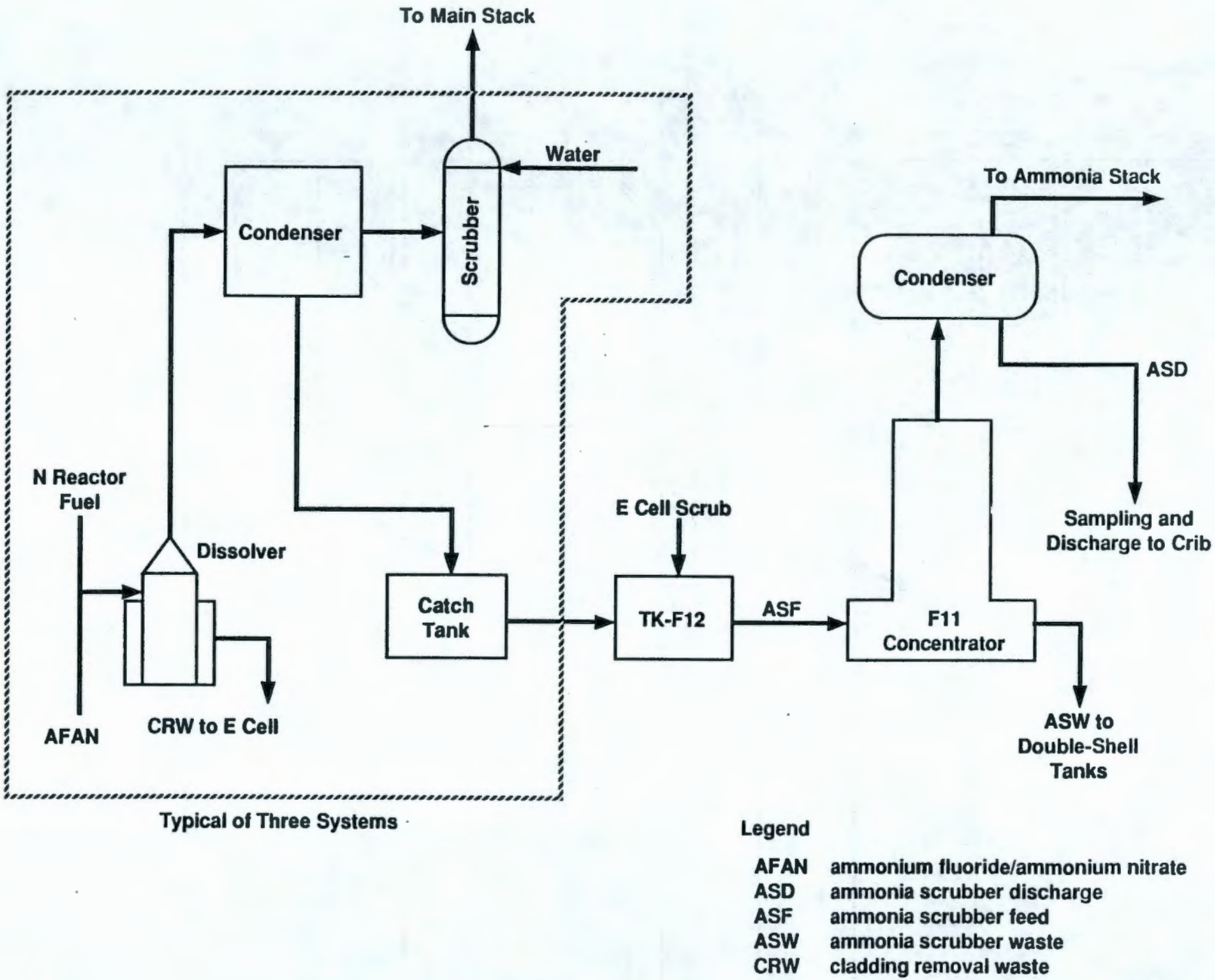


Figure 3-7. Historical Process Flow Diagram for PUREX Ammonia Scrubber Waste Generation.

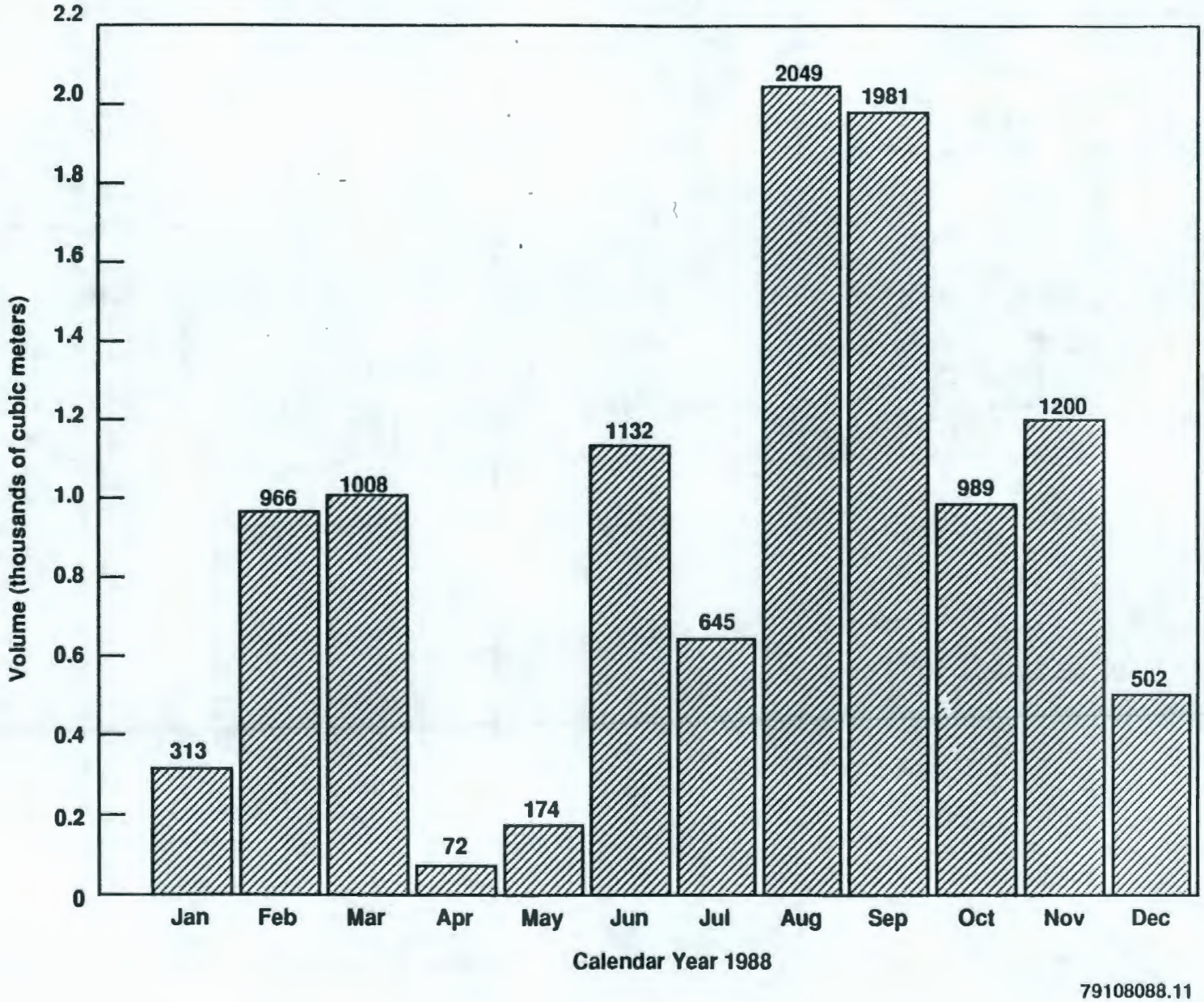


Figure 3-8. Ammonia Scrubber Waste Transfers to Double-Shell Tanks.

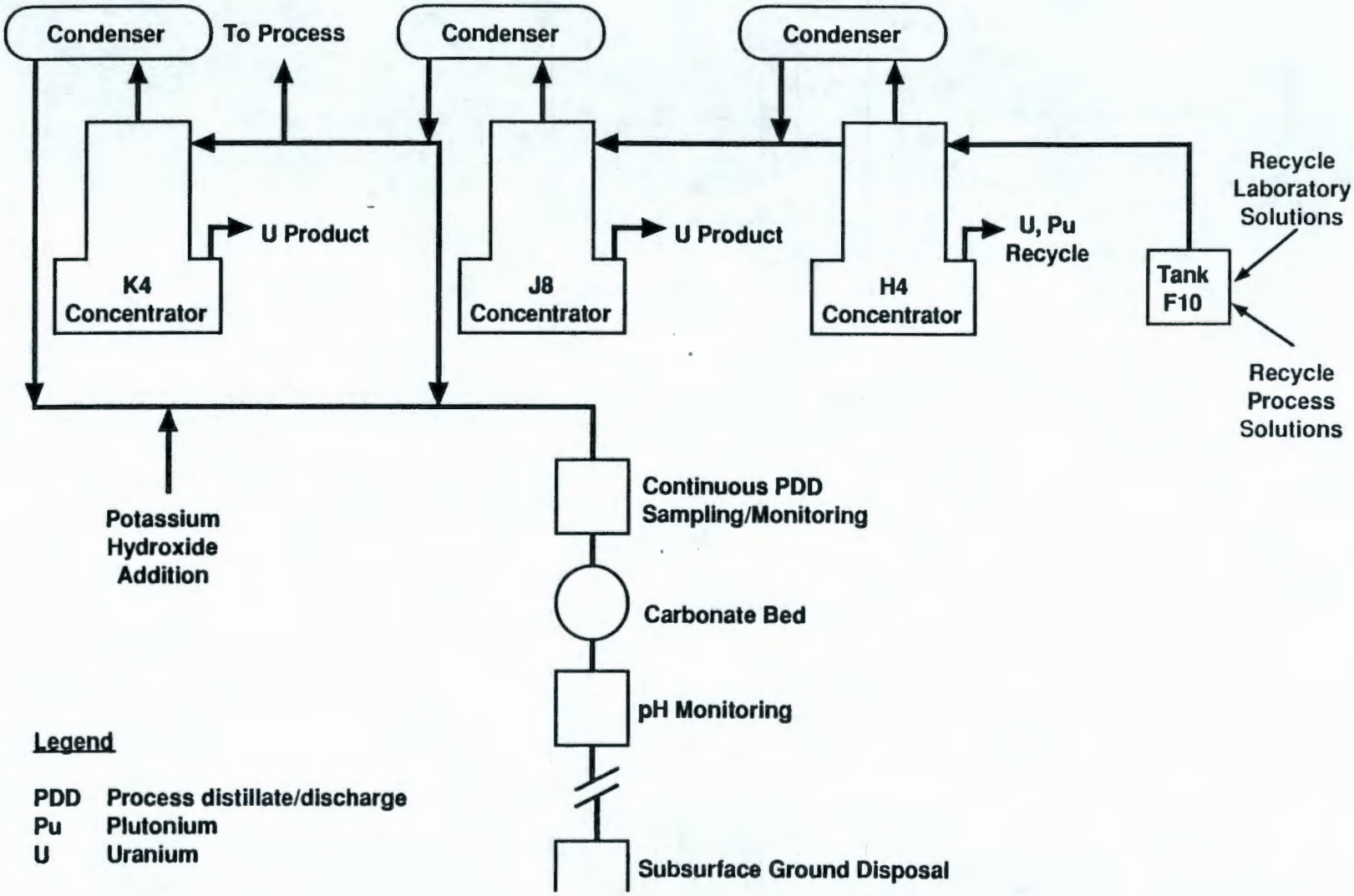


Figure 3-9. Historical Process Flow Diagram for PUREX Process Condensate.

Feed and Processing Equipment

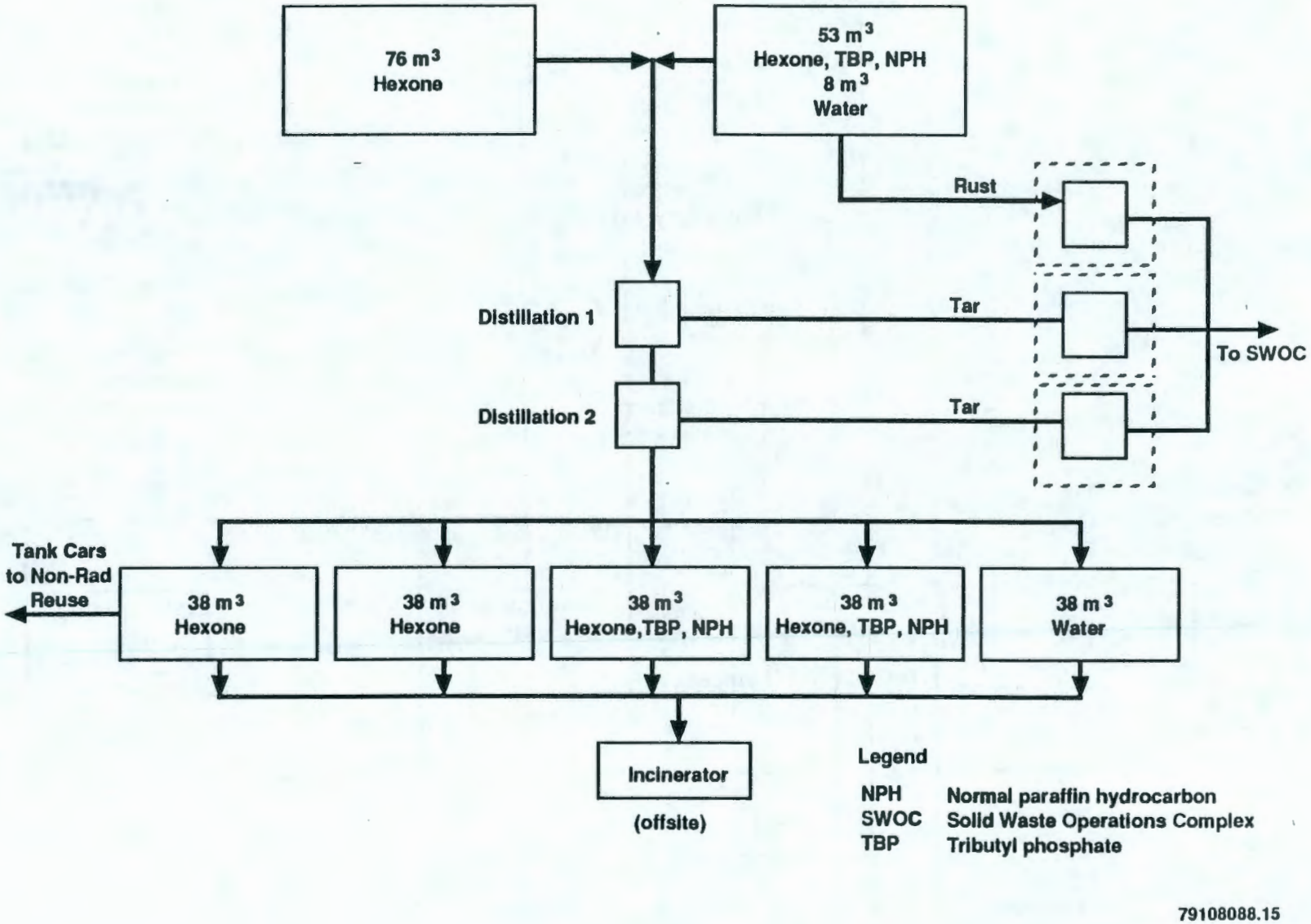
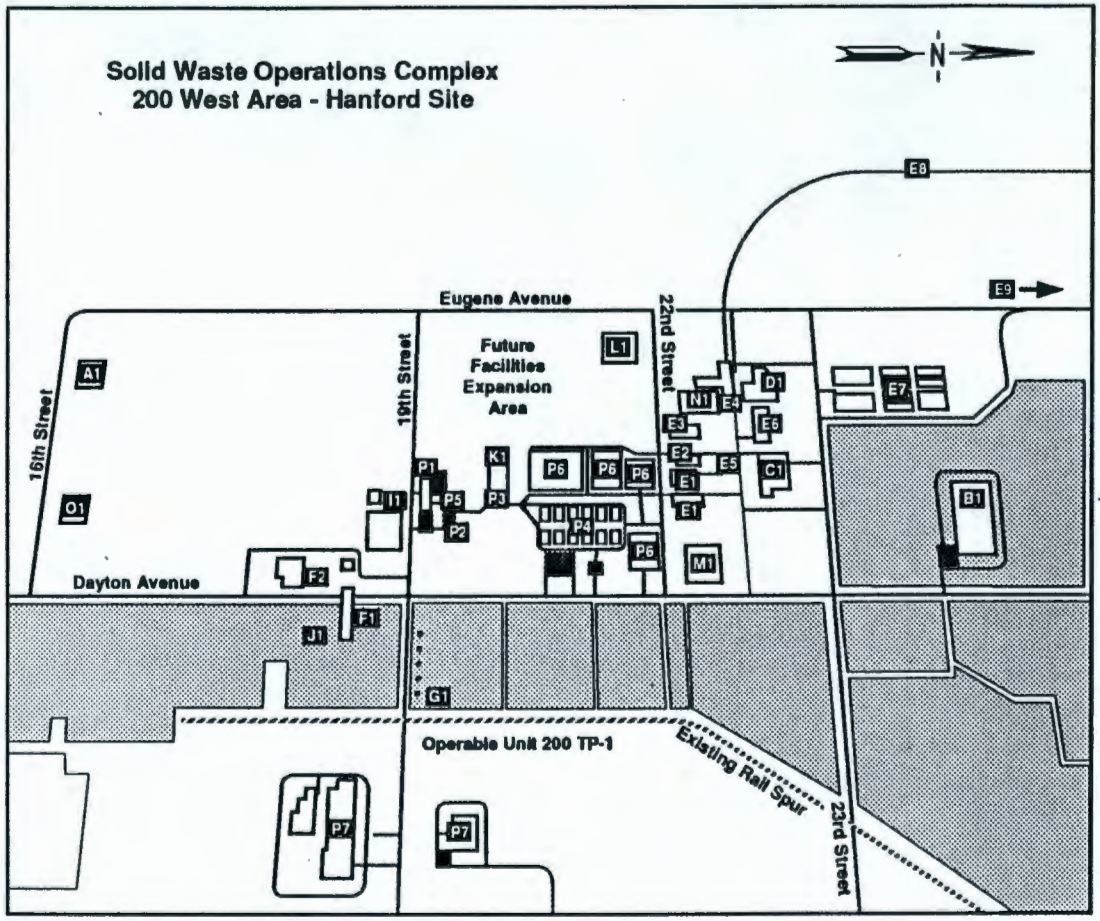


Figure 3-10. Process Flow Diagram for Hexone Waste Processing and Disposal.

Figure 3-11. Plan View of Existing and Planned 200 West Area Facilities.



Low Level Burial Grounds

○ LLBG = Low Level Burial Ground
□ CWC = Central Waste Complex
+ SWOCI = Solid Waste Operations Complex Phase I MSA

LI = Line Item
GPP = General Plant Project
TBD = To Be Determined

Project W-272 (Capital Work Order)
- A1 Special Case Waste Storage Facility

Project W-025 (Expense Funded)
- ○ 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)
- + ○ F1 Solid Waste Retrieval Facility (218-W-4C/T04)
- + F2 NDE/NDA Building

Project W-156 (97 LI)
- ○ G1 Alpha Caisson Retrieval

Project W-174 (TBD)
- ○ 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)
- ○ J1 Solid Waste Retrieval Phase II

Project W-241 (Minor Project)
- K1 Temporary 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 Plutonium Finishing Plant Operations (Non-solid Waste Facilities)

Figure 3-12. Process Flow Diagram for Proposed Waste Receiving and Processing Facility Module 2.

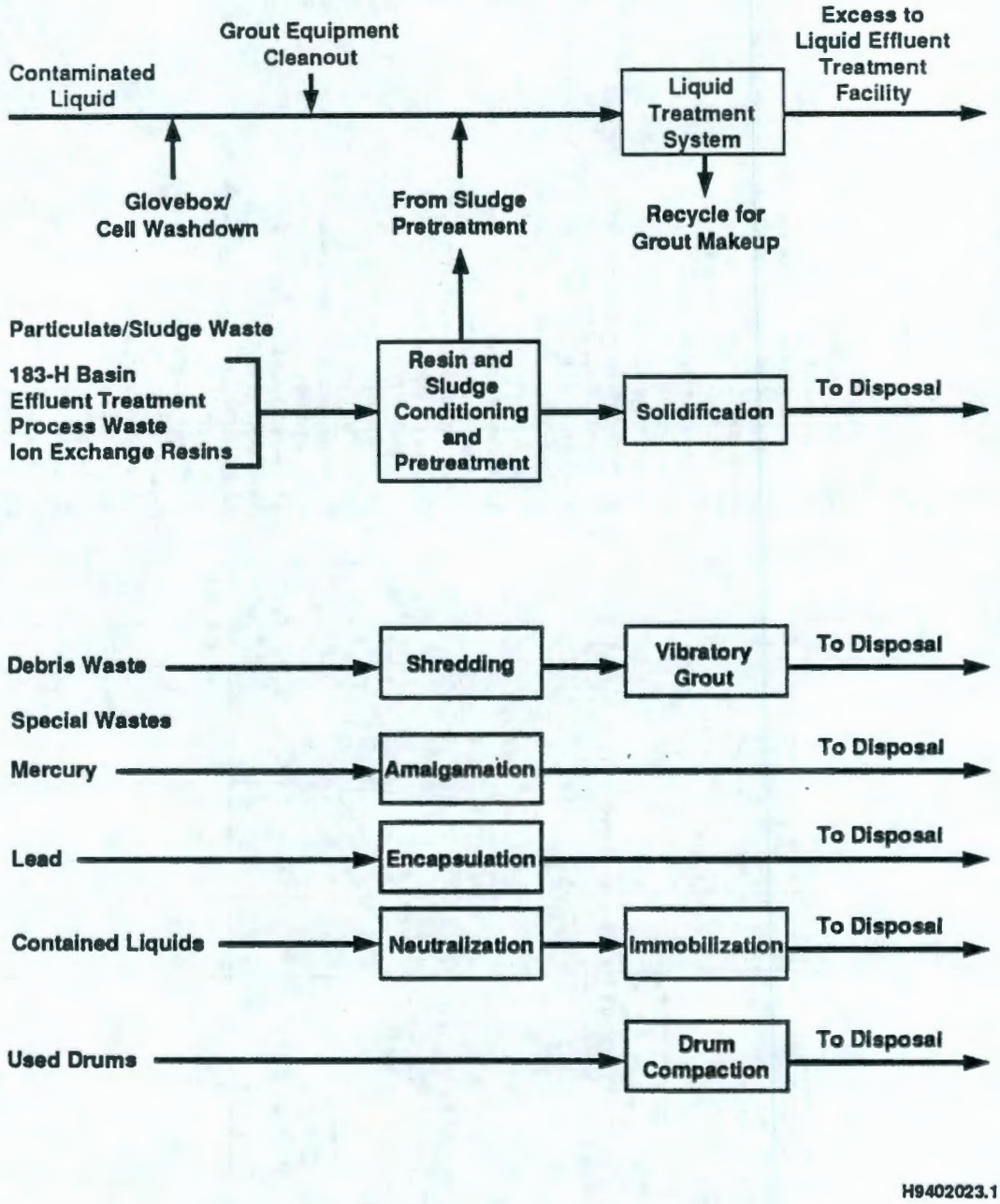


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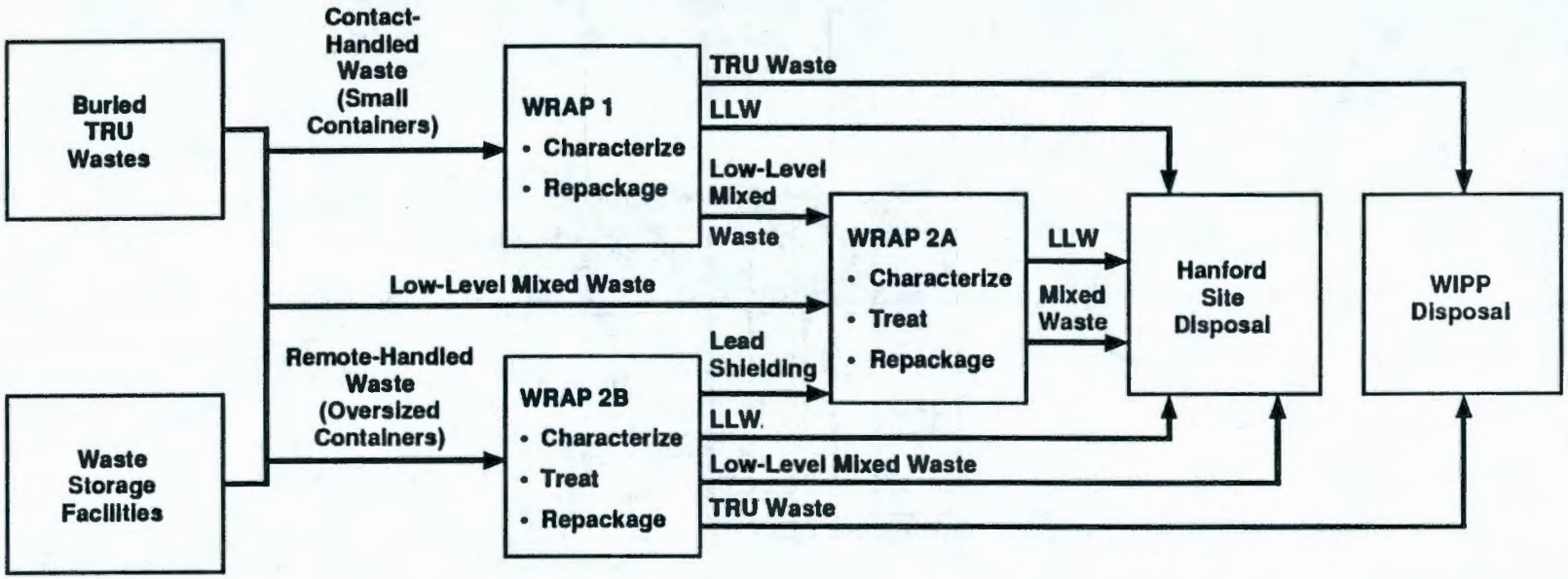
Figure 3-13. Waste Receiving and Processing Modules 1, 2A, and 2B.



LLW Low-Level Waste
TRU Transuranic
WIPP Waste Isolation Pilot Plant
WRAP Waste Receiving and Processing

Figure 3-14. Typical Configuration of Retrievable Storage Unit for Contact-Handled Waste.

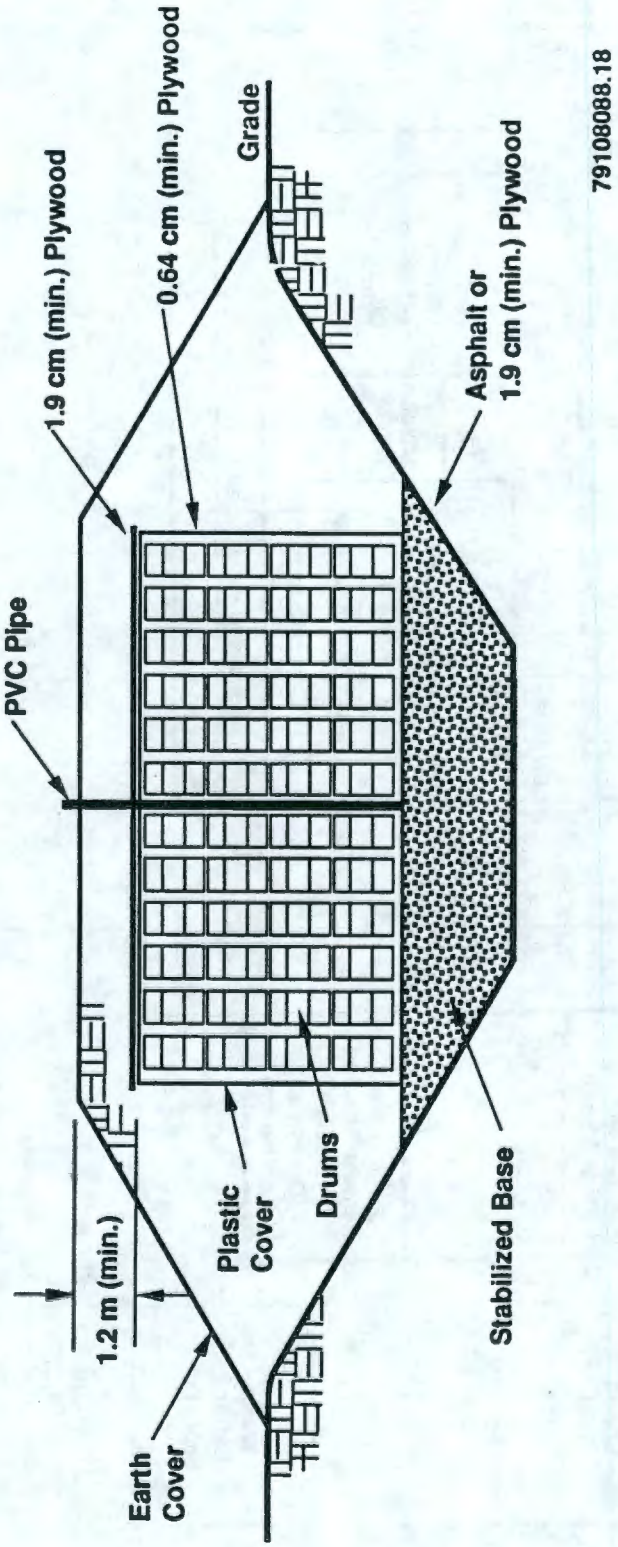


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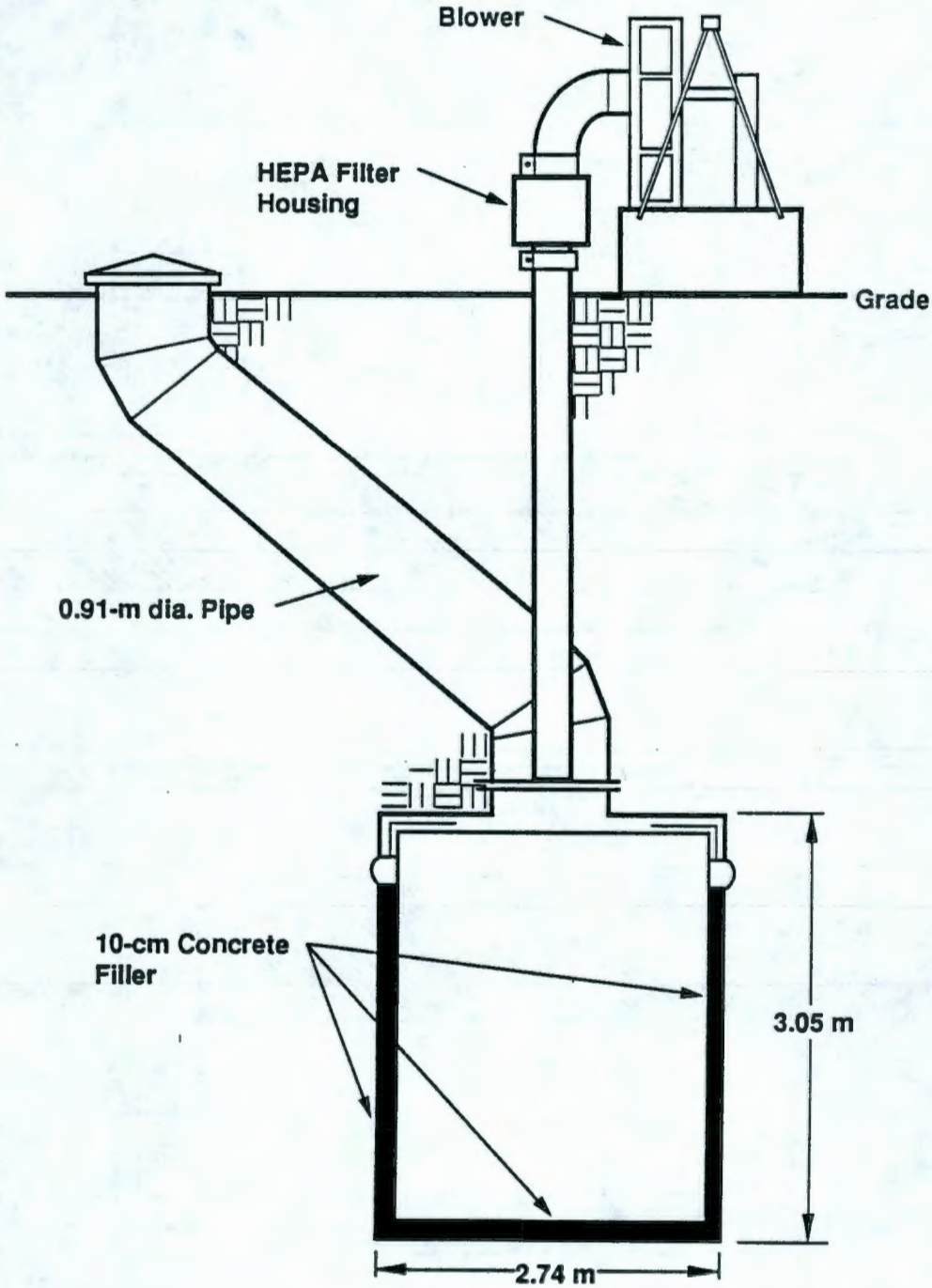
Figure 3-15. Typical Configuration of a Retrievable Storage Unit for Remote-Handled Waste.



HEPA High-efficiency particulate air

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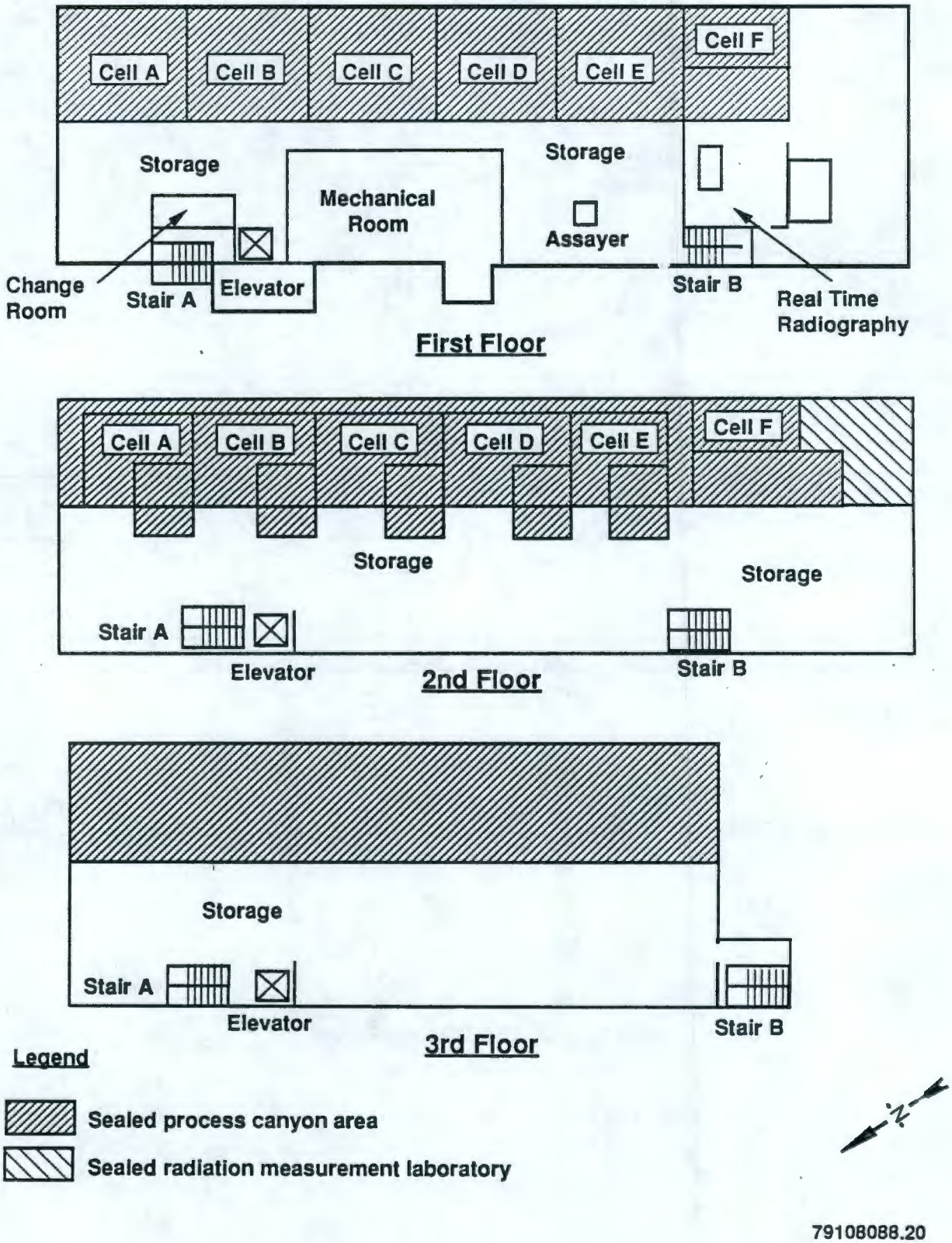
Figure 3-16. Transuranic Storage and Assay Facility Floor Plan.



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9413207.1508

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58 FR 29800, et seq., "Land Disposal Restriction for Ignitable and Corrosive Characteristic Wastes Whose Treatment Standards Were Vacated," *Federal Register*, Vol. 58, No. 98, p. 29860, May 24, 1993, U.S. Environmental Protection Agency, Washington, D.C.

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4.3 FEDERAL AND STATE ACTS

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Toxic Substances Control Act of 1976, 15 USC 2601, et seq.

4.4 WASHINGTON STATE REGULATIONS

Ecology, Technical Information Memorandum 86-3, *Treatment by Generators* (revised July, 1993), Hazardous Waste and Toxics Reduction Program, Technical Assistance and Policy Sections, Washington State Department of Ecology, Olympia, Washington.

WAC, 1990, *Dangerous Waste Regulations*, Washington Administrative Code 173-303, Washington State Department of Ecology, Olympia, Washington. (WAC 173-303-140 covers land disposal restrictions.)

APPENDIX A

INVENTORY DATA CORRELATION

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In response to EPA's comments on the 1993 Land Disposal Restrictions Report, this crosswalk is provided that correlates inventory data among a number of reports. These reports are the following:

- Waste Isolation Pilot Plant No-Migration Variance Petition
- November 1991 Case-by-Case Extension Application
- April 1993 Interim Mixed Waste Inventory Report, required by the *Federal Facility Compliance Act of 1992*.

The approach in this correlation is to use the Interim Mixed Waste Inventory Report as the basis for comparisons. Thus, the organization of this correlation is the following. First, the data in the Interim Mixed Waste Inventory Report is summarized. Next, a correlation will be presented with the data in the Waste Isolation Pilot Plant No-Migration Variance Petition. This will be followed by a comparison with the Case-by-Case Extension Application.

The purpose of this correlation is to show the consistency of inventory data. Any inconsistencies are explained.

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A1.0 INTERIM MIXED WASTE INVENTORY REPORT SUMMARY

A summary of data presented in the Interim Mixed Waste Inventory Report for the Hanford Site is presented in Tables A-1, A-2, and A-3. Tank waste not subject to land disposal restriction (LDR) is single-shell tank (SST) waste. The solid wastes in storage that are not subject to LDR are the following:

- State-only regulated waste
- EPA regulated waste that have only total carbon-organics waste codes.

These wastes are not subject to LDR because relevant LDR standards have not been promulgated.

The data in the Interim Mixed Waste Inventory Report exclude polychlorinated biphenyl (PCB) - TSCA regulated waste.

A2.0 COMPARISON TO WASTE ISOLATION PILOT PLANT NO-MIGRATION VARIANCE PETITION

Only transuranic waste managed by Solid Waste Programs is planned to be shipped to Waste Isolation Pilot Plant, and is thereby covered in their No-Migration Variance Petition. Tank waste that meets the definition of transuranic waste is planned to be pretreated as necessary and vitrified at the Hanford Waste Vitrification Plant. The canisters containing vitrified

transuranic tank waste are candidates for disposal at the Waste Isolation Pilot Plant. Thus, these canisters were not covered in the Waste Isolation Pilot Plant No-Migration Variance Petition.

The comparison of mixed transuranic waste inventories and projections, between the Interim Mixed Waste Inventory Report and the Waste Isolation Pilot Plant No-Migration Variance Petition, is presented in Table A-4. The existing transuranic waste inventory in the No-Migration Variance is expected to be less than the inventory in the Interim Mixed Waste Inventory Report, and this is reflected in Table A-4. This is because the inventories in the No-Migration Variance Petition only cover the period to 12/31/88.

Projected quantities of mixed transuranic waste in the No-Migration Variance Petition are much less than the Interim Mixed Waste Inventory Report. Transuranic mixed waste descriptions are presented in Tables 3-8 and 3-9 of the No-Migration Variance Petition. These are presented in Table A-5, along with the waste descriptions based on Hanford Site records of the types of waste reported in the Interim Mixed Waste Inventory Report. As the information in Table A-5 indicates, the types of waste for the Hanford Site included in the No-Migration Variance Petition includes a small fraction of the wastes that have been actually received at the Hanford Site. The data in the No-Migration Variance Petition does not capture much of the debris generated from maintenance and cleanup activities.

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Table A-1. Interim Mixed Waste Inventory Report Volume Summary[a].

Waste[b]	Type[c]	Reg. Auth.	Not subject to LDR, m^3	Subject to LDR, m^3	Total, m^3
Tank Waste	HLW	EPA	138,600.000	7,352.000	145,952.000
Tank Waste	MTRU	EPA	0.000	2,767.000	2,767.000
Tank Waste	MLLW	EPA	0.000	81,872.000	81,872.000
Wastewater	MLLW	EPA	0.000	0.000	0.000
183-H waste	MLLW	EPA	0.000	2,309.600	2,309.600
Solid Waste	MTRU	EPA	0.000	166.150	166.150
Solid Waste	MTRU	State	2.100	0.000	2.100
Solid Waste	MLLW	EPA	16.600	505.680	522.280
Solid Waste	MLLW	State	89.180	0.000	89.180
Other Solid Waste	MLLW	EPA	0.000	9.641	9.641
Total			138,707.880	94,982.071	233,689.951

[a]Inventories are cumulative through 12/31/91.

[b]Solid waste is defined as waste managed by Westinghouse Hanford Company, Solid Waste Programs. The 183-H Basin waste is also managed by Solid Waste Programs, but because of its relative magnitude of inventory the data are tabulated separately. Inventories of solid waste are cumulative from mid-1987, reflecting the date of the Byproduct Rulemaking. "Other solid waste" refers to waste not managed by Solid Waste Programs--the waste is in permitted storage at other locations on the Hanford Site.

[c]HLW = High-level Waste, MTRU = Mixed Transuranic Waste, MLLW = Mixed Low-level Waste. All HLW is mixed waste, per DOE Order 5820.2A, "Radioactive Waste Management."

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Table A-2. Interim Mixed Waste Inventory Report Mass Summary[a].

Waste	Type	Reg. Auth.	Not subject to LDR, kg	Subject to LDR, kg	Total, kg
Tank waste	HLW	EPA	248,000,000	8,822,000	256,822,000
Tank waste	MTRU	EPA	0	3,876,200	3,876,200
Tank waste	MLLW	EPA	600	98,267,400	98,268,000
Wastewater	MLLW	EPA	0	0	0
183-H waste	MLLW	EPA	0	2,309,630	2,309,630
Solid waste	MTRU	EPA	0	166,030	166,030
Solid waste	MTRU	State	2,100	0	2,100
Solid waste	MLLW	EPA	16,590	513,420	530,010
Solid waste	MLLW	State	91,585	0	91,585
Other solid waste	MLLW	EPA	0	15,638	15,638
Total			248,110,875	113,970,318	362,081,193

[a]The footnotes in Table A-1 also apply to Table A-2.

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Table A-3. Interim Mixed Waste Inventory Report Projections Summary[a].

Waste	Type	Reg. Auth.	5 Year Projected Generation, m^3[b]	5 Year Projected Generation, kg[b]
Tank waste	HLW	EPA	0.000	0
Tank waste	MTRU	EPA	241.000	361,500
Tank waste	MLLW	EPA	110,119.000	121,745,600
Wastewater	MLLW	EPA	114,600.000	114,600,000
183-H waste	MLLW	EPA	310.800	310,800
Solid waste	MTRU	EPA	1,297.560	1,297,440
Solid waste	MTRU	State	14.100	14,070
Solid waste	MLLW	EPA	10,266.810	10,381,725
Solid waste	MLLW	State	1,024.700	1,057,640
Other solid waste	MLLW	EPA	0.872	667
Total			237,874.842	249,769,442

[a]The footnotes in Table A-1 apply to Table A-3.

[b]The five-year projection was required by statute, the data reported in the Interim Mixed Waste Inventory Report actually covers a six-year period, from 1/1/92 to 12/31/97.

Table A-4. Data Comparison between the Interim Mixed Waste Inventory Report and the Waste Isolation Pilot Plant No-Migration Variance Petition.

Existing inventory m^3		Annual average projection m^3/yr	
IMWIR (a)	WIPP No Mig Petition Var.	IMWIR (a)	WIPP No Mig Petition Var.
mid 87 to 12/31/91	through 12/31/88	1/1/92 to 12/31/97	1988 to 2013
168.25	25	218.61	11.12

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Table A-5. Mixed Transuranic Waste Description Comparison.

Waste Isolation Pilot Plant No-Migration Variance Petition		Interim Mixed Waste Inventory Report	
Waste description	Chemical contaminants	Waste description	Chemical contaminants
Organic cleanup of solvent extraction system and analytical lab waste	Xylene	Cleanup activities Maintenance activities Spent equipment Miscellaneous inorganic spent materials Contaminated soil	Lead chromate TC-metals Sodium hydroxide Cadmium Phosphoric acid
Neutralized rags used to clean PUREX and PFP equipment	Sodium hydroxide	Contaminated absorbents Lead acid batteries packaged with soil or absorbent Drained spent lead acid batteries contaminated with Mercury	Sulfuric acid Mercury Beryllium Tri-chloro-ethene Methylene chloride
Gloves containing lead shielding	Lead	Radioactive contaminated lead packaged with soil and various solid debris Lead glass packaged with various solid debris Cellulose material Plastic Rubber Cloth	PCB's (with other RCRA contaminants Lead

Hanford has not reported any stored remote-handled mixed transuranic waste, either as inventories or projections, in either the Interim Mixed Waste Inventory Report or the Waste Isolation Pilot Plant No-Migration Variance Petition.

A3.0 COMPARISON TO THE CASE-BY-CASE APPLICATION

The data comparison between the Case-by-Case Extension Application and the Interim Mixed Waste Inventory Report is presented in Table A-6. An explanation of the differences are as follows:

- Existing inventories--Most of the difference reflects actual generation in CY 1991. A minor correction was made to the inventory of SST waste. Minor corrections for the other waste categories are also incorporated into the difference.

- Projections for tank waste in the Case-by-Case Extension Application excluded residues of waste generated within tank farms. The residues were included in the Interim Mixed Waste Inventory Report. These residues are as follows:

  - Evaporator Bottoms (Double-shell Slurry and Double-shell Slurry Feed)

  - Evaporator Overhead (Process Condensate, Wastewaters).

- Projections for tank waste in the Case-by-Case Extension Application were based on an average generation rate for each waste stream. Projections for tank waste in the Interim Mixed Waste Inventory Report were based on detailed 5-year projections provided by each of the generators and on planned operating campaigns of the Evaporator.

- Projections for tank waste in the Case-by-Case Extension Application were based on the programmatic assumptions applicable in November 1990. At that time, the plan called for continuation of fuel reprocessing and continued operation at the Plutonium Finishing Plant. While preparing the Interim Mixed Waste Inventory Report (Spring 1993), the plan was not to restart the fuel reprocessing plant, and to perform only necessary operations at PFP to place the facility in a safe maintenance condition.

- In the Case-by-Case Extension Application, the assumption was that retrieval of dewatered fuel fabrication sludge from the 183-H Basins had been completed. However, additional quantities of 183-H Basin waste was received in 1991.

- Projections of Solid Waste (other than 183-H Basin waste) in the Case-by-Case Extension Application was based on the annual generation of each waste stream in the 3.5-year period between mid-1987, the approximate date of the Byproduct Rulemaking, and 12/31/90. Projections of solid waste in the Interim Mixed Waste Inventory Report were based on Westinghouse Hanford Company Solid Waste Reference Forecast.

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Table A-6. Data Comparison between Interim Mixed Waste Inventory Report and the Case-by-Case Extension Application.

			Inventory, m^3		Projected average annual generation, m^3/yr	
Waste	Type	Reg. auth.	Case-by-Case Extension Application 12/31/90	Interim Mixed Waste Inventory Report, 12/31/91	Case-by-Case Extension Application	Interim Mixed Waste Inventory Report
Single-shell tank waste			139,500.000	138,600.000	0.000	0.000
Double-shell tank waste	HLW	EPA	7,237.000	7,352.000	0.000	0.000
Double-shell tank waste	MTRU	EPA	2,767.000	2,767.000	829.000	40.167
Double-shell tank waste	MLLW	EPA	78,231.000	81,872.000	13,931.000	18,353.167
Wastewater	MLLW	EPA	0.000	0.000	0.000	19,100.000
183-H waste	MLLW	EPA	1,781.030	2,309.600	0.000	51.800
Solid waste	MTRU	EPA	160.570	166.150	45.877	216.260
Solid waste	MTRU	State	2.100	2.100	0.600	2.350
Solid waste	MLLW	EPA	441.900	522.280	126.257	1,711.135
Solid waste	MLLW	State	72.160	89.180	20.617	170.783
Other solid waste	MLLW	EPA	--	9.641	--	0.145
Solid waste	MTRU	TSCA	1.470	(a)	0.420	(a)
Solid waste	MLLW	TSCA	43.430	(a)	12.409	(a)

(a) The Interim Mixed Waste Inventory Report did not include TSCA regulated PCBs.

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