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1995 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-26-01E. This milestone requires the preparation of an annual report that covers characterization, treatment, storage, minimization, and other aspects of land disposal restricted mixed waste at the Hanford Site.

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.

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 (LDRs) plan and its annual updates to comply with LDR requirements for radioactive mixed waste. This report is the fifth update of the plan first issued in 1990.

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 includes discussions of treatment alternatives and accelerated treatment.

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

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

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

A Tri-Party Agreement change request for the LDR report milestone was approved in 1992. This change request consolidated another LDR report, Milestone M-25-00, that emphasized LDR treatment alternatives. 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.

Total projected generation rates for the streams covered in this report, after waste reduction, range from 20,928 cubic meters per year to 32,974 cubic meters per year. These rates are for the years 1999 and 1996 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 Central Waste 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 598,000 cubic meters. About 389,000 cubic meters of this capacity are in units such as SSTs that no longer actively receive waste. Approximately 249,200 cubic meters of waste are currently in storage. The DSTs currently available are nearly filled to capacity and are expected to be full by 1998 under the current planning baseline. To alleviate the space shortage, up to six new DSTs are planned. Because of reduced funding levels and recent resolution of certain safety concerns, the planning baseline is being revised, which, when finalized, will result in changes to projected storage capacity and potentially eliminate the need for the six new tanks. 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 1996; however, additional buildings will be constructed as required to store waste generated in the future. The 242-A Evaporator processed 24,800 cubic meters of waste into the Liquid Effluent Retention Facility basins in 1994.

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 (DSTs). Current waste treatment consists of pH adjustment and corrosion inhibitors and using absorbents and solidifying agents (Central Waste Complex). Planned waste treatment processes include developing neutralization and toxic constituent destruction processes (corrosivity neutralization processes); developing waste separation, pretreatment, and stabilization processes (Waste Receiving and Processing Facility Module 2); and separating tank waste (pretreatment) into low- and high-level waste fractions, both of which will be vitrified. The low-level fraction will be disposed of on site. The high-level fraction will be sent to an offsite geologic repository for disposal.

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.

The Hanford Site is the only DOE site with a preexisting agreement (Tri-Party Agreement) that meets the legal requirements specified under the *Federal Facilities Compliance Act*. Having this agreement exempts the Site from having

to develop a site treatment plan. This exemption is supported by written exemptions from the State of Washington Department of Ecology and the U.S. Environmental Protection Agency. Both agencies determined that the *Report on Hanford Site Land Disposal Restrictions for Mixed Waste*, required by the Tri-Party Agreement, meets the intent of a site treatment plan.

ACRONYMS AND ABBREVIATIONS

ALARA	as low as reasonably achievable
BDAT	best demonstrated available technology
CAW	current acid waste
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
FFCAct	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)
HLV	High-Level Vault
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

ACRONYMS AND ABBREVIATIONS (cont)

PFP	Plutonium Finishing Plant
PNL	Pacific Northwest Laboratory
PRF	Plutonium Reclamation Facility
PUREX	Plutonium-Uranium Extraction (Plant)
RCRA	*Resource Conservation and Recovery Act of 1976*
REC	Radiochemical Engineering Cells
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*
TWRS	Tank Waste Remediation System
WAC	*Washington Administrative Code*
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 of other action plan milestones and will not become effective until approved by the U.S. Environmental Protection Agency (EPA) (or Washington State Department of Ecology [Ecology]) upon authorization to administer LDRs pursuant to Section 3006 of the *Resource Conservation and Recovery Act of 1976* (RCRA). Disposal of LDR wastes at any time is prohibited except in accordance with applicable LDR requirements for nonradioactive wastes at all times. The plan will include, but not be limited to, the following:
>
> - Waste characterization plan
> - Storage report
> - Treatment report
> - Treatment plan
> - Waste minimization plan
> - A schedule depicting the events necessary to achieve full compliance with LDR requirements
> - A process for establishing interim milestones."

The original plan was published in October 1990. This is the fifth 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, 1994, to March 31, 1995.

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).

This year's report will also be used as the Hanford Site's equivalent to the final Site Treatment Plan (STP) submitted to the U.S. Department of Energy-Headquarters (DOE-HQ) as required by the *Federal Facilities Compliance Act of 1992* (FFCAct). Although the State of Washington and the EPA concurred that the U.S. Department of Energy, Richland Operations Office (RL) was not obligated to complete a site treatment plan, RL and the Hanford Site contractors have been participating in the FFCAct process by providing data and cost information to support a complex-wide effort to prioritize treatment projects. This report has been modified to include an appendix with the treatment facility cost and schedule data as submitted to DOE-HQ and an appendix that contains site treatment plan inventory data prepared to support the FFCAct.

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.

The EPA has promulgated various new LDR rules since the Rocky Flats compliance agreement. (The most recent LDR rulemakings, 59 FR 47982, "Universal Treatment Standards," and 60 FR 242, "Technical Correction to Universal Treatment Standards," were effective December 19, 1994, and January 3, 1995, respectively.) The LDRs apply to the hazardous component of mixed wastes. Of particular interest at federal facilities is the storage prohibition of RCRA Section 3004(j).

By passing the FFCAct, Congress incorporated provisions for the storage of mixed wastes at DOE facilities. Among these provisions was a 3-year delay in the effective date of the waiver of immunity for violations of the land disposal storage prohibition [RCRA Section 3004(j)] with respect to mixed waste storage at DOE facilities. The DOE can continue to avoid penalties after the expiration of the 3-year extension if certain plans are developed and submitted pursuant to RCRA Section 3021(b). Plans are not required for DOE facilities that are subject to an existing State permit, agreement, or order that establishes a schedule for treatment. Because the Tri-Party Agreement addresses compliance with RCRA Section 3021(b)(5), the requirements of RCRA Section 3021(b) are not applicable to mixed wastes in storage on the Hanford Site.

This report describes the generation and management of LDR mixed waste generated, treated, and stored at the Hanford Site. 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 its future treatment before disposal. This grouping resulted in the definition of 18 groups or streams of LDR waste. The 18 stream names used for this plan are shown in Table 1-1. Where a "stream" is

actually in a storage unit, the individual waste streams that make up the storage unit are discussed in this report as applicable.

The 18 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 (TWRS). 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 and replacement of the grout treatment system with a new low-level waste (LLW) vitrification facility. The schedule for high-level waste (HLW) vitrification was changed and the Hanford Waste Vitrification Plant (HWVP) was terminated. These changes were approved on January 25, 1994, and the new milestones are incorporated into this report.

The term LLW is used in this and other sections of this report in conjunction with planning for DST and SST wastes. This term is commonly used to refer to the low-activity fraction of tank waste, which is considered "incidental waste" under Nuclear Regulatory Commission definitions. The LLW that is to be separated from the HLW as part of the tank waste pretreatment process is not to be confused with LLW that is stored at Hanford as solid LLW in facilities such as the Central Waste Complex (CWC).

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).

- Complete vitrification of high-level waste (HLW) by December 2028 (M-51-00). Operation of the HLW Vitrification Plant will begin in 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 2024 (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 177 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). This milestone is complete.

- A revised M-14-00 milestone (for construction and operation of a LLW laboratory) requires compliance with the senior executive committee agreement on resolution of the original M-14-00 milestone change request dispute by October 1995. Milestone M-14-03 specified that the Waste Sampling and Characterization Facility would initiate operations in November 1994 (per Change Request M-14-94-01) and this milestone was met. Milestone M-14-04 requires commencement of local commercial laboratory operations in October 1995.

- Initiate operation of 200 Areas Effluent Treatment Facility (ETF) by June 1995 (M-17-14). Because of construction delays, a change request has been prepared to modify and delay the milestone. A new date is expected by April 30, 1995.

- 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). (Note: Title I design work has been terminated on this project. Current plans call for the procurement of a private contractor to provide required services. A draft Tri-Party Agreement change request on this subject was submitted to the regulators on February 28, 1995.)

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 low- and high-activity streams so that the bulk of chemical waste is in the low-activity stream and the bulk of radionuclides are in the high-activity stream.

- 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 cyanides and 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 or appropriate variances will be obtained.

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

- A treatment unit for 242-A Evaporator process condensate will be available.

- 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.

- During PUREX Plant shutdown, no new PUREX aging waste, PUREX process condensate, or PUREX ammonia scrubber waste will be generated. As part of the cleanup activities in PUREX and B Plant, waste may be sent to aging waste tank storage. (In CY 1994, no wastes were transferred to the aging waste tanks. The increase in volume of the stored aging waste [23 cubic meters] was caused by the addition of water to the tanks to flush air lift circulators.)

- 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 mixed waste effluent streams except those meeting the acceptance criteria of the 200 Areas Effluent Treatment Facility.

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

- Changes in the configuration of the mixed waste complex required under the FFCAct.

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.

Tri-Party Agreement Milestone M-26-01 (Ecology et al. 1992) also requires that appropriate new milestones be proposed through this annual report. Milestones proposed for this reporting period are shown in Table 1-2. 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 monthly milestone review meetings, and summarized each year, as required by Milestone M-26-01.

1.5 ACTIVITIES AND ACHIEVEMENTS

This section summarizes major activities and accomplishments related to compliance with LDRs from about April 1, 1994, through March 31, 1995.

- Completed construction and initiated operations of the laboratory hot cell complex at the 202-S facility in the 200 West Area in June 1994 for analysis of high-level radioactive mixed waste.

- Initiated operations of the Waste Sampling and Characterization Facility (low-level waste laboratory) in November 1994.

- Numerous local and complex-wide activities related to the FCCAct of 1992 were completed in 1994. The Draft Mixed Waste Inventory Report

and the first annual Mixed Waste Inventory Report were prepared and issued. The Draft Site Treatment Plans were prepared and issued to the states for information. The Hanford Site's role in this process included participating on the U.S. Department of Energy-Headquarters FCCAct task force support working groups and policy coordination group, which developed language in both the background and plan volumes. Other tasks completed were the DOE annual report, the Chief Financial Officer's report, and the General Accounting Office's report to Congress. Miscellaneous issues addressed were mixed waste disposal, technical support for mixed waste treatment, legal aspects of consent orders, and public participation for the FFCAct. In conjunction with the business of completing DOE FFCAct tasks, communication channels were developed by DOE, Site, and FCCAct task force representatives with state representatives through the National Governors Association. This interface accomplished open communications with the states and assisted in developing their overall understanding of the complex issues involved with DOE complex-wide mixed waste treatment integration tasks.

- Responsibility for the hexone facility was turned over to Environmental Restoration Inactive Facility Surveillance and Maintenance on October 1, 1993. Surveillance and maintenance activities include weekly surveillance, maintenance of the nitrogen gas purge system, and monthly recording of tank levels. Maintenance activities included installation of riser covers and the change out of two activated charcoal canisters that filter the tank off gas. Offsite incineration of hexone waste was completed in May 1994.

- Completed processing of 24,800 cubic meters of waste into the Liquid Effluent Retention Facility (LERF) basins by the 242-A Evaporator. The evaporator was restarted in April 1994 after upgrades were completed.

- Completed construction of Project W-025, the 218-W-5, T-31 Mixed Waste Disposal Trench. This is a geotextile-lined trench with a leachate collection system that meets minimum technology requirements for landfills 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. Readiness activities for disposal are mostly complete.

- Completed construction of Project W-025A, the 218-W-5, T-34 trench, a duplicate of project W-025 (see previous item).

- Eight additional submarine reactor compartments were received for storage in the 200 West Area, bringing the total to 44.

- Initiated construction of 2336-W, WRAP Module 1, project W-026, Tri-Party Agreement Milestone M-18-00. Construction of WRAP 1, 2336-W, is currently on schedule.

- Forty-four drums of alkali metal mixed waste were shipped from the 4843 Sodium Storage Facility to the CWC on December 16, 1994. Three metal burial boxes (1.2 m x 1.2 m x 3.7 m, 1.5 m x 1.5 m, 0.9 m x

1.2 m x 1.8 m) remain to be shipped. The boxes contain a small heat-exchanger, a cold trap, a steel Hot Trap, and two stainless steel tanks from other Hanford Site operations. The burial boxes will be shipped in the first quarter of calendar year (CY) 1996 contingent on the CWC having adequate storage space for the 1.2-m x 1.2-m x 3.7-m container.

- Cleanout of tiny pyrophoric chips and fines containing an estimated 120-150 kg of uranium was completed April 1, 1994 at the 333 and 313 buildings. The pyrophoric chips and fines stored in 303-K, along with the additional 120-150 kg of chips and fines, were concreted in a RCRA-approved treatment process that changes their designation from mixed to low-level waste. Seventy-three LLW drums were prepared for disposal at the 200 West burial grounds. Of those 73 drums, 51 have been shipped to the 200 West burial ground. The other 22 drums await analysis from Pacific Northwest Laboratory (PNL).

- A backlog of dangerous waste had accumulated in some generating units in excess of the 90-day regulatory storage limit. An internal assessment completed in June 1992 identified container management problems.

  To correct the problems, three categories of waste were processed. First, boxes from the tank farms containing uncharacterized waste were repackaged and characterized at T Plant. Second, remaining backlog tank farm containers were processed to meet the requirements of an Ecology order. Processing was completed in accordance with the *Backlog Waste Analysis Plan* (DOE-RL 1993a). Finally, waste generated by other generating units was processed in a manner similar to the tank farms waste.

- The ongoing cleanout of B-Cell in the 324 Radiochemical Engineering Cells (REC) resulted in the accumulation of highly radioactive mixed waste in excess of the accumulation limits imposed by RCRA. In addition, radioactive process solutions that are no longer needed have been designated as radioactive mixed waste. During the 1994 Tri-Party Agreement negotiation sessions with Ecology and EPA, a new milestone was proposed. The proposed milestone, M-89, included interim milestones for a compliance plan and schedule, a project management plan for the B-Cell Cleanout Project, an assessment of waste disposition options, and completion of a clean closure feasibility study leading to the preparation and submittal by December 31, 1995, of a closure plan for the waste management units. It was also resolved to incorporate the 324 REC/High-Level Vault (HLV) wastes into the *Annual Report on Hanford Site Land Disposal Restrictions for Mixed Waste*. (This is the first year that these waste types have been included in this report.)

- Completed a facility configuration study for the high- and low-level tank waste vitrification and waste pretreatment plants (WHC 1994a).

- Awarded seven contracts for demonstration of LLW vitrification technology. To date, six of the vendors have demonstrated or are demonstrating their systems.

- Initiated an inquiry into possible privatization of all or part of the TWRS and hosted a tour of the facilities for interested parties.

- Achieved mitigation of 101-SY explosion hazards through operation of an in-tank mixer pump, and achieved closure of unreviewed safety questions concerning ferrocyanide and criticality within the tank farms.

- Completed the 40-year, $40 billion TWRS baseline, consistent with the negotiated Tri-Party Agreement, including resource loaded, driven schedules, and basis of estimate. Issued the TWRS *Integrated Technology Plan* (DOE-RL 1992a) and *TWRS Process Flowsheet* (WHC 1994b).

- Small-scale high temperature melter testing was completed, which generated the first data on the vitrification of simulated DST/SST high-level waste in an advanced melter system.

- Completed 20 SST characterization reports (per M-44-05).

- Completed historical tank content estimates for 190 high-level waste tanks.

- Completed a strategy for sampling Hanford Site tank wastes for development of disposal technologies (per M-50-03).

- 340,000 liters of treated dangerous waste from the PUREX steam condensate and rainwater were evaporated in the E-F11 Concentrator in CY 1994; thereby minimizing the waste transferred to the tank farms.

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

Stream name	Waste source
1. DST Waste	Widely varying wastes from chemical separations processes (e.g., PUREX Plant, PFP, cesium and strontium separations) and related support facilities used from 1970 to date
2. PUREX Aging Waste (generated during PUREX operation, inventory in DSTs)[a,b]	First extraction column fission products from PUREX Plant
3. SST Waste (inventory)[a]	Waste from spent nuclear fuel processing and related support facilities 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 (generated during PUREX operation, 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 DSTs)[a]	Condensed vapors from PUREX Plant operations
8. Hexone Waste (has been treated off site)[a]	Hexone that had been planned for use in 202-S solvent extraction
9. 183-H Solar Evaporation Basins Waste (inventory in CWC)[a]	Containerized solid retrieved from solar evaporation basins from 300 Area fuel fabrication wastes, 1973 to 1985. Also wastes generated from closure of the basins
10. PUREX Storage Tunnel 1 Waste (lead)	Lead from discarded equipment and shielding
11. PUREX Storage Tunnel 2 Waste	
a. mercury	Mercury sealed in discarded PUREX fuel dissolvers
b. lead	Lead from discarded equipment and shielding
c. silver	Silver from discarded silver reactors
d. cadmium	Cadmium sheets attached to lead shielding
e. Fluorothene*	Fluorothene from Fluorothene columnar plates
f. Chromium	Chromium as corrosion byproduct from failed product concentrators

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

Stream name	Waste source
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 on site and off site up to 1987.
15. TRUSAF Stored Waste	Transuranic waste from onsite and offsite, packaged for eventual WIPP disposal.
16. 303-K Stored Waste[a]	Temporary storage of 300 Area fuel fabrication solid and liquid wastes. (Facility no longer in use.)
17. 324 REC	Variety of high-activity radioactive wastes, containing regulated quantities of predominantly toxic heavy metals, generated during research and development activities ongoing since the mid-1960s.
18. 324 HLV	High-activity radioactive waste solutions that are corrosive and contain regulated quantities of toxic heavy metals generated during research and development activities ongoing since the mid-1960s.

*Fluorothene is a trademark of Union Carbide Corporation for polytrifluoromonochloroethylene.

[a]Process waste no longer being generated. Waste may be generated during closure of the unit.

[b]PUREX aging waste is a DST waste, but is shown separately to maintain continuity with the first LDR Plan, issued in 1990.

DST = Double-shell tank.
FFTF = Fast Flux Test Facility.
HLV = High-Level Vault
PCB = Polychlorinated biphenyl.
PFP = Plutonium Finishing Plant.
PUREX = Plutonium-Uranium Extraction (Plant).
REC = Radiochemical Engineering Cells.
SST = Single-shell tank.
TRUSAF = Transuranic Waste Storage and Assay Facility.
WIPP = Waste Isolation Pilot Plant.

Table 1-2. New Proposed Milestones.

Proposed Milestone		Proposed Date
M-89-00	Complete closure of non-permitted mixed waste units in the 324 Building REC B-Cell, REC D-Cell, and the HLV	TBD
M-89-01	Complete removal of 324 Building HLV tank mixed waste with the exception of residues that may remain following flushing and draining to the extent possible.	10/31/96
M-89-01A	Submit report identifying preferred option for management of liquid mixed waste in HLV tanks.	3/31/95
M-89-02	Complete removal of 324 Building REC B-Cell mixed waste and equipment.	5/31/99
M-89-03	Achieve compliance with interim-status facility standards at non-permitted 324 Building mixed waste units.	3/31/95
M-89-04	Submit report identifying mixed waste management alternatives and DOE's proposal for achieving clean closure of the 324 Building REC B-Cell, REC D-Cell, and HLV.	6/30/95
M-20-55	Submit closure plan for non-permitted mixed waste units located in the 324 REC B-Cell, REC D-Cell, and HLV.	12/31/95

REC = Radiochemical Engineering Cells
HLV = High-Level Vault
TBD = Date to be established.

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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 on June 1, 1990 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.

- 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 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. Alternative treatment standards for debris were promulgated by EPA on August 18, 1992 (57 FR 37194). These may be used to satisfy LDR requirements in lieu of treating debris to the treatment standards for the waste codes for which the debris has been designated hazardous. Specific treatment standards for LDR soils have not been promulgated as of

March 1995. However, on promulgation of these standards, treatment and possibly expanded storage capacity for waste generated by 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 this waste would be allowable pursuant to Tri-Party Agreement provisions dealing with LDR waste. Planning information, as it develops for this waste, 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.

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.

The F001 through F005 waste codes (spent halogenated and nonhalogenated solvents) have been assigned to the SSTs and DSTs not because the waste contains significant quantities of spent solvents, but because small quantities of waste discharged to the tanks in the past have contained spent solvents. The past discharges of spent solvents to SSTs and DSTs and resultant tank-to-tank transfers have contaminated essentially all of the waste in the tanks. This has resulted in all of the SST and DST waste being designated F001 through F005. The tank waste does not contain 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 F039 waste code was added to the DST, LERF, 242-A Evaporator, CWC, and WRAP Module I facilities' Part A Form 3 Permit applications in November 1994 to allow for future generation of waste potentially listed with this code from onsite mixed waste disposal operations. Currently, no F039 waste is being generated or stored at the Hanford Site.

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 their 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 target compounds. 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).

2.3 WASTE STORAGE

The Hanford Site has 18 streams, as defined by this report, that currently contain mixed waste. These 18 streams can be divided into two groups: (1) 11 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, retrievably stored LLW and TRU waste, the 303-K Facility, 324 Building REC, and 324 Building HLV); and (2) 7 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 two PUREX tunnel streams, the PUREX containment building, the CWC, and the Transuranic Waste Storage and Assay Facility [TRUSAF]). 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 1998, assuming the availability of three additional storage facilities as part of the Central Waste Complex (CWC). After approximately four 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. Efforts are under way to develop procedures to use LERF as a LDR treatment facility. According to the EPA, such treatment is consistent with LDR treatment described in 40 CFR 268. This would allow continued use of LERF as a treatment and storage facility for 242-A Evaporator waste until final treatment at the ETF.

By 1998, the currently available DSTs will essentially be filled to capacity, using current space projections. The baseline 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. Recent programmatic assessments have concluded that the new tank space will not be necessary provided the appropriate actions are taken and several key assumptions are validated, although this proposal is still under study.

The CWC is projected to reach its capacity in 1996 without construction of additional storage facilities. 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.

Except for the SSTs and the 183-H Solar Evaporation Basins, the storage units for mixed waste at the Hanford Site have not released any dangerous constituents to the environment. 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. 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. However, the data evaluation report for this unit characterized the soil contamination associated with the release.

The Part B Permit application submittal date for each mixed waste storage unit is shown in Table 2-4.

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, 1994, the Hanford Site stores approximately 249,200 cubic meters of radioactive mixed waste. The bulk of this waste (96.4 percent) is stored in the SSTs (54.8 percent) and DSTs (31.6 percent), and LERF (10.0 percent). The table also indicates how much waste is LLW, TRU waste, or HLW.

2.4 WASTE TREATMENT

The LDRs apply to each hazardous waste that has been restricted from land disposal. Treatment standards are identified in two different ways: as concentration-based standards and as technology-based standards. Concentration-based standards have been developed based on "best demonstrated available technology." Treatment to meet concentration-based standards can be pursued via any technology (other than dilution, which is not permissible) except for cyanides, which must be destroyed; the only requirement is that the waste be treated to reduce the concentration(s) of the constituent(s) of concern. However, waste that has technology-based standards require that treatment be applied via the pertinent specified technology. Hazardous waste that carries multiple RCRA codes must be treated pursuant to the standards for each waste code (and subcategory, when applicable). In situations where overlap occurs, the more stringent standard must be applied. One of EPA's most recent LDR rulemaking efforts (59 FR 47982) resulted in the Universal Treatment Standards (UTS). The UTS contain numerical limits for 216 underlying hazardous constituents. The UTS are currently applicable to ignitable (D001), corrosive (D002), and toxic characteristic organic (D018-D043) hazardous waste and to pesticide (D012-D017) nonwastewaters that are destined for land disposal.

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

- 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 1 Waste (lead) (Chapter 3.0, Section 3.10)
- PUREX Storage Tunnel 2 Waste (lead, mercury, cadmium, silver, Fluorothene[1] and chromium) (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).
- 324 REC Waste (Chapter 3.0, Section 3.17)
- 324 HLV Waste (Chapter 3.0, Section 3.18).

The applicable treatment standards (required by the universal treatment standards 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 streams and vitrified similarly (Table 2-6). The schedule for the operation of the treatment units is provided in Figure 2-1.

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

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. The DOE is considering the use of nontraditional contracting approaches for site remediation work, i.e., "privatization." 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 stabilization to be provided under WRAP Module 2A and thermal treatment, 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 this waste is considered to be stored in a relatively environmentally sound manner with the exception of SST waste and some DSTs with waste having unique safety problems because of chemical and/or radiological content. Further details on accelerated treatment are located in the individual waste stream treatment discussions in Chapter 3.0.

2.4.1 Double-Shell Tank Waste

The DST waste consists of LLW, TRU waste, and HLW. In the interim storage mode, however, the waste is managed as HLW 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 concentrate its radionuclide loading.

Before disposal, appropriate testing of the LLW and HLW/TRU products will be conducted to ensure that 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 is being evaluated for disposal at WIPP near Carlsbad, New Mexico; 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. No aging waste has been transferred from PUREX to DSTs since

PUREX last operated. Based on RL direction in December 1992 to deactivate the plant, no additional aging waste will be generated.

2.4.3 Single-Shell Tank Waste

The SST waste consists of LLW, TRU Waste, and HLW; however, in the interim storage mode it is managed as HLW. The physical forms of SST waste are sludge, salt cake, and liquid. Liquid waste, which includes supernatant and interstitial liquid within the salt cake, will be transferred to DSTs for subsequent treatment (as long as the safety status of the SSTs is not changed after pumping). 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). Both waste fractions will be vitrified for disposal in the same way as the DST waste shown in Figure 2-2.

2.4.4 242-A Evaporator Process Condensate

The 242-A Evaporator process condensate waste (containing trace organic solvents) is being stored in a surface impoundment (LERF) for a short time until the Effluent Treatment Facility (ETF) is ready for operation. The ETF will destroy organic constituents and cyanides and remove radioactive and certain inorganic constituents. The ETF will treat the process condensate and other waste streams to allow discharge to the ground. A petition was submitted to delist the process condensate after it is treated. EPA released this petition for public comment on February 1, 1995. Efforts are underway to develop procedures to use LERF as an LDR treatment facility. According to the EPA, such treatment is consistent with the LDR treatment specified in 40 CFR 268. This allows continued use of LERF as a treatment and storage facility for 242-A Evaporator waste until its final treatment at the ETF.

2.4.5 4843 Sodium Storage Facility Waste

The 4843 Sodium Storage Facility presently is not receiving additional material. Forty-four drums of alkali metal mixed waste were shipped from the 4843 Sodium Storage Facility to the Central Waste Complex on December 16, 1994. Three DOT metal burial boxes (1.2 m x 1.2 m x 3.7 m, 1.5 m x 1.5 m x 2.7 m, 0.9 m x 1.2 m x 1.8 m) remain to be shipped. The boxes contain a small heat-exchanger, a cold trap, a steel hot trap, and two stainless steel tanks from other Hanford Site operations. The burial boxes will be shipped in the first quarter of CY 1995 contingent on the CWC having adequate storage space for the 1.2 m x 1.2 m x 3.7 m container. A considered treatment for 4843 Sodium Storage Facility waste is deactivation by reacting it to form a sodium hydroxide/solution with further reaction to form sodium carbonate. No DOE facility or private firm has yet been identified to treat this waste.

2.4.6 PUREX Plant Ammonia Scrubber Waste

The PUREX ammonia scrubber waste was generated when ammonia gas from the N Reactor fuel decladding process was sprayed with water. 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 the discharge 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 (sodium hydroxide) to adjust the pH to greater than 12 and adding sodium nitrite to minimize tank corrosion.

The PUREX Plant received official notification to deactivate the plant in December 1992. Ammonia scrubber waste will no longer be generated.

2.4.7 PUREX Plant Process Condensate

The PUREX Plant process condensate was generated by condensing the vapors resulting from concentration of the PUREX uranium/nitric acid product and recycle streams.

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 received official notification to deactivate the plant in December 1992. 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 was completed in May 1994. Spent distillation vessels were sent to the CWC for storage and treatment. Approximately 1.9 cubic meters of distillation tars remain in the vessels. 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, which was 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. The waste will be treated at the WRAP 2A Facility or at a proposed commercial replacement facility and disposed of in a near-surface disposal unit on the Hanford Site. The required treatment technology for formic acid is combustion and cyanides must be destroyed; therefore, a treatability variance may be required before ultimate disposal of this waste. (The total amount of formic acid was 1 kilogram diluted in 9,500 cubic meters total waste volume.) Soil and debris waste also may be generated from closing the basins.

2.4.10 PUREX Storage Tunnels 1 and 2 and PUREX Containment Building Waste

The PUREX Plant waste includes lead solids, mercury, silver, cadmium, Fluorothene, and chromium 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 standard of 5 milligrams per liter. The required treatment for mercury waste is amalgamation or retorting and recovery. Any treatment that achieves the constituent concentration limits is acceptable for the silver waste. Any treatment that achieves the constituent concentration limits of 1.0 and 5.0 milligrams per liter are acceptable for cadmium and chromium waste, respectively, in accordance with 40 CFR 268.40. Under WAC 173-303-140 (d)(i), Fluorothene falls under the category of organic/carbonaceous waste and must be incinerated. Treatments for this waste has not yet been selected; additional treatability studies will be required during facility decommissioning and dispositioning.

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 Module 1 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. Non-TRU mixed waste will be treated as necessary in the planned Module 2A Facility or its proposed commercial replacement. Retrievably stored LLW and TRU waste is primarily contained in 0.21-cubic-meter drums, metal boxes, wood boxes, and fiberglass-reinforced plywood boxes. They are stored in various configurations of underground storage units. After retrieval, the waste will be processed/treated at to be acceptable for permanent disposal. The proposed treatments comply with the universal treatment standards and WAC 173-303-140 treatment requirements. The specific processes to be used currently are being selected. Also, privatization options are being pursued to provide the needed treatment capabilities. The PCBs will be stored until treatment capacity is identified. Figure 2-3 depicts the CWC treatment and disposal processes.

2.4.12 303-K Stored Waste

All mixed waste has been removed from the 303-K building. 303-K is awaiting RCRA closure. Current plans are to include the 303-K closure plan in Modification C of the sitewide Part B Permit, slated for October 1, 1996. The former 303-K waste is being stored at the CWC for treatment; some has been treated and buried as LLW (pyrophoric chips and fines).

2.4.13 324 REC Waste

The 324 REC waste has accumulated during research activities over a period of years. The waste consists of contaminated equipment, construction materials, and evaporated liquids that have accrued on the floor of the REC. In addition, particulate materials introduced with normal air flow into the cell became contaminated. Cleanout of the hot cells was initiated in 1988 with completion expected by 2000. At the end of fiscal year 1994, more than half of the floor area had been cleared of potentially dispersible mixed waste. This dispersible waste was consolidated and containerized within B-Cell. Treatment alternatives are currently being evaluated for all except the 0.5 cubic meter of contact-handled mixed waste lead solids that was shipped to the CWC.

2.4.14 324 HLV Waste

The 324 HLV waste consists of high activity radioactive solutions, which are no longer needed for research and development activities. These solutions were designated as MW in FY 1994. Treatment alternatives are currently being evaluated, which would reduce the radioactivity to contact-handled limits that would allow the solutions to be consolidated with other Hanford Site waste.

2.5 WASTE MINIMIZATION

2.5.1 Waste Minimization Program Elements

Six basic elements make up 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 incentive programs that reward individual and group contributions, and by including 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 integrated into 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 pollution prevention opportunity assessments. This methodology requires that a pollution prevention opportunity assessment team be formed to evaluate each waste-generating process selected.

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 waste generated, (3) waste disposal, and (4) third-party liabilities if the waste is improperly disposed of. Associated costs will include personnel, record keeping, transportation, pollution control, equipment, treatment, storage, disposal, liability, compliance, and oversight costs.

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 as follows:

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

2.5.3 Facility-Specific Waste Minimization

All facilities that generate waste are required to have a waste minimization program in place. The effectiveness and implementation of the programs are audited on a regular basis. The following are key components of the program.

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

Table 2-7 summarizes the waste reduction (minimization and treatment) methods currently in place or planned for the 17 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 the volume of process condensate designated as dangerous waste by more than 99%.

Next to the planned treatment of the 242-A Evaporator process condensate stream, the most significant waste reduction is for DST waste. Process condensate generated at the 242-A Evaporator is a result of volume reduction of DST waste. Very little new volume is actually generated. For every 15 liters of 242-A Evaporator process condensate generated, the volume of DST

waste is reduced by about 11 liters. The increase in 242-A process condensate volume is a result of adding water to the process for radionuclide control.

The waste currently stored at the CWC will be processed at one of the WRAP facilities (described in Chapter 3.0, Section 3.13) or a commercial entity before disposal.

In a typical year, waste reduction practices at the Hanford Site will reduce the waste 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, waste reduction at the Hanford Site is described in the *1993 Annual Report on Waste Generation and Waste Minimization Progress as Required by DOE Order 5400.1, Hanford Site* (DOE-RL 1994).

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 Tri-Party Agreement (Ecology et al. 1992) provides the plan and schedule for treatment of Hanford Site mixed waste currently in storage. The FFCAct of 1992 also contains applicable provisions. Refer to Section 1.1 for additional detail.

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

The Tri-Party Agreement provides for extending a schedule or deadline on 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 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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Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 1 of 16)

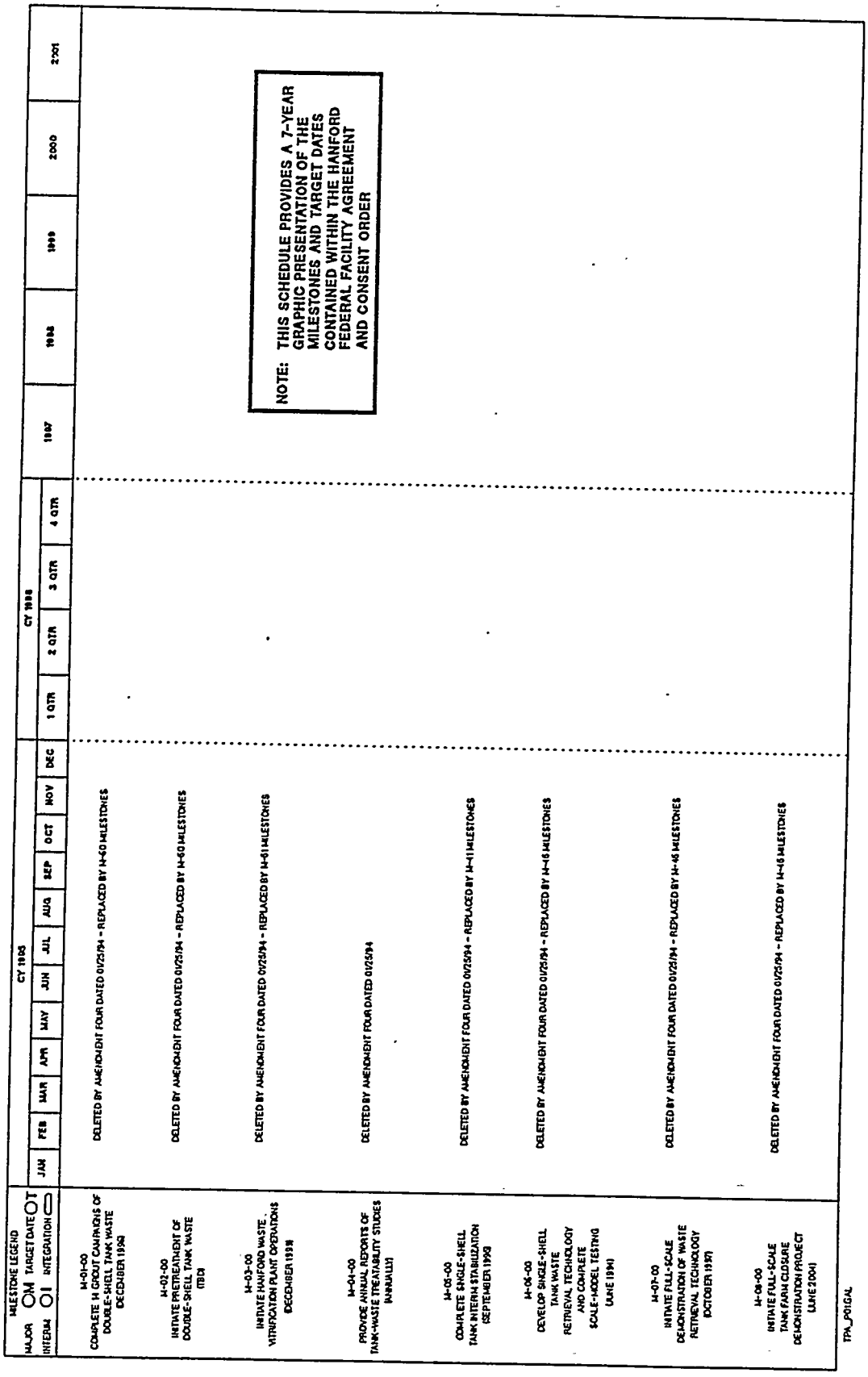

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Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 2 of 16)

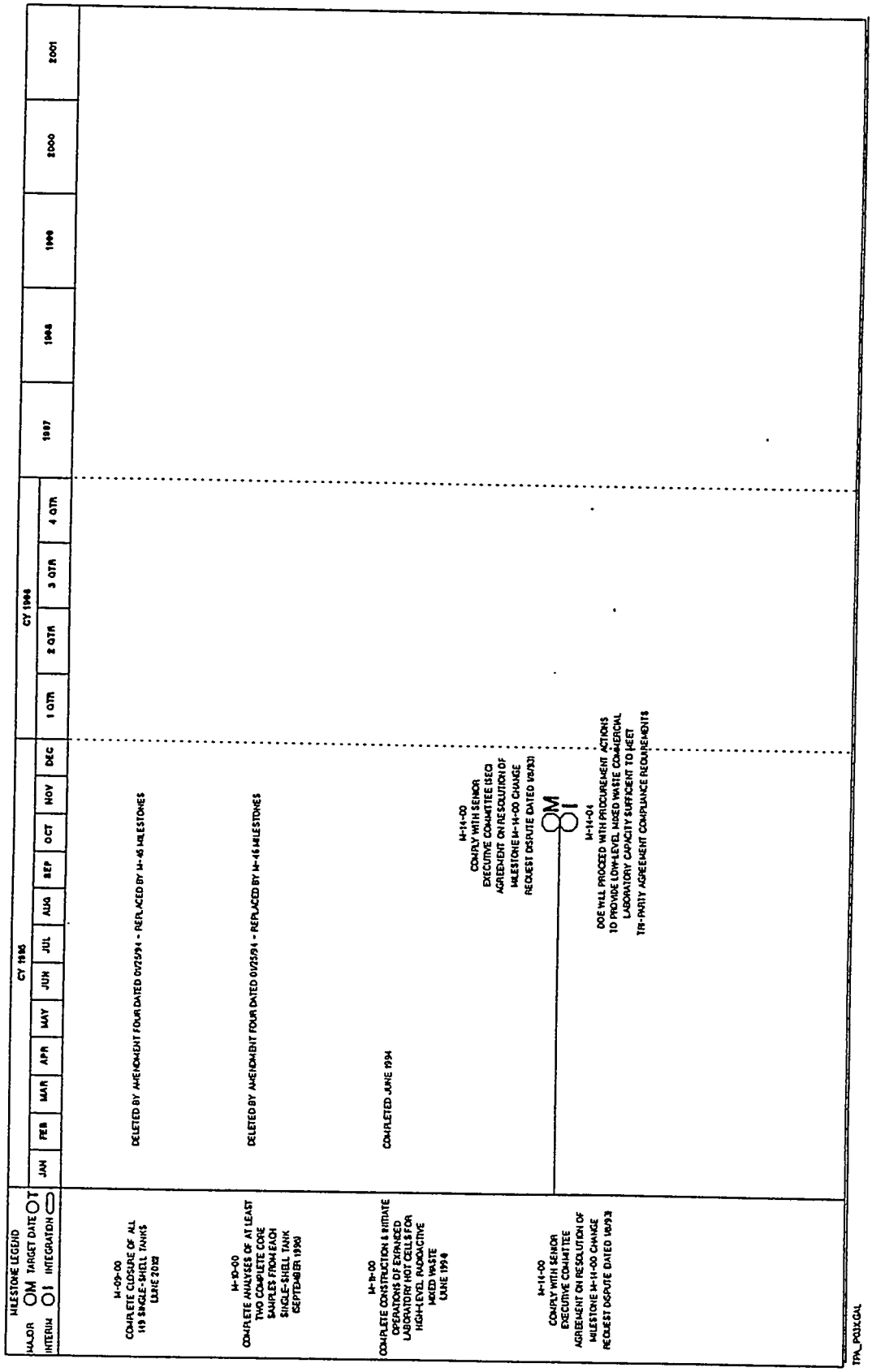


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 3 of 16)

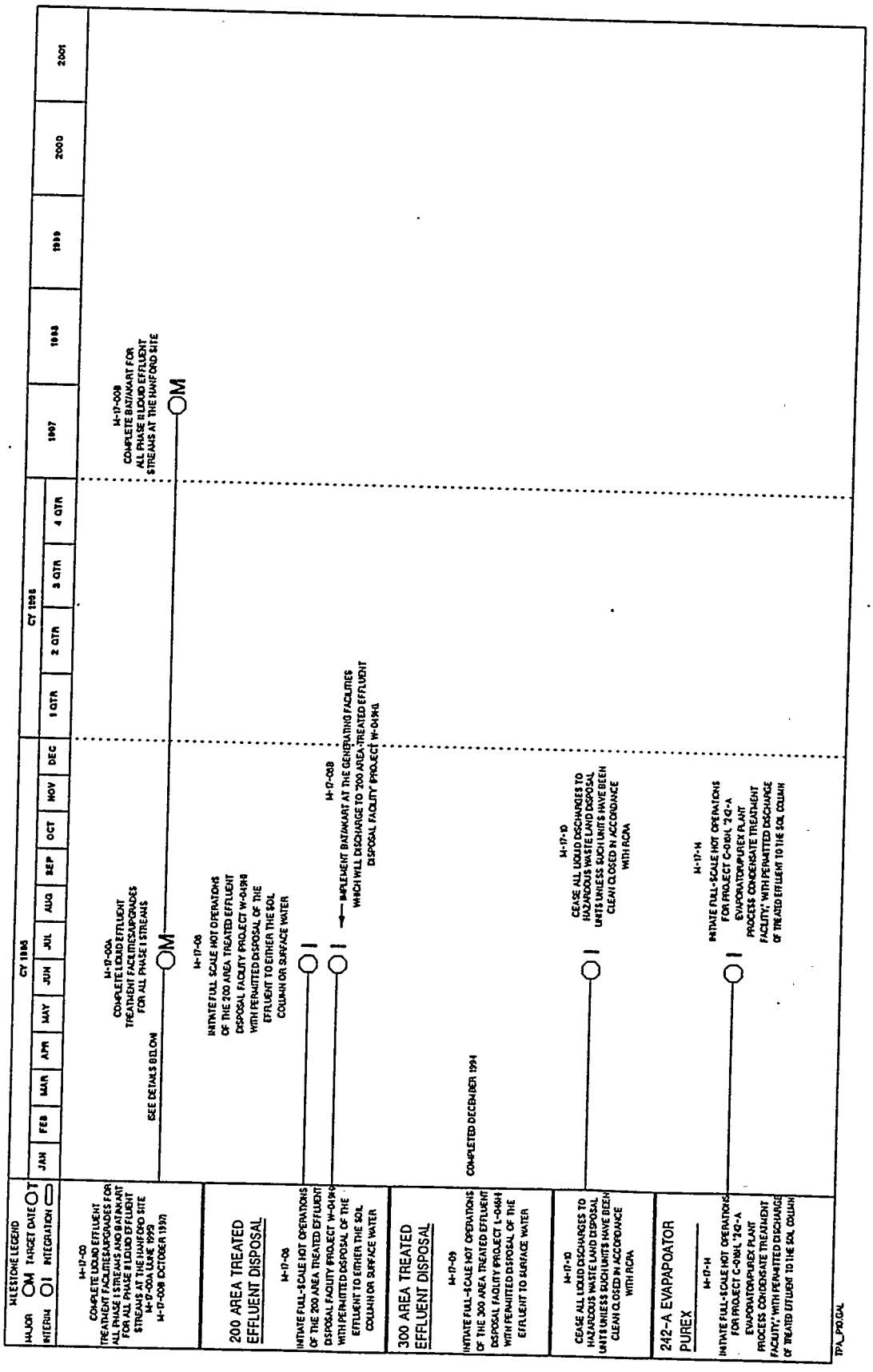


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 4 of 16)

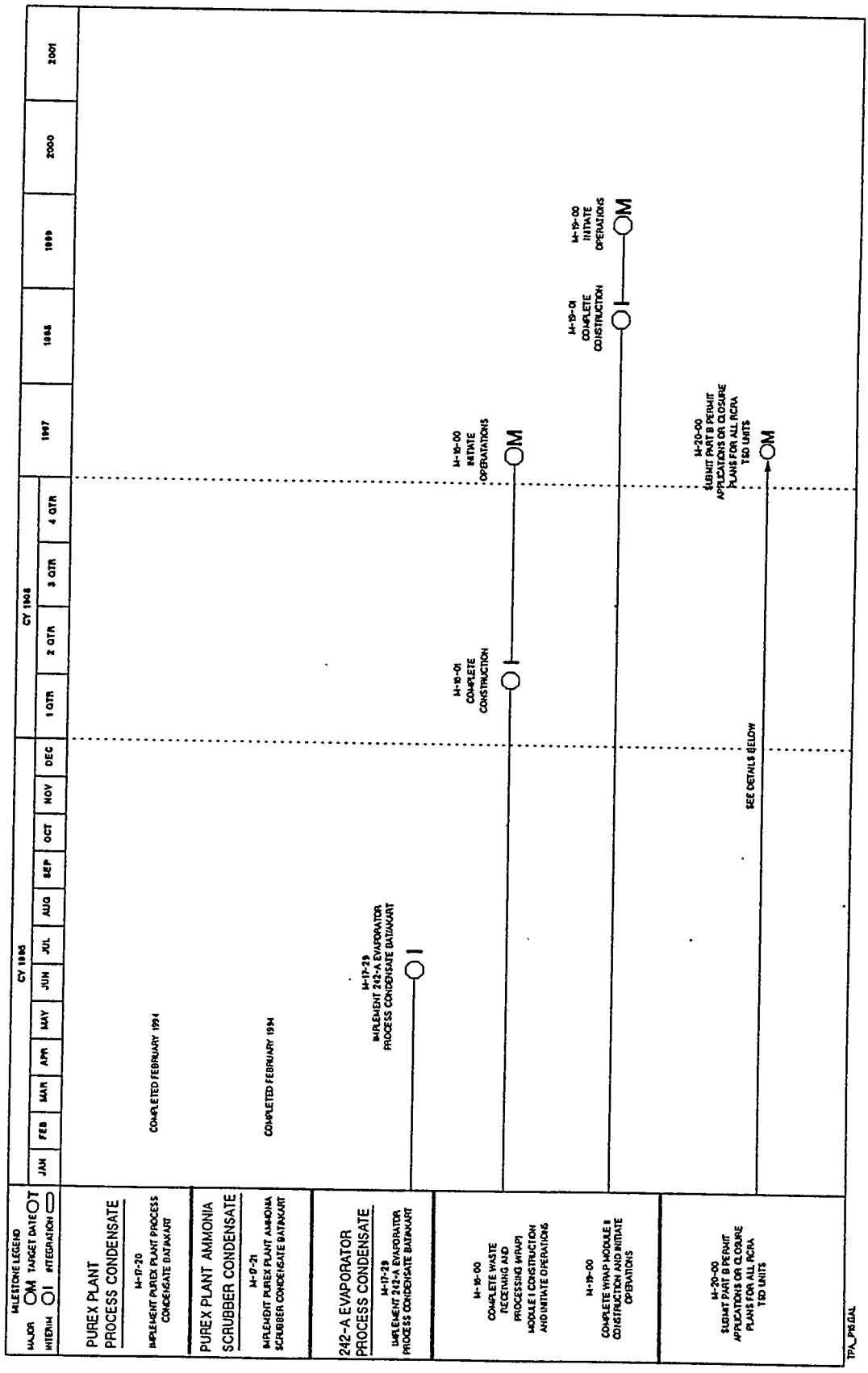


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 5 of 16)

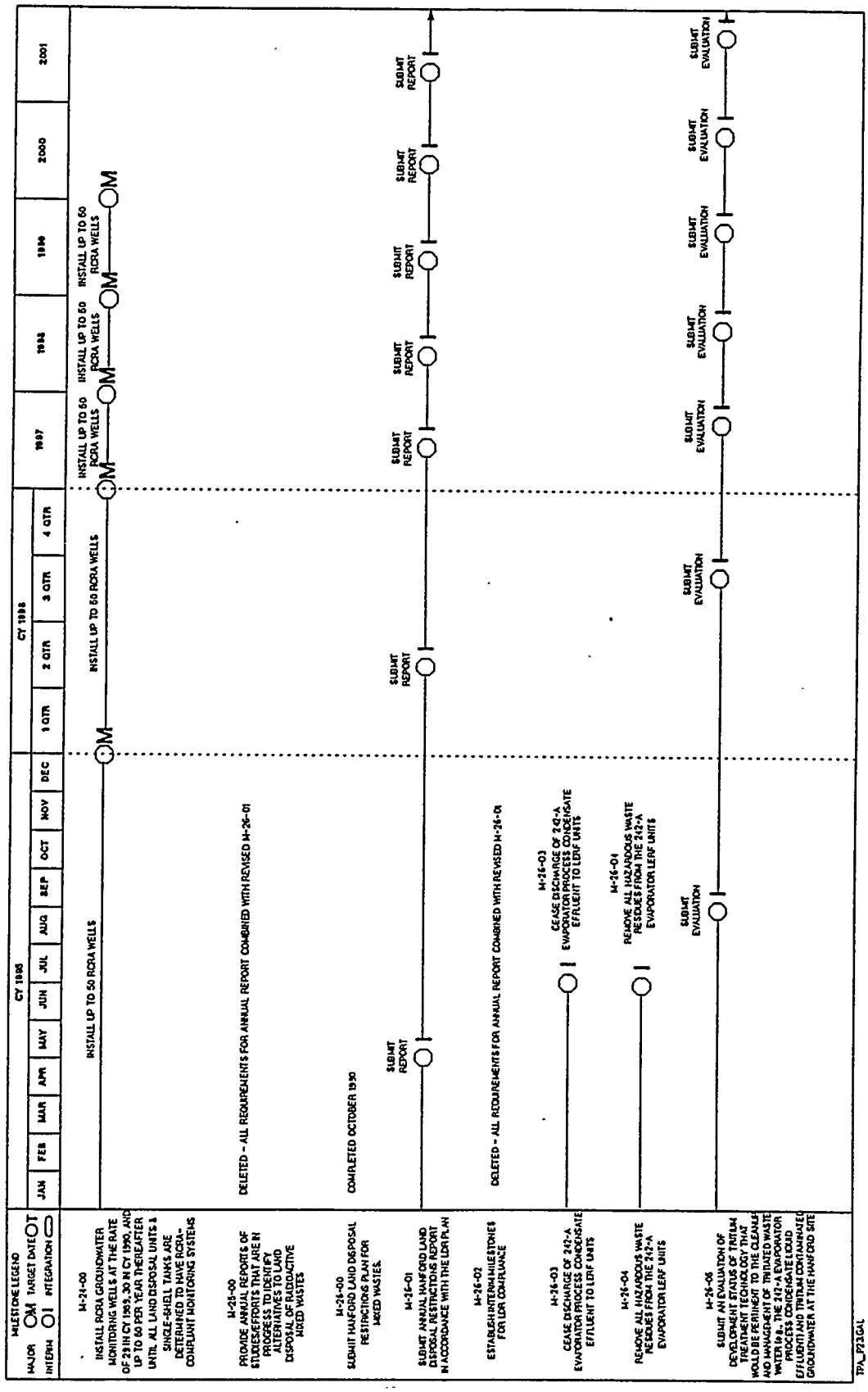


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 6 of 16)

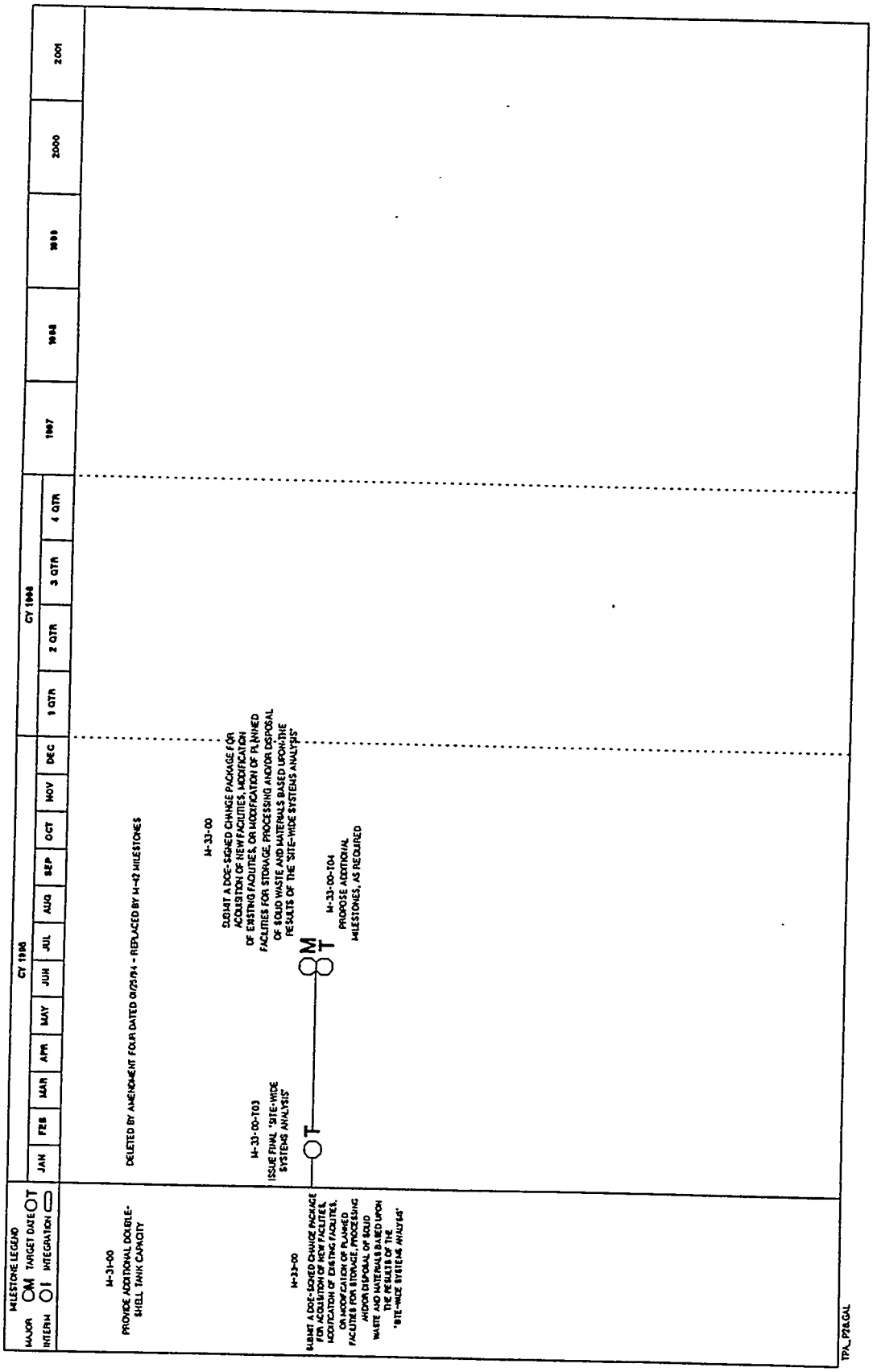


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 7 of 16)

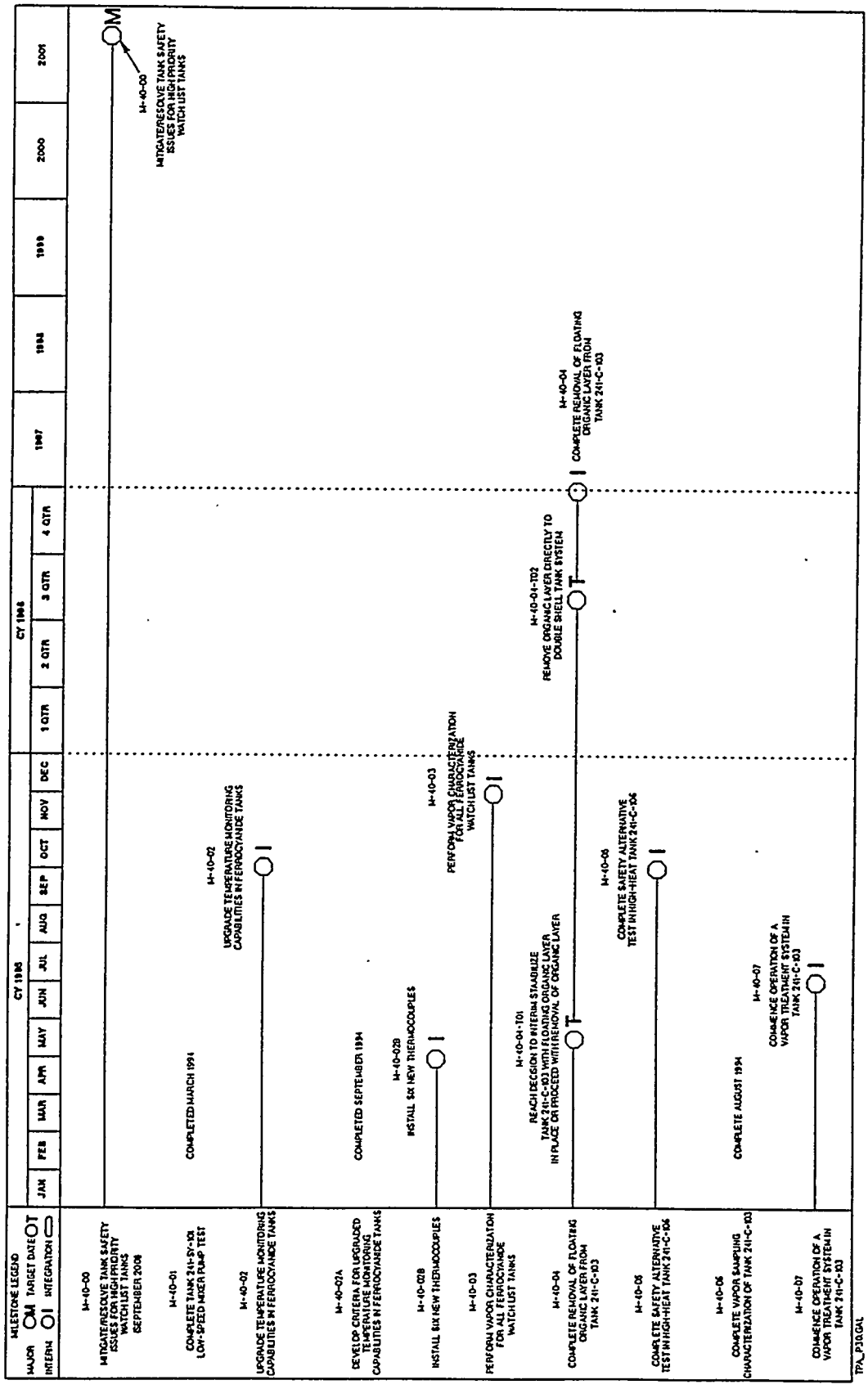


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 8 of 16)

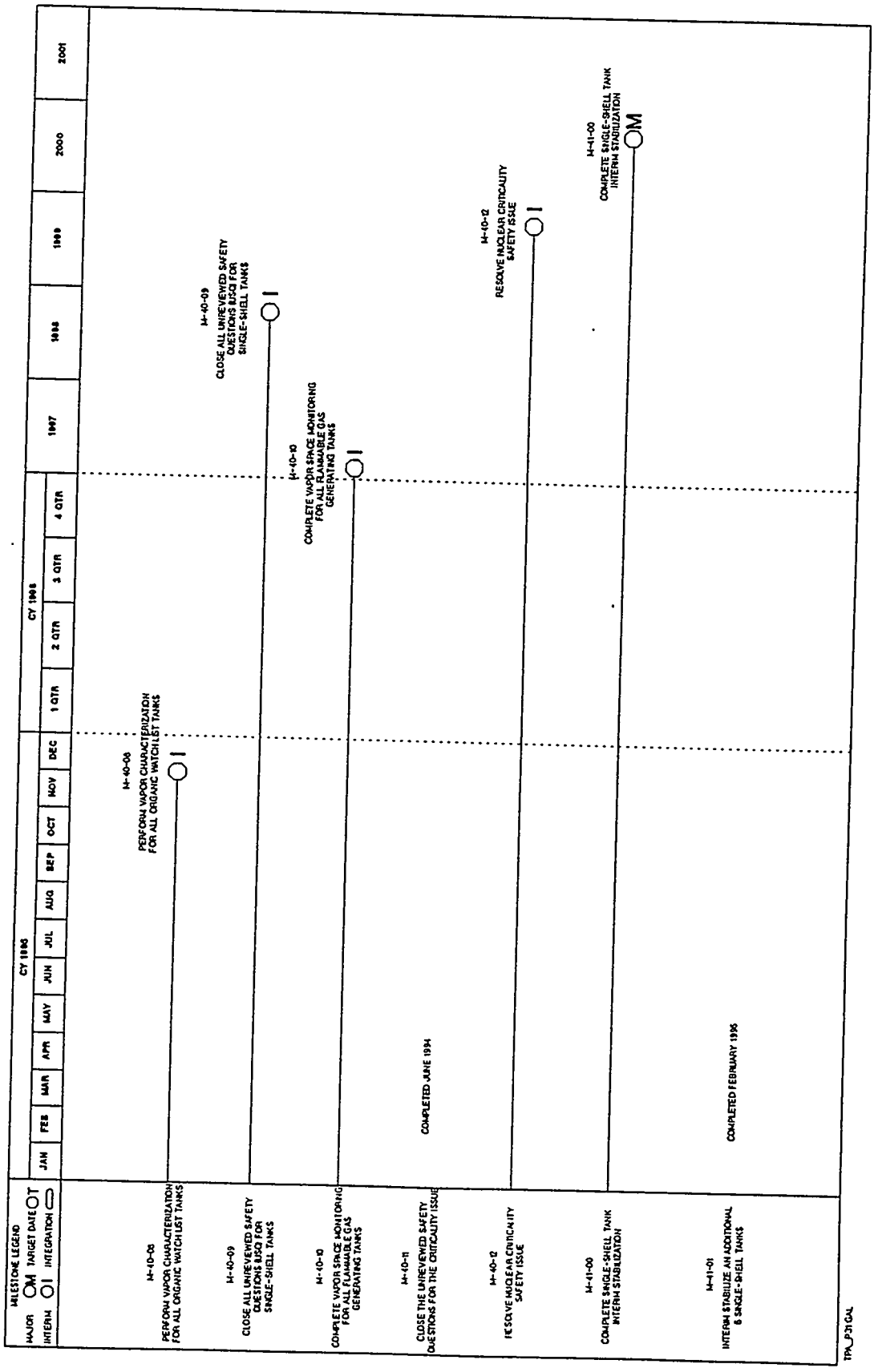


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 9 of 16)

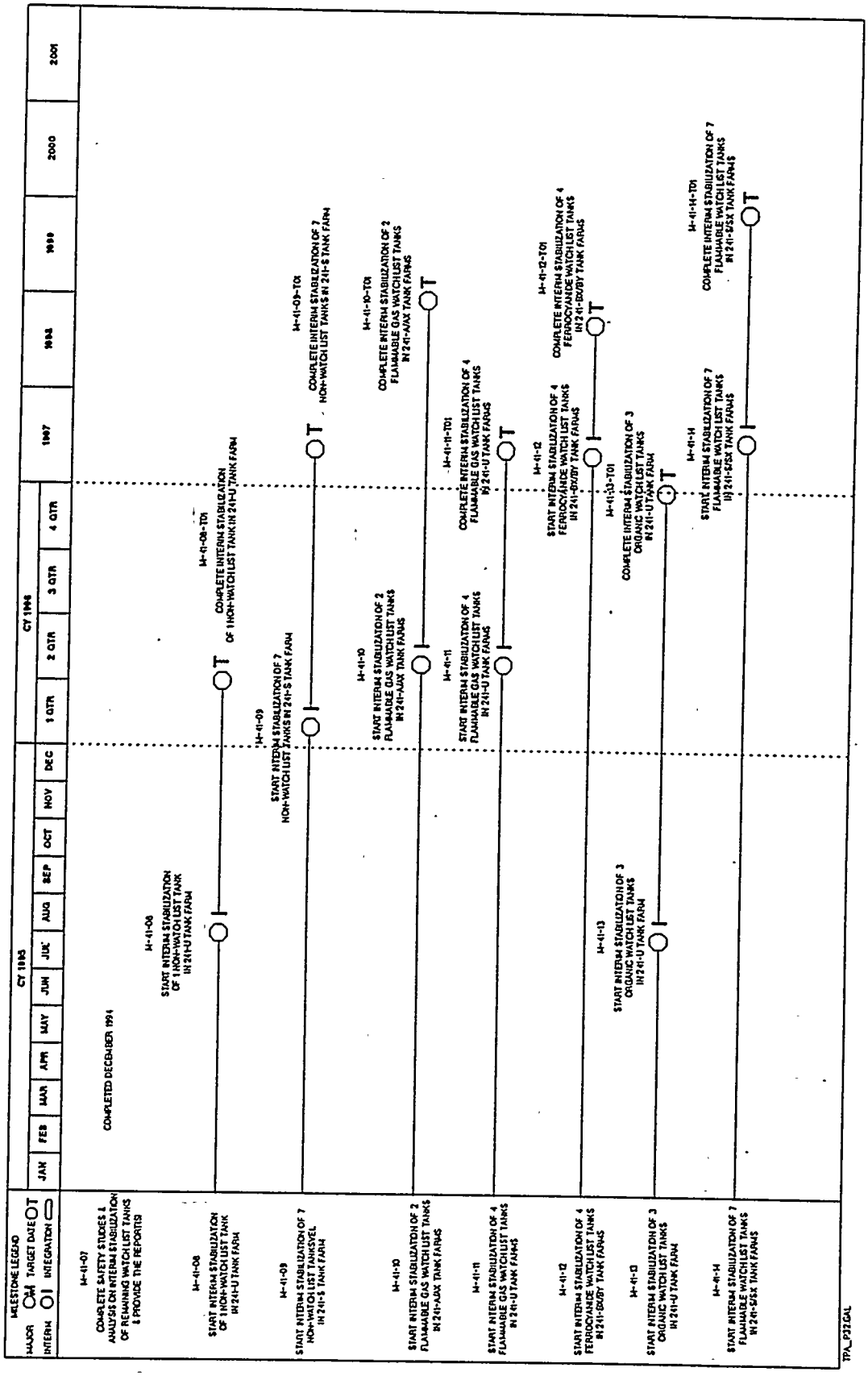


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 10 of 16)

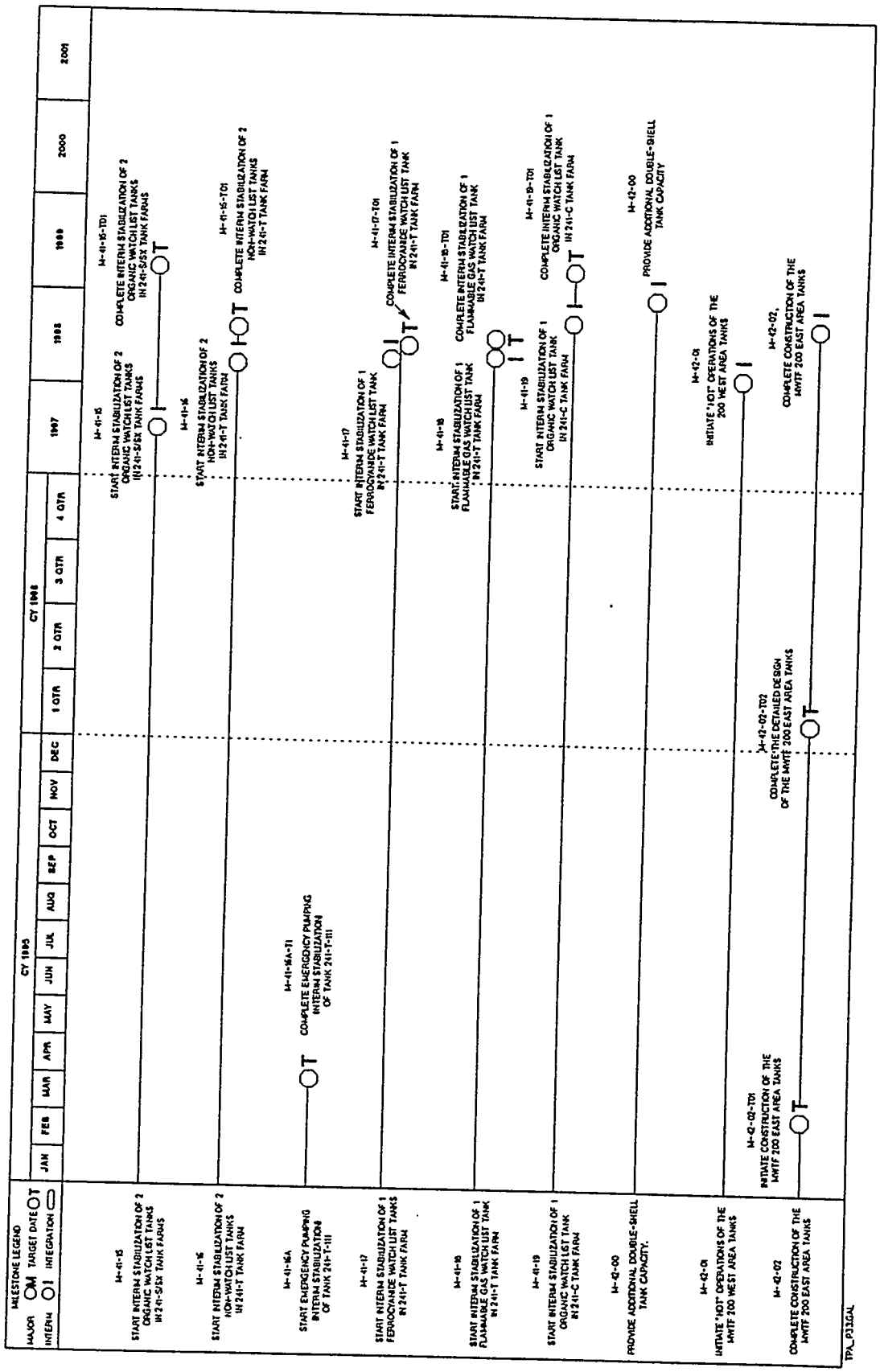


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 11 of 16)

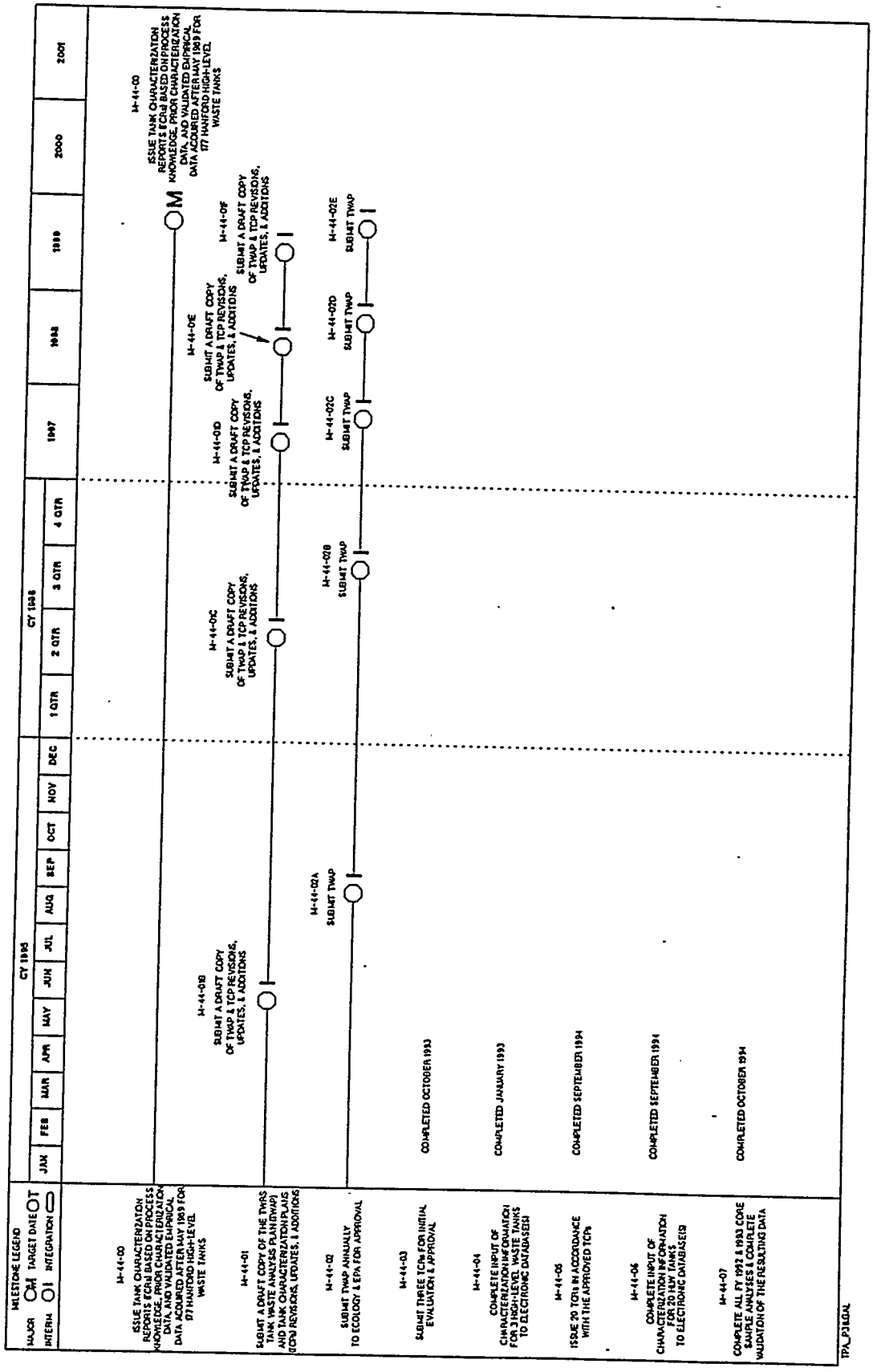


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 12 of 16)

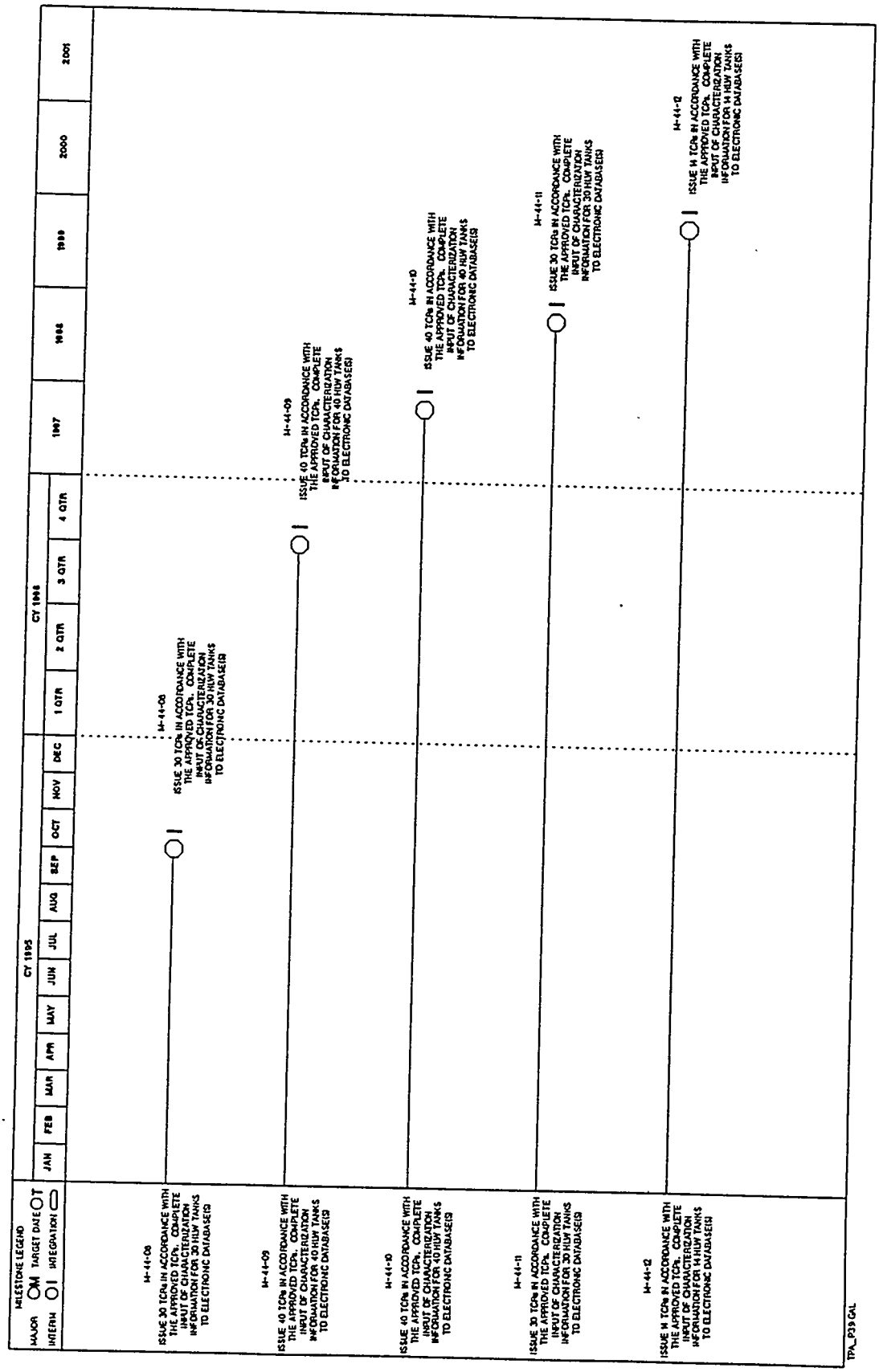


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 13 of 16)

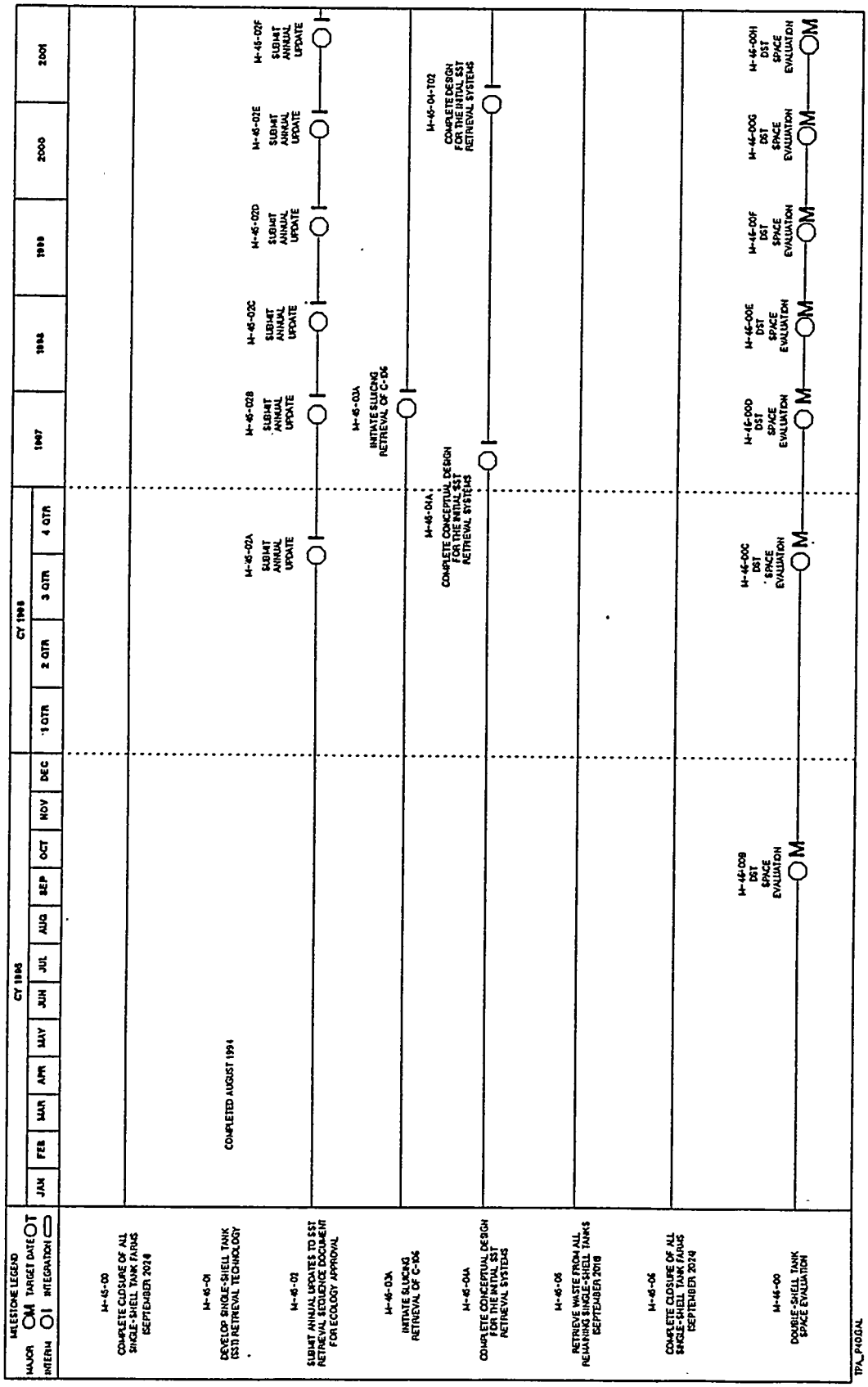


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 14 of 16)

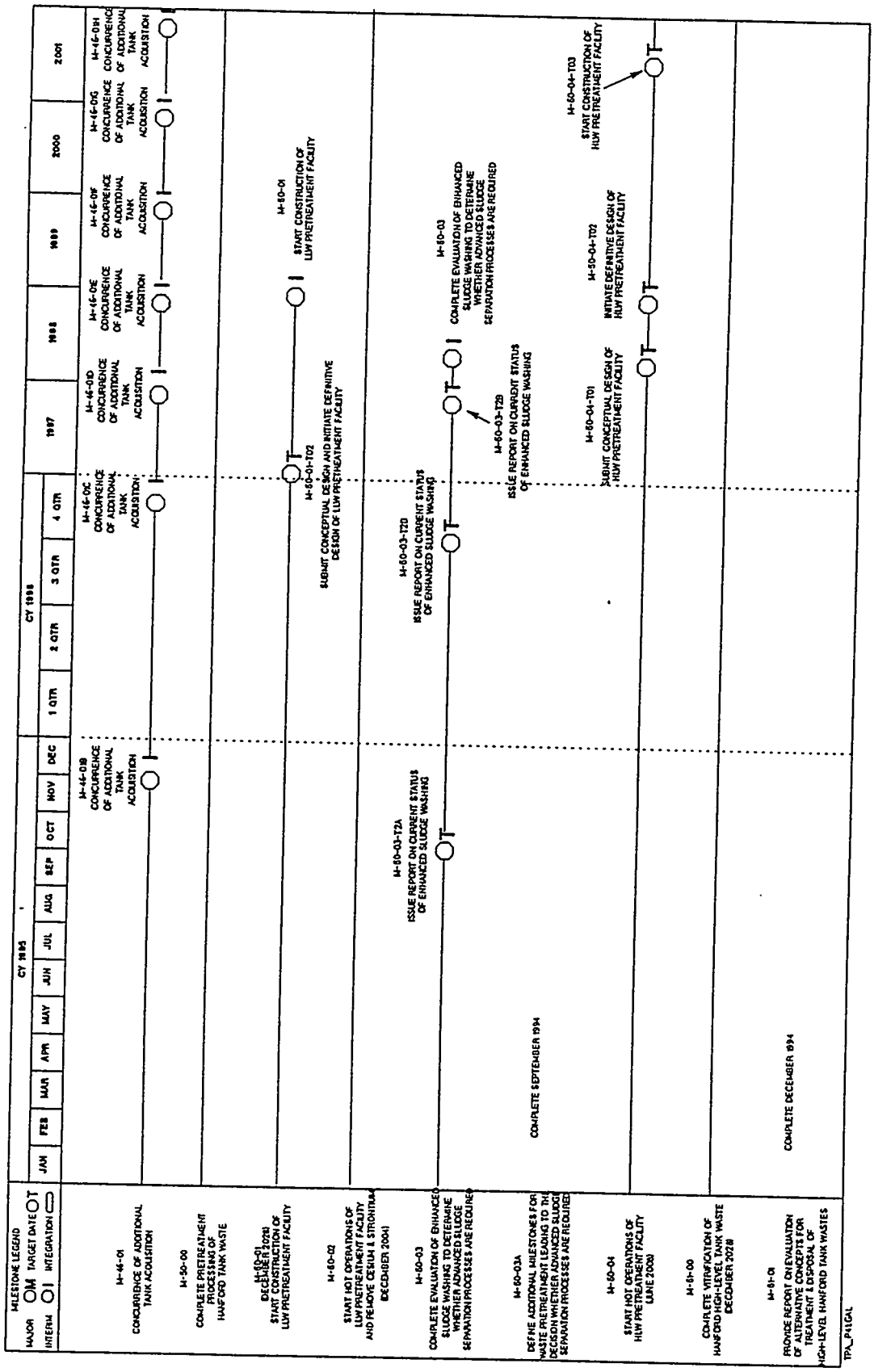


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 15 of 16)

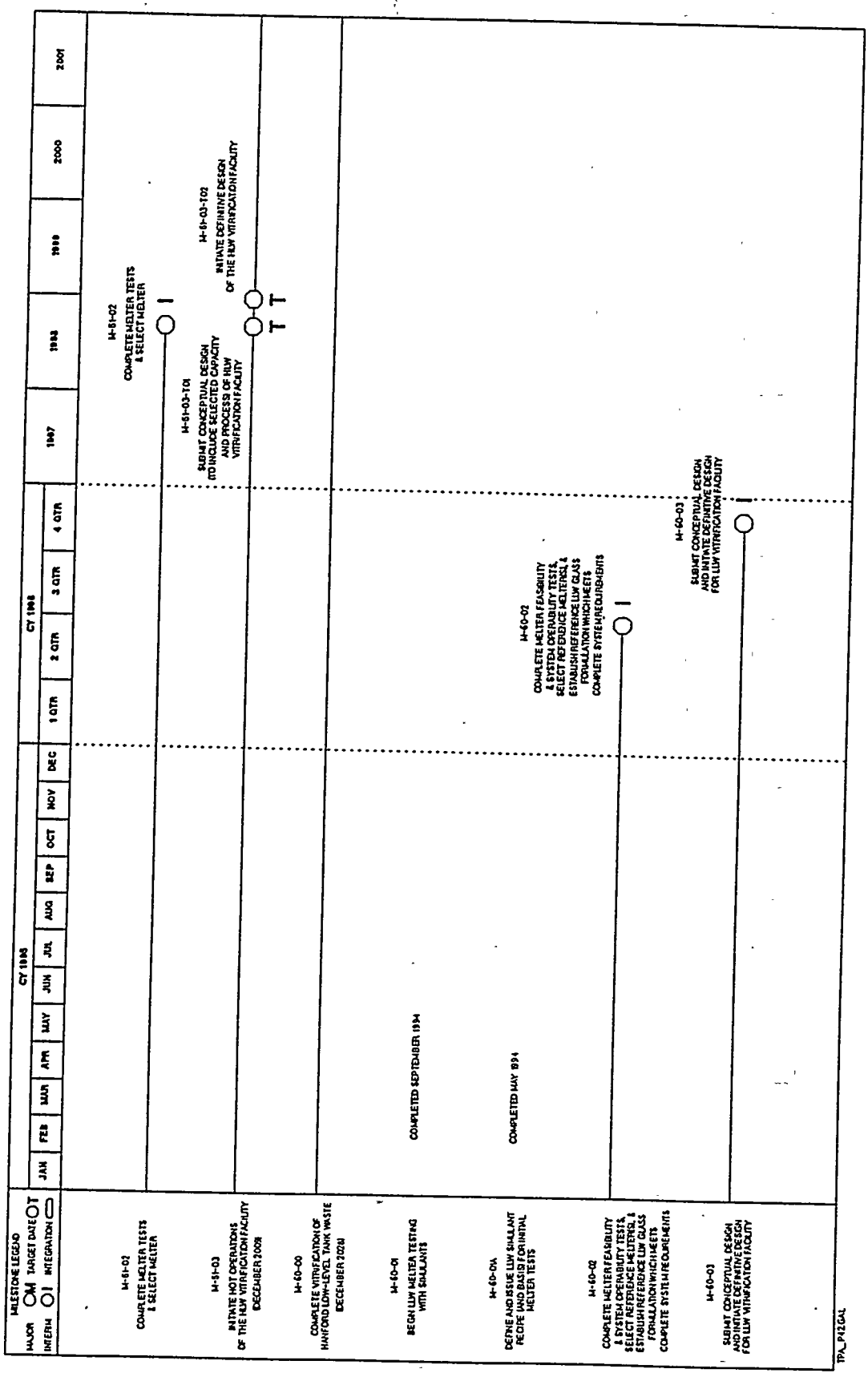


Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 16 of 16)

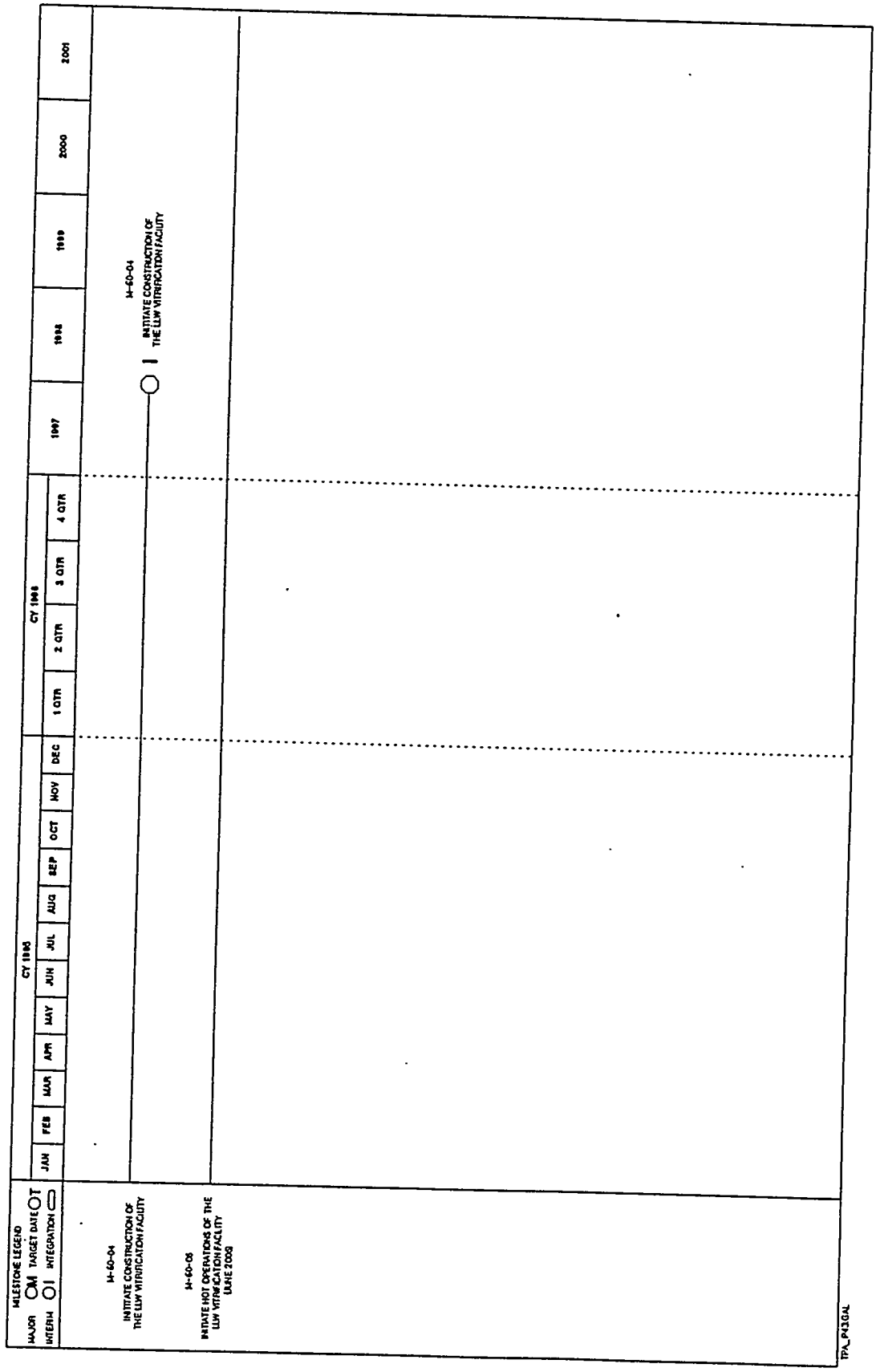


Figure 2-2. Hanford Tank Waste Remediation System.

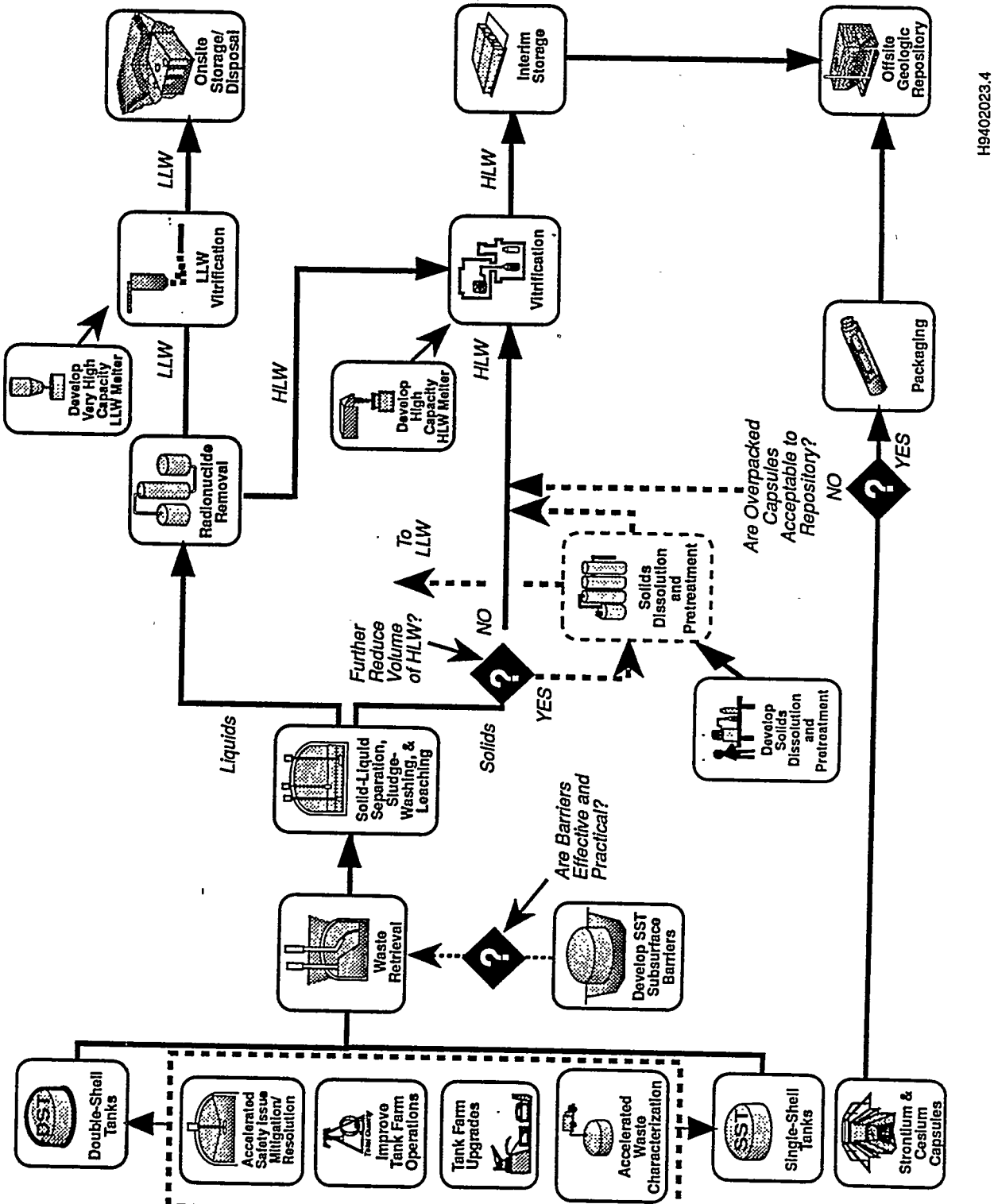
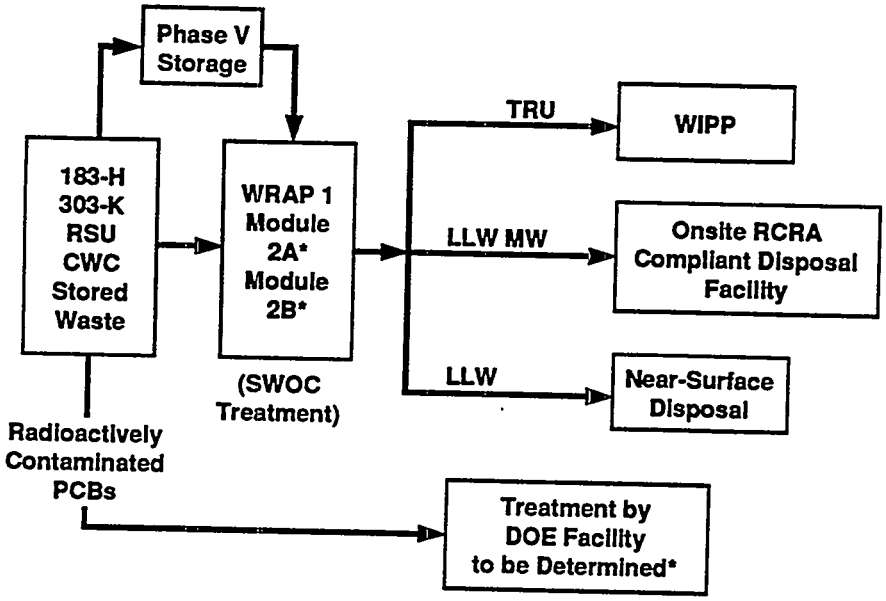


Figure 2-3. Central Waste Complex Stored Waste, Retrievably Stored Waste, 183-H Solar Basin Waste, and 303-K Waste Treatment Flow Diagram.



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

Waste stream	Projected generation or receipt (m^3)				
	1995	1996	1997	1998	1999
1. DST Waste (before evaporation)	6,100	8,800	9,200	10,500	7,000
2. PUREX Aging Waste	0	0	0	0	0
3. SST Waste	0	0	0	0	0
4. 242-A Evaporator Process Condensate	13,800	20,000	10,800	9,500	9,700
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	30	0	0	0	0
10. PUREX Storage Tunnel 1 Waste (lead)[b]	0	0	0	0	0
11. PUREX Storage Tunnel 2 Waste (lead, silver, cadmium, Fluorothene, and chromium)[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	3,907	3,964	3,576	3,961
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	0	0	0	0	0
17. 324 REC[c]	1.3	1.3	1.3	1.3	1.3
18. 324 HLV	0	0	0	0	0
Total Projected Generation	24,470	32,974	24,231	23,843	20,928

[a]These rates are based on the assumptions of Chapter 1.0, Section 1.2. Depending on the stream, figures are for either generation or receipt of waste.
[b]Generation rate depends upon the need to move failed equipment containing mercury, chromium, lead, cadmium, Fluorothene and/or silver into the PUREX tunnels or containment building. (Fluorothene is a trademark of Union Carbide Corporation for polytrifluoromonochloroethylene.)
[c]These generation estimates are based on the assumption that used HEPA filters in the cells may contain hazardous waste.

CWC = Central Waste Complex.
DST = Double-shell tank.
HEPA = high-efficiency particulate air.
HLV = High-Level Vault.
PCB = Polychlorinated biphenyl.
PUREX = Plutonium-Uranium Extraction (Plant).
REC = Radiochemical Engineering Cells.
SST = Single-shell tank.
TRU = Transuranic.
TRUSAF = Transuranic Waste Storage and Assay Facility.

Table 2-2. Waste Stream Characterization. (sheet 1 of 4)

Waste stream	Schedule	Method, protocol, specific analyses
1. DST Waste	1994-1999 (M-44-00, Ecology et al. 1992)	• A Tank Waste Analysis Plan was developed using the results of the data quality objective process for characterization of all tanks. A DST-specific plan is also being prepared. • Specific analysis will be determined by the data quality objectives process. • A tank characterization plan for each applicable tank will also be developed using inputs from 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 for DSTs.
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 individual tank characterization plan. • Data will be reported in a tank characterization report.
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 200 Area Effluent Treatment Facility startup.
5. 4843 Sodium Storage Facility Waste	No future characterization is planned at 4843	NA
6. PUREX Ammonia Scrubber Waste	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 4)

Waste stream	Schedule	Method, protocol, specific analyses
7. PUREX Process Condensate	1990-1995, with other DST waste	• Waste analysis plan completed per M-23-03 (Ecology et al. 1992).
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 for storage of containerized waste; closure of the basins may require further characterization to conclude clean closure of the unit.	• Characterization details contained in DOE/RL-90-39 (RL 1991c) for containerized waste. • Any future verification required for treatment of waste in the CWC will be determined at the time of treatment.
10. PUREX Storage Tunnel 1 Waste (lead)	Waste characterization complete	• Characterization details contained in RL (1990b).
11. PUREX Storage Tunnel 2 Waste (mercury, lead, silver, cadmium, Fluorothene, and chromium)	Waste characterization complete	• Characterization details contained in RL (1990b).
12. PUREX Containment Building (lead and cadmium)	No further characterization is planned	NA

Table 2-2. Waste Stream Characterization. (sheet 3 of 4)

Waste stream	Schedule	Method, protocol, specific analyses
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 have been completed.
14. Retrievably Stored Low-Level and TRU Waste	• In situ characterization 1991-1994 • Waste will be characterized before disposal after processing	• 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	Characterization to be done at WRAP 1 before shipment	• To be certified and shipped to the Waste Isolation Pilot Plant.
16. 303-K Stored Waste	No further characterization at this facility	NA--Waste is stored at CWC

Table 2-2. Waste Stream Characterization. (sheet 4 of 4)

Waste stream	Schedule	Method, protocol, specific analyses
17. 324 REC	1993-1995	All known waste streams characterized based on analysis or process knowledge.
18. 324 HLV	Complete	All waste was designated based on analysis of waste streams.

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.
HEPA = High-efficiency particulate air.
HLV = High-Level Vault
NA = Not applicable.
PCB = Polychlorinated biphenyl.
PUREX = Plutonium-Uranium Extraction (Plant).
REC = Radiochemical Engineering Cells.
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. Dangerous Waste Designations.[a] (sheet 1 of 6)

Waste stream	Designated waste code(s)
1. DST Waste[b,e]	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) F039 (multisource leachate) 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[b]	D001 (ignitable) 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 (methylenechloride) F003 (acetone and hexone) F004 (cresylic acid) F005 (nonspent halogenated solvents) WT01 (toxic)

Table 2-3. Dangerous Waste Designations.[a] (sheet 2 of 6)

Waste stream	Designated waste code(s)
4. 242-A Evaporator Process condensate[e]	D006 (TCLP cadmium) D011 (TCLP silver) F001 (1,1,1-trichlorethane) F002 (methylene chloride) F003 (acetone and hexone) F004 (cresylic acid) F005 (methyl ethyl ketone) F039 (multisource leachate) WP01 (persistent extremely hazardous waste) WP02 (persistent dangerous waste) WT01 (toxic, extremely hazardous) WT02 (toxic)
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 1 Waste (lead)	D008 (TCLP lead)

Table 2-3. Dangerous Waste Designations.[a] (sheet 3 of 6)

Waste stream	Designated waste code(s)
11. PUREX Storage Tunnel 2 Waste (mercury, lead, silver, cadmium, Fluorothene, and chromium)	D001 (ignitable) D006 (TCLP cadmium) D007 (TCLP chromium) D008 (TCLP lead) D009 (TCLP mercury) D011 (TCLP silver) WC02 (carcinogenic) WP01 (persistent extremely hazardous waste) WT01 (toxic) WT02 (toxic)
12. PUREX Containment Building (lead and cadmium)	D006 (TCLP cadmium) D008 (TCLP lead) WT01 (toxic)

Table 2-3. Dangerous Waste Designations.[a] (sheet 4 of 6)

Waste stream	Designated waste code(s)
13. CWC Stored Low-Level, TRU, and PCB Waste[e] 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 Form 3 permit application contains a complete listing. Not all codes are being managed that appear on the Part A Form 3.	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) D039 (perchlorethylene) F001 (spent halogenated degreasing solvents) F002 (spent halogenated solvents) F003 (acetone) F004 (cresols) F005 (spent non-halogenated solvents) F039 (multisource leachate) 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)

Table 2-3. Dangerous Waste Designations.[a] (sheet 5 of 6)

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)

Table 2-3. Dangerous Waste Designations.[a] (sheet 6 of 6)

Waste stream	Designated waste code(s)
16. 303-K Stored Waste Note: This waste has been moved to the CWC.	
17. 324 REC	D006 (TCLP cadmium) D007 (TCLP chromium) D008 (TCLP lead) D010 (TCLP selenium) D011 (TCLP silver) F002 (1,1,1, trichloroethane) WP02 (persistent dangerous waste) WT01 (toxic) WT02 (toxic)
18. 324 HLV	D002 (corrosive) D007 (TCLP chromium) D008 (TCLP lead) WT02 (toxic)

[a]Further information is given in Section 2.2.

[b]TCLP waste codes D018, D019, D022, D028, D029, D030, D033, D035, D036, and D038 through D043 are listed in the DST Part A Form 3 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).

[e]The F039 waste code has been added to these facilities' Part A permit applications, but no F039 waste is currently being managed.

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

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

Waste stream	Facility	Capacity (m^3)	Anticipated capacity fill date	Part B/Closure Plan (Latest Revision)	Known Release of hazardous constituents
1. DST Waste	DSTs	111,800	1998	6/91	none
2. PUREX Aging Waste	DSTs	7,400	NA[b]	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/CWC	8,200[a]	NA[b]	6/91[c]	yes (Section 3.9.3)
10. PUREX Storage Tunnel 1 Waste (lead)	PUREX Tunnel 1	d	NA[e]	12/91[f]	none
11. PUREX Storage Tunnel 2 Waste (mercury, lead, silver, cadmium, Fluorothene, and chromium)	PUREX Tunnel 2	d	NA[e]	12/91[f]	none
12. PUREX Containment Building (lead and cadmium)	PUREX canyon	b	NA[b]	Closure Plan due 7/95	none
13. CWC Stored Low-Level, TRU, and PCB Waste	Various	23,898	1996[g]	12/94	none
14. Retrievably Stored Low-Level and TRU Waste	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/CWC	42	NA[a]	12/93[c]	none
17. 324 REC	324 Building	46.6	NA[b]	Closure plan due 12/95	none
18. 324 HLV	324 Building	56.7	NA[b]	Closure plan due 12/95	none

[a]This unit is no longer used for active storage; capacity noted is for information only.
[b]No future generation of this waste.
[c]Closure plan. Revised SST closure plan is due 4/95.
[d]PUREX Storage Tunnel 1 has a total capacity for 8 rail cars, equivalent to 4,129 cubic meters, and is filled with approximately 596 cubic meters of stored equipment. PUREX Storage Tunnel 2 has a total capacity for 40 rail cars, equivalent to 19,878 cubic meters, and currently contains 19 rail cars or 1,529 cubic meters of stored equipment. The total capacity of both tunnels is 24,007 cubic meters.
[e]Capacity is sufficient for all future generation.
[f]To be changed to a Closure Plan.
[g]New facilities are planned to be on line in 1996.

CWC = Central Waste Complex.
DST = Double-shell tank.
HLV = High-Level Vault
LERF = Liquid Effluent Retention Facility.
NA = Not applicable.
PCB = Polychlorinated biphenyl.
PUREX = Plutonium-Uranium Extraction (Facility).
REC = Radiochemical Engineering Cells.
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	71,472[a]	1975	80	11	9	[b]	[b]	[b]
2. PUREX Aging Waste	DSTs	7,234[a]	1975	93	0	7	0	0	100
3. SST Waste	SST	136,600	1944	31	44	25	b	b	b
4. 242-A Evaporator Process Condensate	LERF	24,800	1994	100	0	0	100	0	0
5. 4843 Sodium Storage Facility Waste	4843 Building	13.8	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	1.9	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 1 Waste (lead)	PUREX Tunnel 1	0.02[d]	1960	100	0	0	100	0	0
11. PUREX Storage Tunnel 2 Waste mercury lead silver cadmium Fluorothene	PUREX Tunnel 2	 0.01[d] 0.26 0.17 1.5 x 10^{-3} 0.08	1971	0	100	0	100	0	0
12. PUREX Containment Building (lead and cadmium)	PUREX Plant	0.31[d]	1987	0	100	0	100	0	0
13. CWC Stored Low-Level, TRU, and PCB Waste	Various	6,818	1988	0	100	0	95	5	0
14. Retrievably Stored Low-Level and TRU Waste	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	65	1985	0	100	0	0	100	0
16. 303-K Stored Waste	303-K Bldg	0[e]	1943	0	100	0	100	0	0
17. 324 REC	324 Building	9.6	Mid 1960s	0	100	0	69	31	0
18. 324 HLV	324 Building	3.6	1994	100	0	0	0	83	17

[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 78,706 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 values 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 waste is in rail cars with 596 cubic meters in storage in Tunnel 1 and 1,529 cubic meters in storage in Tunnel 2 (rail cars included). Chromium inventory is not included because the waste was added after the 12/31/94 inventory date.
[e]Waste from the 303-K facility has been removed. Other reported values are for the waste when it was at 303-K.

CWC = Central Waste Complex.
DST = Double-shell tank.
HLV = High-Level Vault.
HLW = High-level waste.
LERF = Liquid Effluent Retention Facility.
LLW = Low-level waste.
PCB = Polychlorinated biphenyl.
PUREX = Plutonium-Uranium Extraction (Facility).
REC = Radiochemical Engineering Cells
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 11)

Waste codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treatment date
1. **DST Waste** (includes NCAW, NCRW, complex concentrate, and PFP waste)[b] (low-level fraction)						
F001	MCL	vitrification	TBD[c]	TBD	TBD(onsite)	2005
F002	MCL	vitrification	TBD[c]	TBD	TBD(onsite)	2005
F003	MCL	vitrification	TBD[c]	TBD	TBD(onsite)	2005
F004	MCL	vitrification	TBD[c]	TBD	TBD(onsite)	2005
F005	MCL	vitrification	TBD[c]	TBD	TBD(onsite)	2005
F039	MCL	vitrification	TBD[c]	TBD	TBD(onsite)	2005
D001	deactivation	vitrification	TBD[c]	TBD	TBD(onsite)	2005
D002	deactivation	vitrification	TBD[c]	TBD	TBD(onsite)	2005
D003	deactivation	vitrification	TBD[c]	TBD	TBD(onsite)	2005
D004	5.0 mg/L	vitrification	TBD[c]	TBD	TBD(onsite)	2005
D005	100 mg/L	vitrification	TBD[c]	TBD	TBD(onsite)	2005
D006	1.0 mg/L	vitrification	TBD[c]	TBD	TBD(onsite)	2005
D007	5.0 mg/L	vitrification	TBD[c]	TBD	TBD(onsite)	2005
D008	5.0 mg/L	vitrification	TBD[c]	TBD	TBD(onsite)	2005
D009	thermal	vitrification	TBD[c]	TBD	TBD(onsite)	2005
D010	5.7 mg/L	vitrification	TBD[c]	TBD	TBD(onsite)	2005
D011	5.0 mg/L	vitrification	TBD[c]	TBD	TBD(onsite)	2005
WT01	reduction	vitrification	TBD[c]	TBD	TBD(onsite)	2005
WT02	none	vitrification	TBD[c]	TBD	TBD(onsite)	2005
WC02	none	vitrification	TBD[c]	TBD	TBD(onsite)	2005
WP01	reduction	vitrification	TBD[c]	TBD	TBD(onsite)	2005
WP02	none	vitrification	TBD[c]	TBD	TBD(onsite)	2005
Pretreated Complexed Concentrate Waste (high-level fraction)						
F001	MCL	vitrification	TBD[c]	TBD	repository	2009
F002	MCL	vitrification	TBD[c]	TBD	repository	2009
F003	MCL	vitrification	TBD[c]	TBD	repository	2009
F004	MCL	vitrification	TBD[c]	TBD	repository	2009

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

Waste codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treatment date
F005	MCL	vitrification	TBD[c]	TBD	repository	2009
F039	MCL	vitrification	TBD[c]	TBD	repository	2009
D001	deactivation	vitrification	TBD[c]	TBD	repository	2009
D002	vitrification	vitrification	TBD[c]	TBD	repository	2009
D003	deactivation	vitrification	TBD[c]	TBD	repository	2009
D004	vitrification	vitrification	TBD[c]	TBD	repository	2009
D005	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
D009	thermal	vitrification	TBD[c]	TBD	repository	2009
D010	vitrification	vitrification	TBD[c]	TBD	repository	2009
D011	vitrification	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	TBD (onsite)	2009
D002	deactivation	Vitrification	TBD[c]	TBD	TBD (onsite)	2009
D006	1.0 mg/L	Vitrification	TBD[c]	TBD	TBD (onsite)	2009

Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 3 of 11)

Waste codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treatment date
D007	1.0 mg/L	Vitrification	TBD[c]	TBD	TBD (onsite)	2009
D008	5.0 mg/L	Vitrification	TBD[c]	TBD	TBD (onsite)	2009
3. SST Waste[b,d] High-level fraction						
F001	MCL	vitrification	TBD[c]	TBD	repository	2009
F002	MCL	vitrification	TBD[c]	TBD	repository	2009
F003	MCL	vitrification	TBD[c]	TBD	repository	2009
F004	MCL	vitrification	TBD[c]	TBD	repository	2009
F005	MCL	vitrification	TBD[c]	TBD	repository	2009
D001	deactivation	vitrification	TBD[c]	TBD	repository	2009
D002	vitrification	vitrification	TBD[c]	TBD	repository	2009
D003	deactivation	vitrification	TBD[c]	TBD	repository	2009
D004	vitrification	vitrification	TBD[c]	TBD	repository	2009
D005	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
D009	thermal	vitrification	TBD[c]	TBD	repository	2009
D010	vitrification	vitrification	TBD[c]	TBD	repository	2009
D011	vitrification	vitrification	TBD[c]	TBD	repository	2009
Low-level fraction						
F001	MCL	vitrification	TBD[c]	TBD	TBD (onsite)	2005
F002	MCL	vitrification	TBD[c]	TBD	TBD (onsite)	2005
F003	MCL	vitrification	TBD[c]	TBD	TBD (onsite)	2005
F004	MCL	vitrification	TBD[c]	TBD	TBD (onsite)	2005
F005	MCL	vitrification	TBD[c]	TBD	TBD (onsite)	2005
D001	deactivation	vitrification	TBD[c]	TBD	TBD (onsite)	2005
D002	deactivation	vitrification	TBD[c]	TBD	TBD (onsite)	2005
D003	deactivation	vitrification	TBD[c]	TBD	TBD (onsite)	2005

Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 4 of 11)

Waste codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treatment date
D004	5.0 mg/L	vitrification	TBD[c]	TBD	TBD (onsite)	2005
D005	100 mg/L	vitrification	TBD[c]	TBD	TBD (onsite)	2005
D006	1.0 mg/L	vitrification	TBD[c]	TBD	TBD (onsite)	2005
D007	5.0 mg/L	vitrification	TBD[c]	TBD	TBD (onsite)	2005
D008	5.0 mg/L	vitrification	TBD[c]	TBD	TBD (onsite)	2005
D009	thermal	vitrification	TBD[c]	TBD	TBD (onsite)	2005
D010	5.7 mg/L	vitrification	TBD[c]	TBD	TBD (onsite)	2005
D011	5.0 mg/L	vitrification	TBD[c]	TBD	TBD (onsite)	2005
4. 242-A Evaporator Process Condensate						
D006	1.0 mg/L	destruction	ETF	800	SALDS	1995
D011	5.0 mg/L	destruction	ETF	800	SALDS	1995
F001	0.054 mg/L	destruction	ETF	800	SALDS	1995
F002	0.089 mg/L	destruction	ETF	800	SALDS	1995
F003	MCL	destruction	ETF	800	SALDS	1995
F005	0.28 mg/L	destruction	ETF	800	SALDS	1995
F039	MCL	destruction	ETF	800	SALDS	1995
WP01	reduction	destruction	ETF	800	SALDS	1995
WP02	none	destruction	ETF	800	SALDS	1995
WT02	none	removal	ETF	800	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 waste.						
7. PUREX Process Condensate						
Included with LLW DST waste.						

Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 5 of 11)

Waste codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treatment date
8. Hexone Waste						
F003	33 mg/kg	incineration	Diversified Scientific Services, Kingston, TN	12	None (complete destruction)	1991-1994
WT02	none	incineration	Diversified Scientific Services, Kingston, TN	12	None (complete destruction)	1991-1994
D001	combustion	incineration	Diversified Scientific Services, Kingston, TN	12	None (complete destruction)	1991-1994
WC02	none	incineration	Diversified Scientific Services, Kingston, TN	12	None (complete destruction)	1991-1994
9. 183-H Solar Evaporation Basins Waste						
U123	combustion	TBD	TBD	TBD	TBD	TBD
P030	MCL	TBD	WRAP	TBD	TBD	1999[e]
P120	stabilization	TBD	WRAP	TBD	TBD	1999[e]
P029	MCL	TBD	WRAP	TBD	TBD	1999[e]
P106	MCL	TBD	WRAP	TBD	TBD	1999[e]
P098	MCL	TBD	WRAP	TBD	TBD	1999[e]
D007	5.0 mg/L	TBD	WRAP	TBD	TBD	1999[e]
WT01	reduction	TBD	WRAP	TBD	TBD	1999[e]
10. PUREX Storage Tunnel 1 Waste (lead)						
D008	macro-encapsulation	TBD	TBD	TBD	TBD	TBD
11a. PUREX Storage Tunnel 2 Waste (lead)						
D008	macro-encapsulation	TBD	TBD	TBD	TBD	TBD
11b. PUREX Storage Tunnel 2 Waste (mercury)						
D009	amalgamation	TBD	TBD	TBD	TBD	TBD

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

Waste codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treatment date
WT01	reduction	TBD	TBD	TBD	TBD	TBD
11c. PUREX Storage Tunnel 2 Waste (cadmium)						
D006	1.0 mg/L	TBD	TBD	TBD	TBD	TBD
WT01	reduction	TBD	TBD	TBD	TBD	TBD
11d. PUREX Storage Tunnel 2 Waste (silver)						
D001	deactivation	TBD	TBD	TBD	TBD	TBD
D011	5.0 mg/L	TBD	TBD	TBD	TBD	TBD
WT01	reduction	TBD	TBD	TBD	TBD	TBD
11e. PUREX Storage Tunnel 2 Waste (Fluorothene)						
WT02	incineration	TBD	TBD	TBD	TBD	TBD
WP01	incineration	TBD	TBD	TBD	TBD	TBD
11f. PUREX Storage Tunnel 2 Waste (chromium)						
D007	5.0 mg/L	TBD	TBD	TBD	TBD	TBD
WC02	none	TBD	TBD	TBD	TBD	TBD
WT01	reduction	TBD	TBD	TBD	TBD	TBD
12. PUREX Containment Building (lead and cadmium)						
D006	1.0 mg/L	TBD	TBD	TBD	TBD	TBD
D008	macro-encapsulation	TBD	TBD	TBD	TBD	TBD
WT01	reduction	TBD	TBD	TBD	TBD	TBD
13. CWC Stored Low-Level, Transuranic, and PCB Waste Low-level waste[g]						
F001	MCL	Incineration	TBD	TBD	TBD	TBD[h]
F002	MCL	Incineration	TBD	TBD	TBD	TBD[h]
F003	MCL	Incineration	TBD	TBD	TBD	TBD[h]
F004	MCL	Incineration	TBD	TBD	TBD	TBD[h]
F005	MCL	Incineration	TBD	TBD	TBD	TBD[h]
F039	MCL	Incineration	TBD	TBD	TBD	TBD[h]
D001	deactivation	TBD	WRAP	TBD	TBD	1999[e]

Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 7 of 11)

Waste codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treatment date
D002	deactivation	TBD	WRAP	TBD	TBD	1999[e]
D003	deactivation	TBD	WRAP	TBD	TBD	1999[e]
D004	5.0 mg/L	TBD	WRAP	TBD	TBD	1999[e]
D005	100 mg/L	TBD	WRAP	TBD	TBD	1999[e]
D006	1.0 mg/L	TBD	WRAP	TBD	TBD	1999[e]
D007	5.0 mg/L	TBD	WRAP	TBD	TBD	1999[e]
D008	macro-encapsulation	TBD	WRAP	TBD	TBD	1999[e]
D009	amalgamation	TBD	WRAP	TBD	TBD	1999[e]
D010	5.7 mg/L	TBD	WRAP	TBD	TBD	1999[e]
D011	5.0 mg/L	TBD	WRAP	TBD	TBD	1999[e]
D012	0.13 mg/kg	TBD	WRAP	TBD	TBD	1999[e]
D016	10 mg/kg	TBD	WRAP	TBD	TBD	1999[e]
D039	6.0 mg/kg	TBD	WRAP	TBD	TBD	1999[e]
WT01	reduction	TBD	WRAP	TBD	TBD	1999[e]
WT02	none	TBD	WRAP	TBD	TBD	1999[e]
WC02	none	TBD	WRAP	TBD	TBD	1999[e]
WP01	reduction	TBD	WRAP	TBD	TBD	1999[e]
WP02	none	TBD	WRAP	TBD	TBD	1999[e]
U080	30 mg/kg	TBD	WRAP	TBD	TBD	1999[e]
U123	incineration	TBD	TBD	TBD	TBD	TBD[h]
U161	33 mg/kg	TBD	WRAP	TBD	TBD	1999[e]
P029	MCL	TBD	WRAP	TBD	TBD	1999[e]
P030	MCL	TBD	WRAP	TBD	TBD	1999[e]
P098	MCL	TBD	WRAP	TBD	TBD	1999[e]
P106	MCL	TBD	WRAP	TBD	TBD	1999[e]
P120	stabilization	TBD	WRAP	TBD	TBD	1999[e]
W001	incineration	TBD	TBD	TBD	TBD	TBD

Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 8 of 11)

Waste codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treatment date
Transuranic waste						
F003	None[f]	None	WRAP[i]	TBD	WIPP	2002
F005	None[f]	None	WRAP[i]	TBD	WIPP	2002
D001	None[f]	None	WRAP[i]	TBD	WIPP	2002
D002	None[f]	None	WRAP[i]	TBD	WIPP	2002
D006	None[f]	None	WRAP[i]	TBD	WIPP	2002
D007	None[f]	None	WRAP[i]	TBD	WIPP	2002
D008	None[f]	None	WRAP[i]	TBD	WIPP	2002
D009	None[f]	None	WRAP[i]	TBD	WIPP	2002
WT01	None[f]	None	WRAP[i]	TBD	WIPP	2002
WT02	None[f]	None	WRAP[i]	TBD	WIPP	2002
WC02	None[f]	None	WRAP[i]	TBD	WIPP	2002
W001	None[f]	None	WRAP[i]	TBD	WIPP	2002
14. Retrievably Stored Low-Level and Transuranic Waste Low-level waste						
F001	MCL	TBD	TBD	TBD	TBD	TBD[h]
F003	MCL	TBD	TBD	TBD	TBD	TBD[h]
F005	MCL	TBD	TBD	TBD	TBD	TBD[h]
D001	deactivation	TBD	WRAP	TBD	TBD	1999[e]
D003	deactivation	TBD	WRAP	TBD	TBD	1999[e]
D005	100 mg/L	TBD	WRAP	TBD	TBD	1999[e]
D006	1.0 mg/L	TBD	WRAP	TBD	TBD	1999[e]
D007	5.0 mg/L	TBD	WRAP	TBD	TBD	1999[e]
D008	macro-encapsulation	TBD	WRAP	TBD	TBD	1999[e]
D009	amalgamation	TBD	WRAP	TBD	TBD	1999[e]
D011	5.0 mg/L	TBD	WRAP	TBD	TBD	1999[e]
WT01	reduction	TBD	WRAP	TBD	TBD	1999[e]
WT02	none	TBD	WRAP	TBD	TBD	1999[e]

Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 9 of 11)

Waste codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treatment date
WC02	none	TBD	WRAP	TBD	TBD	1999[e]
WP01	reduction	TBD	WRAP	TBD	TBD	1999[e]
W001	incineration	TBD	TBD	TBD	TBD	TBD
Transuranic waste						
D006	None[f]	None	WRAP[i]	TBD	WIPP	2002
D008	None[f]	None	WRAP[i]	TBD	WIPP	2002
WT01	None[f]	None	WRAP[i]	TBD	WIPP	2002
P015	None[f]	None	WRAP[i]	TBD	WIPP	2002
15. TRUSAF Stored Waste						
D002	none[f]	none	WRAP[i]	TBD	WIPP	2002
D005	none[f]	none	WRAP[i]	TBD	WIPP	2002
D006	none[f]	none	WRAP[i]	TBD	WIPP	2002
D007	none[f]	none	WRAP[i]	TBD	WIPP	2002
D008	none[f]	none	WRAP[i]	TBD	WIPP	2002
D009	none[f]	none	WRAP[i]	TBD	WIPP	2002
WC02	none[f]	none	WRAP[i]	TBD	WIPP	2002
WP01	none[f]	none	WRAP[i]	TBD	WIPP	2002
WT01	none[f]	none	WRAP[i]	TBD	WIPP	2002
16. 303-K Stored Waste Note: This waste is now in CWC (see Stream 13 in this table).						
17. 324 REC						
D006	1.0 mg/L, macro-encapsulation	TBD	TBD	TBD	TBD	1999
D007	5.0 mg/L	TBD	TBD	TBD	TBD	1999
D008	5.0 mg/L, macro-encapsulation	TBD	TBD	TBD	TBD	1999
D010	5.7 mg/L	TBD	TBD	TBD	TBD	1999
D011	5.0 mg/L	TBD	TBD	TBD	TBD	1999
F002	MCL	TBD	TBD	TBD	TBD	1999

Table 2-6. Treatment of Land Disposal Restricted Waste for Disposal. (sheet 10 of 11)

Waste codes	Required treatment[a]	Planned treatment	Treatment facility	Facility capacity (m^3/day)	Disposal facility	Treatment date
WP02	none	N/A	N/A	N/A	N/A	1999
WT01	none	N/A	N/A	N/A	N/A	1999
18. 324 HLV						
D002	deactivation	TBD	TBD	TBD	TBD	1996
D007	CCW/5.0 mg/L	TBD	TBD	TBD	TBD	1996
D008	CCW/5.0 mg/L	TBD	TBD	TBD	TBD	1996
WT02	none	N/A	N/A	N/A	N/A	N/A

[a]Treatment required by WAC 173-303-140 and 60 FR 242, universal treatment standards. Nonwastewater category assumed for this table except for the 242-A Evaporator and HLV waste.
Deactivation treatment standards (e.g. D001 waste) were affected by the May 24, 1993 emergency rule. This waste must also be treated to standards for underlying hazardous constituents and to meet F039 concentration standards.

[b]The Tri-Party Agreement strategy calls for pretreatment of essentially all waste 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. The current baseline strategy has TRU waste combined with the HLW fraction after pretreatment and for vitrification. Studies are planned to be done to see if it is feasible to generate a separate TRU stream that will be processed to meet WIPP waste acceptance criteria.

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

[d]Waste will be retrieved from the SSTs to the extent needed for closure.

[e]The WRAP 2A facility or commercial services for treating this waste are available on this date. This waste will be treated based on facility/commercial services operating schedules. The dates shown are for WRAP 2A or equal commercial services only.

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

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

[h]A commercially procured thermal treatment is being pursued for low-level mixed waste to support this required treatment.

[i]WRAP 1 will process waste to meet WIPP waste acceptance criteria.

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

CCW = Constituent concentrations in waste.
CWC = Central Waste Complex.
DST = Double-shell tank.
ETF = Effluent Treatment Facility.
HLV = High-Level Vault.
LLBG = Low-level burial grounds.
MCL = Multiple concentration limits (potential multiple constituents within waste code)
LLW = Low-level waste.
LWVP = Low-level waste vitrification plant.
PCB = Polychlorinated biphenyl.
PUREX = Plutonium-Uranium Extraction (Facility).
REC = Radiochemical engineering cells
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 Waste. (sheet 1 of 3)

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 complete (1994)	88%
9. 183-H Solar Evaporation Basins Waste	• Evaporate liquid	Complete (1990)	unknown
10. PUREX Storage Tunnel 1 Waste (lead)	• Segregation from nonhazardous waste	ongoing	variable
11. PUREX Storage Tunnel 2 Waste (mercury, lead, silver, cadmium, Fluorothene)	• Segregation from nonhazardous waste	ongoing	variable

Table 2-7. Waste Reduction Activities for Hanford Site Land Disposal Mixed Waste. (sheet 2 of 3)

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 Waste	• 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	• This facility is in the process of RCRA closure. Future generation not anticipated	NA	NA

Table 2-7. Waste Reduction Activities for Hanford Site Land Disposal Mixed Waste. (sheet 3 of 3)

Waste	Method to reduce	Schedule for implementing waste reduction procedures	Projected waste reduction
17. 324 REC	• Waste is no longer being generated	NA	NA
18. 324 HLV	• Waste is no longer being generated	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 2B, will be included in the M-33-00 change package.

CWC = Central Waste Complex.
DST = Double-shell tank.
HLV = High-Level Vault.
NA = Not applicable.
PCB = Polychlorinated biphenyl.
PUREX = Plutonium-Uranium Extraction (Facility).
REC = Radiochemical engineering cells.
SST = Single-shell tank.
TBD = To be determined.
TRU = Transuranic.
TRUSAF = Transuranic Waste Storage and Assay Facility.

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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 78,706 cubic meters of waste as of December 31, 1994 (WHC 1995). 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, separate the waste into high- and low-level fractions, 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 on site.

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 described in the following sections (DOE 1987). All waste streams transferred to the DSTs for storage are treated with sodium hydroxide and sodium nitrite to minimize tank corrosion and to address compatibility issues of waste with the tanks. 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, although it physically and chemically differs considerably because of historical evaporation and/or crystallization practices and years of storage. 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.

Liquid waste streams destined for DSTs from current operations can be classified into four waste categories.

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; laboratory wastes are generated from sampling to support Tri-Party Agreement activities.

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

As a result of the delay in the restart of the 242-A Evaporator and the shortage of DST space, waste minimization limits have been set based on Categories 1 through 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 *A History of the 200 Area Tank Farms* (WHC 1990e) and monthly waste tank summary documents (WHC 1995).

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. In December 1992, RL gave direction to deactivate the PUREX Plant.

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

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.

The uranium recovery process operated in U Plant and at the PUREX Plant were similar in that they used tributyl phosphate as the solvent; however, there were significant differences between the two processes. The process in U Plant recovered uranium from bismuth phosphate metal wastes and produced wastes consisting of fission products and residual plutonium. Also, the process in U Plant produced relatively dilute HLW, approximately 19 liters of waste per kilogram of uranium processed. The PUREX Plant process recovered uranium and plutonium, and, at times, neptunium in addition to separating the fission products. The PUREX process produced a much more concentrated high-level waste product, approximately 0.2 liter per kilogram of uranium processed.

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 intimately mixed 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 liters of waste for every liter 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 volume of waste in the tanks, and the ferrocyanide scavenging decontaminated the waste sufficiently to enable disposal to the cribs. (Disposal to cribs would not have been allowed by today's standards.)

3.1.1.1.5 Reduction-Oxidation Process. The reduction-oxidation process in the 202-S Plant 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. Waste resulting from the strontium recovery was transferred to complex concentrate tanks. Waste resulting from cesium recovery (cesium raffinate) was segregated and placed in tank 241-AY-101, where it is now known as "dilute complexant waste."

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 then 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 Areas and 300 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).

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 DST system include supernate and interstitial liquids pumped from SSTs, laboratory wastes, dilute wastes from across the Hanford Site, and waste from inactive facilities. Outflows include waste destined for 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 2000 is shown in Figure 3-1 in terms of tank space used versus space available. The average generation rate for DST waste is about 8,300 cubic meters per year before evaporation. This generation rate is based on waste generation projections through 2000 (Table 2-1).

Any TRU solid waste from DST operations that is to be sent to WIPP for disposal will have to comply with WIPP packaging content requirements and TRUPAC II shipping requirements. Current planning calls for all shipments to WIPP to be managed through the WRAP 1 facility or the proposed WRAP 2B facility required by Milestone M-33. The potential quantities and future packaging/shipping requirements of such waste are still being studied and are unknown at this time. For this report, waste generation projections will be incorporated into the receiving facility's projections.

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. Many listed waste codes are also present. 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, and transferring waste from tank to tank 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.

In addition, DST waste may be categorized into several types, each having a specific history and character. These wastes types 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
- Dilute Non-complexed Waste
- Concentrated Phosphate 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 concentrating 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 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 evaporating 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. 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.

3.1.2.2 Sample Analyses. Samples of the DSTs have been analyzed using EPA SW-846 methodology (EPA 1986). Because no one DST constitutes a "representative" tank, the analytical data from these samples are presented in Table 3-1 as a total mass in all tanks for various chemicals.

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 which underlying hazardous constituents must be quantified to determine compliance (per 58 FR 29860 and 59 FR 47992). The DST waste also is suspected to contain spent solvents including 1,1,1-trichloroethane, hexone, acetone, and cresylic 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 (WC02) and persistent (WP01, WP02).

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. The codes are meant to be all encompassing for the DST system. Waste within specific tanks may be designated using fewer than all of the codes on the list.

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.

Sampling is carried out based on the type of waste in each tank. The types of sampling efforts that support various TWRS activities include push-mode and rotary-mode core sampling, grab sampling (bottle-on-a-string), auger sampling and various types of vapor sampling. 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) (EPA 1986). 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 can be found in the Tank Waste Analysis Plan (Bell 1994).

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, 1994, the tanks held 71,472 cubic meters of waste (WHC 1995). This does not include PUREX aging waste (Chapter 3.0, Section 3.2). Projections indicate that the DSTs could be filled to capacity in 1998 based on current expected generation rates. The construction of up to six new DSTs is required by Tri-Party Agreement Milestone M-42-00 to relieve the limitations, although certain programmatic assumptions and operating decisions currently under evaluation may eliminate the need for the new tanks and ultimately result in this milestone being renegotiated.

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. These actions may include the following:

- Record-keeping 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). It began operating in 1977 and has evaporated more than 270,000 cubic meters of water from the DST stored waste. The evaporator was restarted for further treatment campaigns in 1994.

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 of using 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 treated to further 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 pursued.

In separate facilities, both the LLW and HLW fractions will be vitrified, a process that will destroy or extract organic and cyanide constituents to below treatment standards, neutralize or deactivate dangerous waste and extremely hazardous waste, and immobilize toxic metals. The LLW fraction will

be disposed of near surface on site in a retrievable form. The vitrified HLW stream will be stored on site 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 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.

3.1.5 Waste Reduction

Currently 11 major plants or programs generate DST waste. Annual waste generation for FY 1990 through 1994 is listed in Table 3-2. Total waste generation was reduced by 60 percent from 1990 to 1991, 54 percent from 1991 to 1992, and 26 percent from 1992 to 1993. Total waste increased by 7 percent between 1993 and 1994 because of SST to DST pumping. (The latter figure does not include water additions used in evaporator tests. See Table 3-2 for details.) "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 is concentrated by the 242-A Evaporator, further reducing the waste volume by 30 to 95 percent. In 1994, two evaporator campaigns were completed. In Campaign 94-1, DST waste volume was reduced by 9,050 cubic meters; in Campaign 94-2, DST waste volume was reduced by 10,700 cubic meters. In an average year, the volume of newly received dilute waste is projected to be reduced by approximately 71 percent.

3.1.6 Variances, Exemptions, Time Extensions

The DST waste consists of waste managed as 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). DST waste also includes corrosive and reactive characteristic waste, TCLP metals and organics, and Washington State-only waste.

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.

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. Variances and exemptions are expected because of the final sampling and analysis requirements imposed on the final vitrification forms of DST waste.

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). The 241-AY-101 and -102 tanks were never used to store aging waste and currently contain non-aging dilute wastes.

Aging waste from the PUREX Plant came from the first decontamination solvent extraction column in the PUREX solvent extraction process. The feed to the extraction column was irradiated fuel elements dissolved in nitric acid. The extraction column separated the uranium and TRU products from the majority of the fission products. The fission products were contained in the aqueous nitric acid phase from the extraction column. The aqueous phase was concentrated to recover nitric acid and reduce volumes, and the concentrated stream was sampled. If it was determined to be a waste, based on sample analysis, it was treated with sugar to destroy the majority of the nitric acid. Sodium hydroxide is added to meet storage tank specifications and the waste was transferred to the aging DSTs for storage. As of December 31, 1994, a total of 7,234 cubic meters of PUREX aging waste was in storage. No aging waste has been transferred since 1990. Any annual increases are caused by the water added to flush the air lift circulators.

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 of on site 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 in December 1992. Aging waste has not been generated since 1990 and will not be generated in the future. Deactivation planning for the PUREX plant is under way. 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, at times, neptunium from the fission products contained in the fuel. The aging waste contained the majority of the fission products from the fuel and was generated from the aqueous stream from the first extraction column. Before startup of N Reactor, PUREX also received irradiated aluminum-clad reactor fuel from the Hanford Site's single-pass reactors.

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. Sample analyses of the PUREX aging waste stored in the DSTs performed in accordance with SW-846 methods (EPA 1986) where possible. In some cases, high radioactivity levels made using these methods impossible. The results of the analyses are given in Table 3-3.

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. Based on equivalent concentration calculations, Concentrations of sodium nitrate and sodium hydroxide are sufficient to make the aging waste

toxic extremely hazardous waste (WT01). In addition, sufficient quantities of heavy metals are present 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 3-3), the waste designation is correct.

3.2.2.5 Schedule for Further Characterization. Three core samples have been taken and characterized to date; six supernate samples are planned for FY 1995.

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 241-AY tank farm currently contains dilute non-aging waste. Each AY and AZ aging waste tank has 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. The air-lift circulators keep the supernate agitated and aid in removing heat 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 7,234 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 Milestone M-21-00 (Ecology et al. 1992). 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 of on site. 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.

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. Aging waste was minimized 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.

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 deactivation 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.

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

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

3.3 SINGLE-SHELL TANK WASTE

The 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 (according to the *Atomic Energy Act of 1954*) of processing spent nuclear fuel 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 tanks 241-C-105 and 241-C-106 to control evaporative cooling. Tank 241-C-106 is still receiving water as necessary. 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 136,600 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 percent 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 cubic meters of liquid to the soil column (Table 3-4). 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, 456,752 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 3-4 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 extracted and purified by ion exchange. These isotopes (cesium and strontium) were converted to fluoride and chloride salts and encapsulated in the Waste Encapsulation and Storage Facility. Sodium hydroxide or sodium carbonate was added to the waste before transfer to the SSTs to create an alkaline solution and to minimize tank corrosion (RL 1989b). The processing of irradiated fuels produced waste that included most of the fission products and comparatively small quantities of uranium, plutonium, and other actinides (WHC 1990h).

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

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

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

Any TRU solid waste from SST operations that is to be sent to WIPP for disposal will have to comply with WIPP packaging content requirements and TRUPAC II shipping requirements. Current planning calls for all shipments to WIPP to be managed through the WRAP 1 facility or the proposed WRAP 2B facility required by Milestone M-33. The potential quantities and future packaging/shipping requirements of such waste are still being studied and are unknown at this time. For this report, waste generation projections will be incorporated into the receiving facility's projections.

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 136,600 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 1995). The salt cake and sludge contain interstitial liquid. The bulk of this liquid, approximately 23,700 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 during the neutralization of acid waste before transfer to the SSTs. Sludges vary greatly in their physical properties. Salt cake contains various salts, primarily sodium nitrate, formed by the evaporation of the water from the waste. Damp salt cake is a jelly-like material; dried salt cake is a hard, abrasive, brittle material that may have formed as large single crystals. The salt cake porosity ranges from 10 to 50 percent. The liquid exists as supernate and interstitial fluid (WHC 1990h).

Additional equipment components also are found in the tanks with the process waste. These include metal measuring tapes, level instrumentation, other contaminated scrap, pump heads and shafts, samarium balls, one or more spent fuel elements, 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 the liquid and soft, solid tank waste. One to four core samples were removed from each of 15 SSTs in FY 1985 and 1986. Core samples were analyzed by the individual segment removed or as a homogenized sample of all segments retrieved from each core. The detailed waste analysis results are reported in Weiss (1986) and Adams et al. (1986).

The SST waste is made up of primarily sodium hydroxide; sodium salts of nitrate, nitrite, carbonate, aluminate, and phosphate; and hydrous oxides of iron and aluminum. A relatively small amount of solvents such as tri-butyl phosphate and normal paraffin hydrocarbon 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). Estimates of inventories of nonradioactive chemicals are given in Table 3-1.

Eighteen SSTs are on the Safety Issue Watch List because 140 metric tons of ferrocyanide were placed in the tanks during the 1950s to precipitate soluble cesium out of solution as cesium-sodium nickel ferrocyanide. If present in sufficient concentration, dry mixtures of ferrocyanide and sodium nitrate may undergo uncontrolled exothermic reactions when heated to temperatures (250 °C) significantly above current tank storage temperatures (<55 °C). Analytical results of recent samples obtained from the ferrocyanide tanks continues to confirm, as do ongoing simulant tests, that significant degradation of the ferrocyanide has occurred over the years of storage. Ferrocyanide concentrations in the worst case tanks have been shown to be less than 1/10th the amount originally present.

The potential buildup of flammable gases in 19 SSTs and 6 DSTs is another safety issue because a release from the waste could result in concentrations above the lower flammability limit in the tank head space. Work controls were instituted to prevent introduction of spark sources in these tanks, and evaluations were completed to ensure that installed equipment was intrinsically safe. The worst case DST, 241-SY-101, was successfully mitigated in 1994 with the insertion of a mixing pump. The pump is operated up to three times a week to mix the waste and release gases that accumulate in the waste (Babad et al. 1995). Hydrogen monitors have been installed on all 25 flammable gas tanks to monitor for background concentrations and potential releases over time.

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 to meet Tri-Party Agreement Milestone M-44-00 (Ecology et al. 1992). The concentration of chemical and radionuclide species of leaked or spilled materials will require future characterization. Characterization results for SSTs are entered into and are available in the integrated database. The regulators have access to this database.

3.3.2.3 Waste Designation and Basis. The waste in the SSTs is considered ignitable (because of the presence of nitrate), corrosive, reactive, 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). Other codes are also applicable (see Table 2-6). 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 categorize all tanks by safety designation within the next 3 years, with selected sampling and analysis of designated tanks.

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 136,600 cubic meters of solids including 25,800 cubic meters of interstitial liquid and supernatant. The volume of waste in each tank farm is shown in Figure 3-5 (WHC 1995). No waste has been added to the tanks since November 1980 or will be added in the future. (However, the reference approach for waste retrieval is sluicing, which requires the addition of water or supernate.)

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 as long as the safety class of the tank following liquid removal is acceptable. 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 7 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 of using the DST pretreatment and disposal facilities and that tank 241-C-106 will be the first to undergo retrieval. Closure options, which will identify the level of retrieval necessary, will be documented in a comprehensive tank waste remediation system supplemental environmental impact statement. The supplemental environmental impact statement is in the planning stages.

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

- Hazardous waste listings applicable to the waste must be identified, and the waste must be delisted in accordance with regulatory requirements
- The treated waste must not exhibit a hazardous waste characteristic (corrosivity, ignitability, reactivity, or TCLP toxicity)
- Treated waste must meet the other 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 173-303-100 and is prohibited by WAC 173-303-140.

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 the Hanford Site.

3.3.4.3 Accelerated Treatment. The SST waste treatment schedule is based primarily on Tri-Party Agreement Milestones M-41-00 (interim stabilization and M-45-00 (retrieval technology and closure). (Refer to Figure 2-1 for details.) Budget limitations make accelerating treatment beyond these milestone dates unrealistic.

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 water. Further efforts to reduce the potential for leakage include the transfer of waste materials from the SSTs to DSTs. During 1994, portions of tanks T-111, BX-110, BX-111, BY-102, BY-109, C-102, C-107, and C-110 were transferred to DSTs.

3.3.6 Variances, Exemptions, Time Extensions

The SST waste consists of radioactive waste mixed with dangerous waste constituents.

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.

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.

3.4 242-A EVAPORATOR PROCESS CONDENSATE

The 242-A Evaporator concentrates the low-level liquid waste that is stored in underground DSTs. The DSTs 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.

Before 1989, the process condensate was routed to retention basins, analyzed for radionuclides and ammonia, and discharged to a crib. In April 1989, process knowledge on listed waste management applicability became available and high concentrations of ammonia were detected in the process

condensate and discharge to the crib was discontinued. The 242-A Evaporator restarted in calendar year 1994. The process condensate is discharged to the LERF and ultimately will be treated for disposal at the 200 Areas Effluent Treatment Facility.

3.4.1 Generation

The 242-A Evaporator concentrates liquid LLW by evaporation. The 242-A Evaporator receives a mixture of waste from DST evaporator feed tanks. These tanks receive 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 filtered, condensed, and discharged to the LERF as process condensate. The remaining slurry is recirculated. When the slurry is sufficiently concentrated, it is pumped to underground storage in DSTs.

The 242-A Evaporator will generate up to 17 million liters of process condensate per campaign. Two campaigns were completed in 1994. In campaign 94-1, 11,700 cubic meters of process condensate were generated; in Campaign 94-2, 13,100 cubic meters of process condensate were generated. Two campaigns are scheduled through 1995; these are expected to fill the LERF to capacity. The 242-A Evaporator will then be shut down until the 200 Area Effluent Treatment Facility becomes operational.

3.4.2 Characterization

The process condensate is a liquid LLW consisting of the condensed vapor fraction from the evaporation process and raw water. The process condensate is designated a dangerous waste for the following reasons:

- Toxicity (WT02)
- Persistence (WP01, WP02) because of spent halogenated and nonhalogenated solvents, such as 1,1,1-trichlorethane, acetone, and methyl isobutyl ketone (hexone) (F001 through F005)
- The potential presence of cadmium and silver (D006, D011)
- The application of the derived-from rule from the DSTs.

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.

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 3-5 (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.

In addition, the process condensate is designated a State-only dangerous waste because of toxicity (WT02) caused by 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 173-303-100. The resulting equivalent concentration sum is 10 percent higher than the limit of 0.001 percent; therefore, the process condensate is a State toxic dangerous waste. The dominant contributor to the equivalent concentration sum is ammonia.

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 was modernized and restarted in 1994. The process condensate from the evaporator 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 6 to 12 months after start-up.

The LERF consists of surface impoundments that comply with interim status design and operating 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 to RCRA final status design and operating requirements.

A request was submitted to EPA in 1994 to approve LERF for use as a treatment facility. The treatment would consist of allowing the waste in LERF to mix for better process control when it is transferred to the Effluent Treatment Facility. In December, the EPA issued a letter stating that the treatment proposed was consistent with the treatment described in 40 CFR 268, Subpart A. This allows the continued use of LERF for treating and storing LDR waste. The Tri-Party Agreement milestones to discontinue process condensate discharge to LERF (M-26-03) and to remove residues from LERF (M-26-04) would no longer apply. These milestones have been extended to August 1995 via an approved Tri-Party Agreement change request until residue sampling and

cleanout issues have been resolved. Additional Tri-Party Agreement change requests may be submitted pending resolution of this issue.

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 described in the following steps.

1. Adjust the pH of the waste stream with sulfuric acid to a pH of about 6 within a 380-cubic meter surge tank using a recirculation pump and eductor.

2. Filter suspended particles using roughing filter.

3. Degrade organic compounds into carbon dioxide and water and destroy cyanides in an organic destruction unit using hydrogen peroxide and ultraviolet light.

4. Lower the pH of the waste stream to 4 by adding sulfuric acid. This adjustment ensures that 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. Adjusting the pH to 4 also converts carbonate and bicarbonate to carbon dioxide for removal by a degasser in Step 6.

5. Filter out residual particulates down to about 0.5 μm.

6. Remove the carbon dioxide generated in the previous steps using degasification.

7. Use reverse osmosis to remove dissolved aqueous salts (including metal ions, radionuclides, and ammonium sulfate), producing a secondary waste stream that will be further concentrated by evaporation in subsequent steps.

8. Treat the stream by ion exchange to remove residual dissolved aqueous salts not removed by reverse osmosis.

9. Neutralize the treated stream as necessary and send to verification tanks. A system of three verification tanks holds the treated effluent for sampling before discharge (current plans call for discharge to a state-approved land disposal structure). A recycle loop is provided in case verification analyses show that a rework is required to meet permit conditions.

10. Send secondary waste (primarily produced from the reverse osmosis step, regeneration wastes from the ion exchange step, and blow-down from the two filtration steps) to an evaporation process consisting of a mechanical vapor recompression evaporator and a thin-film dryer. Feed to the evaporation process will be routinely analyzed to determine the nature of the dry secondary waste product. If the

dried secondary waste product is a hazardous or dangerous waste, it will be sent to the 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 CWC.

The treatment unit will reduce each 85 cubic meters of process condensate to one 0.20-cubic-meter drum of solid waste; this is a waste reduction factor of 425. The amount of the reduction is based on information contained in the 200 Area Effluent Treatment Facility flow sheet.

3.4.6 Variances, Exemptions, Time Extensions

The 242-A Evaporator process condensate is a LLW mixed waste that is LDR because it is derived from DST wastes that received spent solvents.

The Tri-Party agreement allows LDR waste to be placed in the LERF basins until treatment and disposal based on the following schedule:

- Cessation of discharge of process condensate to the LERF by August 30, 1995.
- Removal of all hazardous waste residues from the LERF by August 30, 1995.

Although a Tri-Party Agreement change request has not yet been drafted, the current planning base is to delete these milestones and allow use of the LERF surface impoundments for treatment, in accordance with 40 CFR 268.4. Provisions to meet the regulation are currently being developed.

Process condensate generated is being discharged to and stored in the LERF until the Effluent Treatment Facility is constructed and operating. Also, a petition has been sent to the EPA asking to delist the 242-A Evaporator process condensate effluent from the 200 Areas Effluent Treatment Facility to allow land disposal of the treated effluent.

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 (completed August 1993). In 1994,

it was proposed to combine the three facilities into one unit and therefore combine the three Part B Permit Applications into one permit application, the *200 Area Liquid Waste Complex Permit Application*. The delisting petition for the 200 Areas Effluent Treatment Facility was submitted in October 1992 and released by the EPA for public comment on February 1, 1995.

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 remaining in storage is sodium derived from operations at other Hanford Site locations.

The waste stored in the 4843 Sodium Storage Facility currently is untreated. The nonradioactive material has been shipped for disposal while the FFTF-generated portion of the radioactive alkali metal has been shipped to the CWC for storage. This facility is scheduled for closure and a closure plan has been prepared. The remaining waste will be shipped 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 used liquid sodium in the primary coolant loop. One cubic meter of sodium and 0.5 cubic meter of structural and other equipment waste 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 waste production decreased because the FFTF procedures that permitted reuse of some of this material were modified. The FFTF facility has received a shutdown directive. This eliminates waste generated by 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 consisted of spill residue and retired equipment from liquid sodium processes at the FFTF. The 4843 Sodium Storage Facility no longer receives waste for storage.

3.5.2 Characterization

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

3.5.2.1 Process Knowledge. All material in the 4843 Sodium Storage Facility is solid 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 of waste 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. No other buildings are 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 roll-up doors in the east and west ends and through personnel doors in the southeast and northwest corners.

The 4843 Sodium Storage Facility is used to store radioactive alkali metal waste that was generated at the FFTF and other operations at the Hanford Site that use alkali metals. Radioactive alkali metal waste is stored in a cold trap, hot trap, heat exchanger, and two shielded stainless steel tanks. These items are further contained in U.S. Department of Transportation-approved metal shipping containers.

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 is 351 kilograms of radioactive alkali metal contained in three metal boxes with a combined internal volume of 13.8 cubic meters.

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 Milestone M-21-00 (Ecology et al. 1992). 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 scheduled for closure. The closure plan has been prepared and it is anticipated that closure will be completed in FY 1996.

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 was prepared and transmitted to Ecology in June 1991. In accordance with these plans, the nonradioactive alkali metal waste was sent off site to an approved facility for treatment and disposal while the radioactive alkali metal will be transported to the CWC for storage until appropriate treatment and disposal systems are available. A considered method for treatment involves converting 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).

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 stored at the 4843 Sodium Storage Facility is managed to ensure that the quantity and toxicity are minimized. No waste has been generated since 1993.

The 4843 Sodium Storage Facility has an operating procedure for the disposal of waste stored at the 4843 Sodium Storage Facility 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

If 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.

3.6 PUREX AMMONIA SCRUBBER WASTE

The ammonia scrubber waste was 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) extremely hazardous waste 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. On December 21, 1992, PUREX received notice to deactivate the plant. Therefore, no PUREX ammonia scrubber waste will be generated in the future.

3.6.1 Generation

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

In the past, the ammonia scrubber feed was boiled in a concentrator to separate the bulk of the water from the entrained fission products. The condensed water vapors were disposed of to a crib. The remaining ammonia scrubber waste was treated to comply with DST storage specifications and transferred to DSTs as shown in Figure 3-7.

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

Approximately 15 cubic meters of ammonia scrubber feed was generated per metric ton of uranium processed. The amount of ammonia scrubber waste generated by month for 1988 is shown in Figure 3-8. 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 percent of the ammonia present in the ammonia scrubber feed was removed by volatilization during waste concentration and was discarded into the ammonia offgas system or with the ammonia scrubber condensate waste stream.

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

- The ammonia scrubber feed produced before late 1987, most of which was evaporated, condensed, and discharged to cribs as ammonia scrubber discharge (Figure 3-7)
- 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.

The ammonia scrubber discharge was sampled randomly four times over 23 months during routine operation, once in 1985 and three times in 1987. The number of chemical analytes detected was 12, although not every analyte was detected at each sampling time. Table 3-6 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 3-7.

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 caused by ammonia for these streams is only a result of exceeding the 1-weight-percent limit for these few hours. The average concentration for ammonia in this waste is less than 0.1 M, as shown in Table 3-6.

Based on the chemicals added to the ammonia scrubber waste that was sent to DSTs and on sample analyses, the ammonia scrubber waste is 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 universal treatment standards reasonably expected to be present will be quantified. 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-meter tanks, of which 26 store nonaging waste. The total contents of the DSTs are addressed 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 Milestone M-21-00 (Ecology et al. 1992). 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.

3.6.6 Variances, Exemptions, Time Extensions

If 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.

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 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). The stream also 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 while its dangerous waste designation was reevaluated. 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 the concentration of the PUREX uranium/nitric acid product and recycle streams. This condensate contained trace quantities of nitric acid. Before 1987, the condensate was monitored for radioactivity and discharged to a crib. In 1987, the PUREX process condensate system was upgraded to include a potassium hydroxide neutralization system and a calcium carbonate neutralization bed to neutralize the traces of nitric acid in the PUREX process condensate before discharge to a second crib (Figure 3-9).

In 1989, while reevaluating the designation of the PUREX process condensate stream to ensure that no improperly designated waste was being

discharged to the environment, the PUREX process condensate waste stream was treated to meet tank storage specifications and to be transferred to the DSTs. Since March 1990, no PUREX process condensate has been generated.

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

3.7.2 Characterization

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

3.7.2.1 Process Knowledge. Before 1986, the traces of nitric acid that distilled over with the PUREX process condensate were not neutralized before discharging that stream to a crib. In 1987, a neutralization system was installed that included a pH polishing tank containing calcium carbonate (crushed limestone), and pH monitoring instrumentation (Figure 3-9) (WHC 1990g). Neutralization was accomplished by the controlled addition of potassium hydroxide to the PUREX process condensate.

3.7.2.2 Sample Analysis. During PUREX operations, PUREX process condensate was sampled as follows.

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

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

Before 1989, samples of the PUREX process condensate stream going to the crib were analyzed. The PUREX process condensate was randomly sampled 8 times over 24 months during routine operations, once in 1985, twice in 1986, and five times in 1987. The number of chemical constituents detected was 46, although not every constituent was detected in each sample. Table 3-8 summarizes the analytical results (WHC 1990g).

3.7.2.3 Waste Designation and Basis. Before 1987, the PUREX process condensate waste stream was occasionally corrosive (pH less than 2) because of the nitric acid present in the PUREX process condensate. Under these conditions, the occasionally corrosive stream would have been designated as a corrosive (D002). After the neutralization system was installed in 1987, the PUREX process condensate stream was nondangerous. During a reassessment of the designation of the PUREX process condensate waste stream to ensure that no discharge to the environment of improperly designated waste was occurring, the PUREX process condensate was rerouted to DSTs in early 1989. The PUREX process condensate waste stream sent to the DSTs was treated with sodium hydroxide (to adjust pH to above 12) and sodium nitrite (to control tank corrosivity). This treated waste was designated corrosive D002.

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

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

3.7.3 Storage

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

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

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

3.7.3.3 Storage Compliance Assessment. The previously generated PUREX process condensate is stored in the DSTs. The DSTs were reviewed for compliance with interim-status dangerous waste regulations in accordance with Tri-Party Agreement Milestone M-21-00 (Ecology et al. 1992). The results of the compliance assessment are provided in Section 3.1.3.3.

3.7.4 Treatment

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

3.7.5 Waste Reduction

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

3.7.6 Variances, Exemptions, Time Extensions

Previously generated PUREX process condensate waste was restricted from land disposal by the Third-Third promulgation (55 FR 22520). As a component of the DST contents, PUREX process condensate will be treated and disposed of in accordance with the plans for DST LLW discussed in Chapter 3.0, Section 3.1.6.

If 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.

3.8 HEXONE WASTE

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

3.8.1 Generation

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

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

3.8.2 Characterization

The hexone (methyl isobutyl ketone) waste is a dangerous liquid LLW. The dangerous waste codes for this material are F003 (hexone), WT02 (toxic dangerous waste), WC02 (carcinogenic), and D001 (ignitable). The result of a chemical analysis for each tank (before distillation, as well as the residual after distillation) is shown in Table 3-9.

After distillation, 63 cubic meters of pure hexone remained in two tank cars and 46 cubic meters of a mixture of hexone, kerosene, and small amounts of tributyl phosphate (less than 1 percent) remained in two other tank cars. Also in the latter two tank cars were 16 cubic meters of water stored with hexone (1 to 2 percent). Among the four cars was 0.71 curie of tritium. All of the distilled material was trucked to the Diversified Scientific Services, Inc. incinerator in Kingston, Tennessee and burned.

The distillation tars have a volume of 1.9 cubic meters and contain essentially all of the nonvolatile radionuclides. The tar has been analyzed and found to be non-TRU mixed waste.

3.8.3 Storage

The waste remaining in the two original storage tanks will be handled and disposed of as part of the tank closure process. The vessels containing distillation tars are in storage at the CWC.

3.8.4 Treatment

During 1990, the waste was treated by distillation to remove radionuclides to allow disposal of the bulk of the waste by incineration. The next treatment step was offsite incineration to destroy the hexone. This treatment was completed in May 1994. The last of the hexone was shipped off the Hanford Site in June 1992. A flow sheet summarizing the treatment and disposal of hexone waste is shown in Figure 3-10.

Distillation of the liquid waste produced three primary product streams: the "clean" distillate, the tar-like bottoms in the distillation vessel, and the offgases of the distillation. Tanks 276-S-141 and -142 still contain a liquid level of under 200 liters and approximately 1,000 liters of sludge each.

The tar-like bottoms will remain in the distillation vessels, which have been sealed until the tanks are addressed under the Tri-Party Agreement. The vessels are 0.9 meter in diameter and 1.9 meters long, with an approximate weight of 860 kilograms. The spent vessels are non-TRU and are stored at the CWC for further treatment by the WRAP Facility. Waste minimization was achieved by limiting the number of vessel changeouts.

The offgases were vented back through the underground tanks to maximize condensation (minimizing gaseous effluents and the amount of activated charcoal required for treatment) and treated by high-efficiency filtration and charcoal adsorption and filtration. The charcoal adsorbent becomes a mixed waste. Approximately 270 kilograms of charcoal (six 0.21-cubic-meter drums) were used during treatment. Two 0.21-cubic-meter drums currently filter the tank offgas.

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

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

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

3.8.5 Waste Reduction

Distillation has reduced the volume of mixed waste from 136 cubic meters of hexone waste to less than 1.9 cubic meters of tar-filled vessels and 1 cubic meter of charcoal adsorbent. Most of the equipment has been dismantled, packaged, and shipped to the CWC for storage before final treatment and disposal. Additional reduction information is located in Section 3.8.4. No true waste minimization efforts are in effect for hexone waste because it is no longer being generated.

3.8.6 Variances, Exemptions, Time Extensions

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

If 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.

3.9 183-H SOLAR EVAPORATION BASINS WASTE

The 183-H Solar Evaporation Basins are being closed under interim-status Tri-Party Agreement conditions, which used WAC 173-303 regulations.

The 183-H Solar Evaporation Basins are four concrete basins located in the 100-H Area. The 183-H Basins were constructed in 1949. Originally 16 flocculation and sedimentation basins were a part of the 183-H Filter Plant. The filter plant provided water treatment, filtering units, and reservoir capacity for the 100-H Reactor process water system. In the spring of 1974, after decontamination, demolition of the 183-H Filter Plant was initiated. The 183-H headhouse, 12 of the flocculation and sedimentation basins, the filter building, and the clearwell pump room were demolished to ground level and the underground portions were backfilled to ground level. The remaining four basins were used from 1973 to 1985 to store and treat liquid chemical waste from 300 Area fuel fabrication plants. The 183-H Basins reduced waste by natural solar evaporation.

The waste stored in the 183-H Basins has undergone solar evaporation. The waste precipitates and the residual liquids have been treated by solidification; sludges have been removed; everything has been packaged in lined 0.21-cubic-meter drums, and shipped to the CWC for storage and future processing at the WRAP facility. Waste consisting of debris and soils may be generated as a result of demolishing the unit for closure.

3.9.1 Generation

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

During the operating life of the 183-H Basins 9,623 cubic meters of routine waste were added to the basins. Table 3-10 presents the quantity of chemical constituents discharged to the basins.

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

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

3.9.2 Characterization

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

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

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

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

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

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

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

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

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

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

Before removing sludge from Basin 2, samples of the liquid and sludge phases were analyzed for chemical constituents. The major constituents in the

sludge were copper (13 percent), sodium ion (9.7 percent), and nitrate ion (13.5 percent). Moisture content in the sludge averaged 53 percent. Uranium was present in the sludge in concentrations up to 2,500 ppm.

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

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

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

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

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

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

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

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

- Basin 1 (solid): WT01 (fluoride ion concentration)
- Basin 2 (sludge): WT01 (fluoride ion concentration); D007 (TCLP chromium)

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

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

3.9.2.5 Schedule for Further Characterization. Confirmation sampling is planned for the basins and soil in calendar year 1995.

3.9.3 Storage

The majority of solid and liquid wastes in the 183-H Basins has been removed and is being stored in the CWC. Other waste to be generated during closure will be handled in an agreed-on manner following regulatory requirements. Small concentrations of arsenic and lead have been found in the soil. A TCLP analysis on the berm soil has been completed and results show below regulatory levels for lead and arsenic. Confirmation sampling will occur during closure activities.

It is DOE's intent to operate the CWC in compliance with all applicable federal and state requirements related to mixed waste storage. Further details on this facility are provided in Chapter 3.0, Section 3.13. The storage unit compliance status of the CWC is discussed in Section 3.13.3.3.

3.9.4 Treatment

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

All dangerous waste from the 183-H Basins will be retrieved for processing in the CWC's WRAP Module 2A facility, a multipurpose waste processing facility that is scheduled to start operation in 1996, or its commercial equivalent. The WRAP facility and plans for treatment are described in Section 3.13.4.2.

3.9.5 Waste Reduction

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

3.9.6 Variances, Exemptions, Time Extensions

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

The 183-H Basins waste consists of LLW containing dangerous waste constituents. The 183-H Basin waste is restricted from land disposal because it contains waste covered by the Third-Third Promulgation (55 FR 22520).

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

A variance will be required to allow alternative treatment of waste code U123 (formic acid), for which the required treatment is combustion. Currently, no incineration capacity is planned for mixed waste at the Hanford Site. In addition, if it can be shown that cyanides were not destroyed during the solar evaporation process, a variance for the cyanide waste codes may be required.

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.

3.10 PUREX STORAGE TUNNEL 1 WASTE (Lead)

The text describing this waste has been incorporated into Section 3.11.

3.11 PUREX STORAGE TUNNELS 1 AND 2 WASTE

The PUREX Storage Tunnels 1 and 2 contain 0.26 cubic meter of elemental lead. The PUREX Storage Tunnel 2 contains 0.17 cubic meter of silver (mostly as silver nitrate), 0.01 cubic meter of elemental mercury, 0.0015 cubic meter of cadmium, and 0.08 cubic meter of Fluorothene. The lead is in jumper counterweights and equipment weights, the silver is in discarded silver reactors, the mercury is sealed inside thermowells that are an integral part of the irradiated fuel dissolvers, the cadmium is present as elemental cadmium attached to equipment for neutron shielding, and the Fluorothene is found in Fluorothene columnar plates in canyon columns. As of January 27, 1995, 0.0035 cubic meter of chromium was added to PUREX Storage Tunnel 2. This addition is not included in the 1994 inventory shown in Tables 2-5 and 3-11. The chromium is a corrosion byproduct from a failed stainless steel process concentrator; the waste is designated TCLP toxic (D007) and toxic (WT01).

The elemental lead waste is TCLP toxic for lead (D008). The silver nitrate waste is classified as TCLP toxic for silver (D011), ignitable (D001) because nitrates are present, and toxic (WT01). The Fluorothene columnar

plates are classified by Ecology as toxic (WT02) and persistent (WP01) extremely hazardous waste because they are classified as halogenated hydrocarbons in accordance with WAC 173-303-090(6)(d) (RL 1990b).

3.11.1 Generation

Elemental lead waste is generated in the PUREX process as an integral part of equipment, such as process pipe jumpers, jumper alignment tools, and shielding equipment. Historically, elemental lead was used as weights, counterweights, and radiation shielding in the fabrication of process equipment used in the PUREX Plant; generally, the lead was encased in steel (carbon or stainless) to facilitate its attachment to process equipment. Counterweights are used to facilitate remote installation of in-cell process and service piping (jumpers). A jumper alignment tool may have contained as much as 680 kilograms of lead. This tool is used as a weight to pull down the free end of a jumper so the connecting parts align vertically and the connection can be made.

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

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

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

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

As of December 1994, three dissolvers have been discarded, one in 1971, a second in 1972, and a third in 1986. The first two dissolvers each contain 45 kilograms of elemental mercury; the third one contains 38 kilograms. All three dissolvers are stored on rail cars in PUREX Storage Tunnel 2 (RL 1990b).

Cadmium may be present in the PUREX Storage Tunnel 2 as elemental cadmium attached to equipment for neutron shielding. The presence of cadmium is determined on the basis of process knowledge and the design of equipment used during PUREX operation known to possibly contain cadmium metal.

Fluorothene is stored in the PUREX Storage Tunnel 2 as columnar plates. These perforated plates or trays were used in Column 10 to provide the desired mixing and flow characteristics for solvent extraction. The plates are 0.002 meter thick with 0.004-meter-diameter holes on 0.009-meter center-to-center triangular spacing giving 23 percent free perforated area. The plates are assembled in cartridges that, in most cases, were installed and removed by canyon crane.

Fluorothene (polytrifluoromonochloroethylene) is a thermoplastic material that retains its strength at high temperatures. It has been found to be impervious to the action of all inorganic agents except molten alkali metals. However, concentrated solutions of alkali will not attack the compound and organic solvents will not chemically react with the material.

Chromium is present in the PUREX Storage Tunnel 2 as a corrosion byproduct of the stainless steel from a failed process concentrator. This concentrator was evaluated for reuse in 1986 and was determined to be unacceptable because of incompatibilities and a potential short service life. The concentrator was inspected and found to contain silicate solids that contained high levels of chromium.

During PUREX shutdown, waste may be generated from plant maintenance activities.

3.11.2 Characterization

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

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

Characterization of the mercury waste relies on fabrication and installation specifications. The quantity of mercury present in each

dissolver is documented on the fabrication drawings. None of the mercury will evaporate because each thermowell is sealed.

The quantity of cadmium is estimated from the dimensions of the cadmium metal sheets attached to the equipment. The quantity of Fluorothene is estimated from the knowledge of the dimensions and design of the Fluorothene fabricated columnar plates. The quantity of chromium is estimated from knowledge of silicate solids that have high levels of chromium and are contained within the failed concentrator sampled during PUREX operation.

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

Sampling and chemical analysis is not performed on mercury associated with the dissolvers. The need for sample analyses will be evaluated during planning for closure of the PUREX Plant, including the storage tunnels. A PUREX preclosure work plan will be submitted to Ecology and the EPA about July 1996.

3.11.2.3 Waste Designation and Basis. Elemental lead exhibits the characteristic of toxicity as determined by the TCLP and is designated D008. The form of lead present could produce an extract greater that 500 milligrams per liter should it be exposed to a leachate. (At greater than 500 milligrams per liter, it is an extremely hazardous waste and WAC 173-303-140(4)(a) is invoked. However, because the bulk of the lead is encased in steel on rail cars that isolate the lead from other materials stored within the tunnel, the potential for exposure of lead to a leachate is considered to be negligible.

Silver salts exhibit the characteristics of toxicity as determined by the TCLP and are designated D011 as well as D001 because of their oxidizer characteristics. The form of silver present could produce an extract having greater than 500 milligrams of silver per liter should the salts be exposed to a leachate; therefore, the mixed waste is managed as extremely hazardous waste and is further designated as WT01. Although nitrate is an oxidizer and is designated D001 silver (ignitable), the dispersion of a nitrate salt on unglazed ceramic packing contained within a stainless steel vessel and isolated from other materials stored within the storage tunnel results in a probability for ignition to be considered negligible.

The designation of mercury waste is based on process knowledge and the fabrication and installation specifications. Elemental mercury exhibits the characteristic of toxicity as determined by the TCLP and is designated D009. The quantity of mercury present, if exposed to a leachate, could produce an extract greater than 20 milligrams per liter. This dictates that the mixed waste be managed as extremely hazardous waste and be further designated as toxic (WT01) (RL 1990b).

Cadmium exhibits the characteristics of toxicity as determined by the TCLP and is designated D006 and toxic (WT01). The form of cadmium present

could produce an extract greater than 100 milligrams per liter should it be exposed to a leachate.

Fluorothene exhibits the characteristic of toxicity as determined by Ecology and is designated at WT02. Fluorothene is classified as a halogenated hydrocarbon because of its molecular composition; therefore, it is classified as a persistent dangerous waste and is further designated as WP01 in accordance with WAC 173-303-909(6)(d).

Chromium exhibits the characteristics of toxicity as determined by the TCLP and is designated D007. If exposed to a leachate, the quantity of chromium present could produce an extract of greater than 500 milligrams per liter; therefore, the mixed waste is managed as carcinogenic, extremely hazardous waste (WC02) and toxic (WT01).

3.11.2.4 Uncertainty of Waste Designation. The designated waste codes for the PUREX tunnel waste are considered accurate.

3.11.2.5 Schedule for Further Characterization. No schedule for further characterization has been established. The need for additional waste characterization will be evaluated during planning for closing the PUREX Storage Tunnels.

3.11.3 Storage

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

3.11.3.1 Storage Unit Capacity. The PUREX Storage Tunnels are a mixed waste storage unit. The two tunnels are connected to the PUREX Plant and, combined, provide storage space for 48 rail cars. The PUREX Storage Tunnels provide long-term storage for process equipment removed from the PUREX Plant. Equipment transfers into the PUREX Storage Tunnels are made as needed. Radioactively contaminated equipment is loaded on rail cars and remotely transferred into the PUREX Storage Tunnels. Rail cars act as both transport and a storage platform for equipment placed in the tunnels.

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

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

Tunnel 2 (218-E-15) was an expansion project constructed in 1964. This tunnel is designed differently from and is considerably longer than Tunnel 1, providing storage space for 40 rail cars. Each rail car can hold 497 cubic meters of waste. To date, 19 rail cars containing 1,529 cubic meters of discarded equipment and associated waste have been placed in the tunnel,

filling 47.5 percent of the storage area. Sufficient storage capacity remains for all future waste projected to be generated. A more complete description of the PUREX Storage Tunnels may be found in *PUREX Storage Tunnels Dangerous Waste Permit Application*, Rev. 1 (RL 1990b).

3.11.3.2 Amount in Storage. As of December 31, 1994, 0.26 cubic meter of elemental lead is stored in PUREX Storage Tunnels 1 and 2. PUREX Storage Tunnel 2 currently holds 0.17 cubic meter of silver nitrate, 0.01 cubic meter of elemental mercury, 0.0015 cubic meter of cadmium, and 0.08 cubic meter of Fluorothene. The estimated volume of equipment associated with the elemental lead, silver nitrate, cadmium, and Fluorothene is approximately 10 cubic meters, 15 cubic meters, 2 cubic meters, and 0.085 cubic meter, respectively (RL 1990b). As of January 27, 1995, 0.0035 cubic meter of chromium was added to PUREX Storage Tunnel 2. This addition is not included in the 1994 inventory shown in Tables 2-5 and 3-11. The chromium is a corrosion byproduct from a failed stainless steel process concentrator; the waste is designated TCLP toxic (D007) and toxic (WT01).

The amounts of these types of waste in the storage tunnels are given in Table 3-11. The estimated amount of lead listed in the table accounts for only the lead in alignment tool and jumper counterweights. Counterweights on equipment dunnage and lead used for shielding cannot be quantified from existing historical records and are not included in the estimated lead in storage. The amount of silver salts listed in Table 3-11 is a function of time of reactor use, regeneration history, and the impurities in the process chemical that may have been reacted with the silver nitrate. Sample analyses have not been conducted to verify that the predicted quantities are present. The estimated amount of metallic cadmium accounts for the cadmium metal sheets attached to equipment. The estimated amount of Fluorothene columnar plates accounts for the 81 plates in a column cartridge from Column 10.

3.11.4 Treatment

3.11.4.1 Planned Treatment. Planned treatment of the elemental lead and mercury, and the silver salts associated with the process equipment stored in the 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 and 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. No planned treatment has been developed for the cadmium, Fluorothene, and chromium associated with the process equipment stored in the tunnels. The EPA-required treatment for elemental mercury is amalgamation. Therefore, the treatment of choice is the current approach of adding zinc powder to create an amalgam. An alternative treatment being considered is to mineralize the elemental mercury (creating elemental mercury sulfide).

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

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 the completion of the Sitewide Land Use Plan, the Sitewide Decontamination and Decommissioning Priority Schedule, the Environmental Impact Statement, and public comments. A basis for the treatment plan for the wastes associated with PUREX storage will be developed after all of these items are complete.

3.11.5 Waste Reduction

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

The silver, elemental lead, elemental mercury, cadmium, Fluorothene, and chromium 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

This waste was placed in the PUREX storage tunnels before November 1987 and is, therefore, not subject to LDRs until it is removed from the tunnels. Removal is planned as part of the PUREX Plant closure. At that time the 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.

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. Also, waste cadmium storage was added to the canyon deck on this date.

Segregation of lead in this way began in December 1987. The current inventory (as of December 31, 1994) is approximately 0.284 cubic meter (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 meter, approximately 0.25 cubic meter also contains 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 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 that will be generated during deactivation will be added to the LDR report when quantified.

3.12.2 Characterization

This section discusses the waste characterization and its basis. 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 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 is 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 rail car into the PUREX Storage Tunnels. The remaining non-lead-containing 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.

3.12.3.2 Amount in Storage. The combined quantity of lead and cadmium waste in storage is 0.31 cubic meter (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 Milestone M-21-00 (Ecology et al. 1992). 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. Milestone M-20-24A reestablishes M-20-24 to prepare a PUREX preclosure work plan by July 1996.

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 and nondangerous materials such as carbon or stainless steel were substituted. On December 21, 1992, RL directed deactivation of the PUREX Plant. The PUREX containment building is used to store discarded process equipment as permitted in the PUREX Plant Part A Permit.

As of January 27, 1995, a burial box storing discarded equipment containing lead was transferred from the PUREX containment building to PUREX Storage Tunnel 2. This transfer was conducted to allow fuel removal from the canyon floor. This equipment is not included in the 1994 inventory. Revisions to the PUREX Plant Part A Permit allow for additional storage activities associated with PUREX Plant transition efforts. Additional transfers within the PUREX containment building are not anticipated.

3.12.6 Variances, Exemptions, Time Extensions

Removal of the mixed waste remaining 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, 1994, approximately 6,597 cubic meters of mixed LLW subject to LDRs and 221 cubic meters of TRU mixed waste subject to LDRs. (TRU mixed waste would not be subject to LDRs if sent to a no-migration facility such as the WIPP.) 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). As of December 31, 1994, 191.4 cubic meters of PCB-contaminated LLW and 78.4 cubic meters of PCB-contaminated TRU waste are in storage.

An internal assessment completed in July 1992 identified container mismanagement 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 accumulation time. To correct these 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 (1993e).

During the completion of the first phase, Ecology issued a fine and compliance order against 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, 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 manner similar to the requirements of RL 1993a and should be completed this year.

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 (1993e). 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 3-12. 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 land disposal restricted mixed waste and the general type of waste they generate are discussed below.

In the past, the PUREX Plant, located in the 200 East Area, was used to process irradiated nuclear fuel from N Reactor. The PUREX process used 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, converted uranyl nitrate solution generated from the reprocessing of N Reactor fuel to uranium oxide solids that were shipped off site for reuse. The plant is currently shut down awaiting decontamination and decommissioning. 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.

B Plant, located in the 200 East Area, was used to separate cesium and strontium from waste streams to be sent to SSTs and DSTs from PUREX. 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 as needed because of plant maintenance and upgrading.

T Plant, located in the 200 West Area, is used to decontaminate failed equipment to facilitate its repair, reuse, or disposal. 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 generate several mixed LLW streams. These operations have been shut down since December 1986, and the only waste generated is from decontaminating and closing these operations. The waste has been transferred to the CWC, or off site 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.

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 (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 indicate that 191.4 cubic meters of PCB-contaminated LLW and 78.4 cubic meters of PCB-contaminated TRU waste were generated between 1970 and December 1994.

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 any waste is accepted at the CWC, it is characterized and packaged as described in *Hanford Site Solid Waste Acceptance Criteria* (WHC 1993e). 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; waste is 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 a 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 1993e), 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

of the waste, additional characterization needs to be performed to determine proper treatment and disposal options. This characterization will be performed during processing at one of the WRAP facilities. 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-- Twenty-three modules are operational to store flammable LLW, TRU waste, mixed LLW, and TRU-mixed waste with flash points 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. These facilities can store PCB wastes.

- 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 836 square meters 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 an 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 17,908 cubic meters. This capacity includes 1996 construction and is adequate to store the current projected volumes of mixed waste to be generated through the year 1996, 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. Currently, three additional storage buildings are planned to be finished in 1996.

3.13.3.2 Amount in Storage. The amount of dangerous waste restricted from land disposal stored at the CWC as of December 1994 is 6,818 cubic meters. This includes 2,627 cubic meters of waste from the 183-H Solar Evaporation Basins (see Section 3.9).

As of December 1994, 78.4 cubic meters of PCB TRU waste have been placed in the CWC for storage. Existing storage capacity is judged to be adequate for any future generation.

As of December 1994, 191.4 cubic meters of PCB LLW have 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.

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 facilities. 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 one of the WRAP facilities. The WRAP facilities will be constructed in modules, with Module 1 operational in 1997 and Module 2A or the proposed commercial treatment alternative 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. Module 1 will also provide for decontamination of small items, primarily drums and overpacks. Most mixed LLW will be characterized and repackaged pending processing in Module 2A.

Module 2A or its proposed commercial replacement 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 a RCRA trench.

Module 2B, if authorized by the M-33 milestone, 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 or commercial equivalents 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 facilities for mixed waste.

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 processes 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 in a transfer drum, and transferred to the restricted waste management 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 drum. Collected liquids will be transferred to the restricted waste management gloveboxes.

In the restricted waste management 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 waste management 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.

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.

The WRAP Facility, Module 2A, or its commercial replacement 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. All waste containers will be accompanied by paperwork attesting to the physical, chemical, and radiological contents.

Alternatives that were studied for WRAP, Module 2A, but are 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).

During FY 1995, privatized thermal treatment will be given 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. 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 for alpha-contaminated wastes not amenable to commercial treatment.

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. This is consistent with the recommendation of the Options Analysis Team, a task team under the FFCAct. 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 alternative currently favored 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 1995. 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.

3.13.4.4 Accelerated Treatment. RL is pursuing alternative treatment requirements through the direct disposal team to minimize and thereby accelerate treatment.

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 solvents (40 CFR 268.30) and waste identified by the Third-Third LDRs (55 FR 22520).

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 initiate 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). RL has requested that the regulators replace this with the use of commercial facilities.

If 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.

A treatment waiver is being prepared for formic acid in 183-H waste. The waiver, if approved, would allow for less costly stabilization treatment of the waste. Currently, the only acceptable treatment is incineration. However, the formic acid concentration is very low compared to other constituents.

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. 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 off site 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 placed 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.

As of March 1995, 44 reactor compartments were stored awaiting disposal. Additional reactor compartments will be shipped to the Hanford Site in the future.

A pilot project to retrieve 138 drums from retrievable storage was stared in 1994. To date, 171 drums have been retrieved, inspected in place, or stored at the CWC. Data on the integrity of the drums currently are being studied.

3.14.1 Generation

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

3.14.2 Characterization

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

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

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

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

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

3.14.2.4 Uncertainty of Waste Designation. There is high confidence in the accuracy of the designations for newly generated TRU waste material. Older waste will require additional characterization before treatment and disposal.

3.14.2.5 Schedule for Further Characterization. In situ sampling of retrievably stored TRU waste was initiated in FY 1991 (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.

The TRU pilot retrieval and inspection program conducted in 1994 laid out a three-step approach to gather and provide data on the retrievably stored TRU waste at the Hanford Site for the WRAP facilities and the DOE complex. The first step evaluated existing TRU waste records to assess completeness of waste characterization data. The existing written data lacked detail and little physical data were available to support a full-scale retrieval program. Therefore, the second step was undertaken to physically retrieve and inspect stored TRU wastes, while a third step would fully characterize the retrieved waste.

Locations for retrieval and inspection were chosen based on waste storage configurations, waste generator records, radioisotope distribution, radiation dose, age of waste, and several other parameters. Inspection equipment was developed to ultrasonically inspect TRU waste drum integrity. Retrieval equipment was developed to lift the unearthed drum from the storage trench, vent the drum, and sample the drum gas for analysis. The entire program would evaluate TRU waste storage at several different trench locations and provide the needed retrieval, inspection, and characterization data to the WRAP project and other DOE sites.

Retrieval and inspection of TRU waste drums at the first two sites is complete. Twenty-three TRU drums that were placed in underground storage between 1977 and 1980 were retrieved for characterization and examination. The retrieved drums have been radiographed to compare contents against waste records. Radioassay of the drums was also conducted and yielded a $\pm$50-percent assay accuracy (total plutonium) when compared to the original assay records. Drum head-gas sampling was conducted on 10 vented drums after an 8-day collection period. Elevated total volatile organic (VOC) readings were found in each sample ranging from 84 to 517 ppm. When tests were conducted to determine the composition of the organic compounds more than 23 compounds were revealed. It appears that the individual compounds are not above the reportable limits in WAC 173-303. This determination is based only on the head-gas sample. When the containers are opened and the soil is sampled, the results may be different. Lower explosive limits were also much higher than anticipated for vented drums, ranging from 14 to 58 percent.

Ninety drums were ultrasonically inspected by taking almost 1,700 separate ultrasonic readings. Drums also were examined in situ using an remote viewing camera. In all, 171 drums were examined between the two sites. Three drums contained areas of concern and were overpacked and left in the trench. One drum had two small holes in the side. The area was patched and the drum was stabilized and left in the module in accordance with safety documents and procedures. In addition, ground-penetrating radar was used to locate underground drums in all 19 sites identified for retrieval, and its accuracy was evaluated in the two sites entered. The retrieval and inspection of stored TRU drums was terminated as inclement weather set in.

Additional sampling will be performed as necessary to adequately characterize suspected mixed waste when waste packages are retrieved and processed through the WRAP 1 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 (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 1 (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 this waste 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 percent or 2,184 cubic meters are known to be dangerous waste based on information contained in the Solid Waste Information and Tracking System. Additional waste may be redesignated as dangerous, land disposal restricted waste on retrieval.

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 routinely was placed 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. After the waste has been processed to remove the hazardous constituent to LDR levels, mixed LLW will be placed in lined trenches with leachate collection and removal systems. The TRU mixed waste eventually will be retrieved, treated to comply with any LDR requirements at the WRAP Facility or other appropriate treatment unit, and disposed of at a permitted dangerous waste disposal unit. If sent to the WIPP site, LDR treatment will not be required (see 40 CFR 268.6).

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 should be installed around the low-level burial grounds, which include the retrievable storage units.

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 then-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, Module 1. The WRAP Facility, Module 2, or its proposed commercial equivalent will treat mixed 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 was proposed to be constructed as three modules with Module 1 operations to begin in March 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. RL has requested that WRAP Module 2A be privatized.

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 may be restricted from land disposal because it contains spent solvent waste if process knowledge identifies the spent solvent listing as applicable when the waste is retrieved. In addition, California List waste, characteristic waste, or state-only criteria waste designations may cause additional disposal restrictions.

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 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.

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 collecting 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 small quantities of TRU mixed waste. Included in this mixed 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 (such as 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 moratorium 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.

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 1993e). 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, panel boards, 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).

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.

3.15.3.2 Amount in Storage. As of December 31, 1994, 65 cubic meters of TRU mixed waste are 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 that 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. LDR treatment is not expected to be required because of the WIPP no-migration petition. This petition has not yet been approved. 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 regularly. Key elements of this program are described in Section 2.5.

3.15.6 Variances, Exemptions, Time Extensions

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. These are not expected because of the no-migration petition for the WIPP site.

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. All mixed waste from 303-K has been shipped to the CWC (see Section 3.13).

3.16.1 Generation

This section describes the past waste generation process. The 303-K Facility operated from 1943 to 1994.

The 303-K Facility was used between January 1986 and 1994 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.

3.16.2 Treatment

The degreasing solvents, uranium-contaminated lead, and filter press and sludge wastes previously stored at the 303-K Facility have been 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 were concreted (treated to deactivate characteristics) in CY 1994 in the 304 Building for burial at the low-level burial ground as low-level waste. There were 73 concreted drums. Of these, 51 have been buried in the 200 West Area and 22 await analysis at PNL.

3.17 324 RADIOCHEMICAL ENGINEERING CELLS WASTE

The 324 REC is located in the 324 Building in the 300 Area of the Hanford Site. It consists of four hot cells (A, B, C, and D) located around a central airlock.

The 324 Building has been used in numerous DOE-sponsored research and development programs since the mid-1960s. The major activities that have influenced the generation of mixed waste include:

- The Waste Solidification Engineering Prototypes Program (completed 1972)
- The development of treatment technologies via the Nuclear Waste Vitrification Project for wastes from Spent Nuclear Fuel reprocessing (1979)
- A pilot-scale Radioactive Liquid-Fed Ceramic Melter testing program in conjunction with the Federal Republic of Germany (1984-1987).

3.17.1 Generation

This section describes how the waste in the 324 REC was generated. Most of the materials now in the REC accumulated during research activities from 1965 to 1987. Over the 20+ years of these engineering demonstrations, equipment (such as tools, manipulator boots, and construction materials) were

dropped and liquids (such as feed materials and samples) leaked onto the floor. In addition, particulate materials (essentially dust) introduced with normal air flow into the cell became contaminated.

Operational protocols in the REC were based on the radioactive properties of these materials. These materials were secured within the cell and did not interfere unduly with engineering operations. Because of technical difficulties, funding constraints, and safety issues associated with consolidating and/or retrieving, packaging, and/or transporting the waste materials, they were left in place.

Cleanout of the hot cells to eliminate the unacceptable radiological hazards associated with the dispersible material in the B Cell began in 1988 with completion estimated by 2000.

No further generation of waste, other than used HEPA filters, is anticipated. Current waste types contained within the REC and their estimated volumes are provided below. The last two waste types have *not been confirmed as mixed waste*.

- Approximately 2.5 cubic meters of tools, equipment, and pieces of metal dropped on the floor during operations; dust and particulates contaminated with sporadically released material (feed solution that contained heavy metals) from process equipment.
- Approximately 0.17 cubic meter of dried out and containerized feed solution from the Radioactive Liquid-Fed Ceramic Melter testing program.
- An estimated <0.2 cubic meter of liquid metal alloy (believed to be bismuth-tin-lead-cadmium) used to seal the interface between the melter and the canister turntables that received the glass.
- An estimated <0.2 cubic meter of mineral oil that leaked out of a broken B-Cell viewing window and was absorbed with a clay-based absorbent.
- Approximately 1.02 cubic meters of waste elemental lead, used as shielding and counterbalances. Some of this may eventually be cleaned and reused or recycled during the cleanout of the hot cells.
- An estimated <0.2 cubic meter of rags contaminated with 1,1,1 Trichloroethane. The solvent is used to decontaminate equipment parts in the REC support areas outside the hot cells.
- Approximately 0.28 cubic meter of refractory brick. Although the brick consists of a chrome oxide spinel, it is not expected to be mixed waste. Section 3.17.2.4 covers this in greater detail.
- Approximately 5.0 cubic meters of used HEPA filter media. Testing is required before this waste can be confirmed as mixed waste. Section 3.17.2.4 covers this in greater detail.

3.17.2 Characterization

This section discusses the best available waste characterization information.

3.17.2.1 Process Knowledge. Based on process knowledge, none of the designated mixed waste in the REC is currently classified under RCRA as "listed" hazardous waste, except for a small amount of rags contaminated with 1,1,1, Trichloroethane. The waste types characterized solely on the basis of process knowledge are as follows.

- Dried melter feed (0.17 cubic meter)--D007, D008, WT01
- Liquid metal alloy seal (<0.2 cubic meter)--D006, D008, WT01
- Oil-contaminated absorption media (<0.2 cubic meter)--WT02
- Waste elemental lead (0.80 cubic meter)--D008, WT01
- Rags contaminated with cleaning solvent (<0.2 cubic meter)--F002, WP02, WT02 (This is the only listed waste.).

3.17.2.2 Sample Analyses. In 1993, results of laboratory analyses of some waste became available. The following waste types are characterized on the basis of process knowledge supported by analytical data when available.

- Dispersible debris (2.5 cubic meter of tools, equipment, metal pieces, dust, and particulates)--D006, D007, D008, D010, D011, WT02

3.17.2.3 Waste Designation and Basis. The basis for the designation of the 324 REC waste is process knowledge, supported by analytical data when available.

3.17.2.4 Uncertainty of Waste Designation. The following waste types have not been designated as mixed waste, but do have the potential to be designated as such. The designation of all other waste types in the REC is considered accurate.

- Refractory brick (0.28 cubic meter)--The brick consists of a chrome oxide spinel that, under normal melter conditions, does not permit the chrome to leach in a TCLP test because the chrome is maintained in a nonleachable matrix. However, it is unknown if high radioactivity might cause the chrome to become leachable. Testing is required before this waste can be excluded as mixed waste (possibly D007).

- Used HEPA filter media (5.0 cubic meters)--Since 1991, an electrostatic precipitator system prefilters air before it passes through HEPA filters, which may result in subsequently generated HEPA filters being non-RCRA waste. Testing is required before this waste can be excluded as mixed waste (possibly D007, D008).

3.17.2.5 Schedule for Further Characterization. At this time, a mixed waste analysis plan for the REC is being prepared. Analysis on the refractory brick and used HEPA filters is expected to be completed by May 1995. At this time, the designation of the waste will be completed.

3.17.3 Storage

The 324 REC does not receive any waste from other sources. It only stores waste that was generated from the operations conducted within the REC itself. The volumes currently in storage are provided in Section 3.17.1.

3.17.3.1 Storage Unit and Capacity. The 324 REC is located in the 324 Building and consists for four hot cells (A, B, C, and D) located around a central airlock. The 324 Building was constructed to strict nuclear standards to safely house operations involving highly radioactive materials and to prevent releases to the environment.

The capacity for mixed waste storage of the hot cell section available for mixed-waste storage is estimated to be 15 cubic meters. This estimate is based on the current inventory in storage (9.17 cubic meters) and the consideration that no future significant generation of waste at this facility is anticipated.

3.17.3.2 Amount in Storage. A detailed explanation of the volumes currently in storage is provided in Section 3.17.1.

3.17.3.3 Storage Compliance Assessment. The high radioactivity field in most of the 324 REC precludes manned entry into the cells. As a result, certain Ecology requirements (e.g., use of written labels, physical inspection, closure by removing all wastes to background levels) are not practicable. In an effort to bring the 324 REC into compliance, negotiations with Ecology and the EPA took place as part of the 1994 Tri-Party Agreement negotiations sessions. As a result, a new milestone (M-89) has been proposed. Milestone M-89 includes both interim and final action to complete the closure of the 324 REC. (Refer to Table 1-2 for a list of proposed milestones.)

3.17.4 Treatment

Currently stored waste in the 324 REC unit is not being treated. Negotiations are currently under way with Ecology to develop an approved approach for treatment of some of the stored waste. A new milestone has been proposed that will require the submittal of a clean closure feasibility study by December 31, 1995. Additional treatment options may be addressed in the study.

3.17.4.1 Current Treatment. Currently stored waste in the 324 REC unit is not being treated.

3.17.4.2 Proposed Treatment. Negotiations are under way with Ecology to develop an approved treatment program.

3.17.4.3 Treatment Alternatives and Accelerated Treatment. Proposed Milestone M-89-02 provides for removal of all REC B-Cell mixed waste and equipment by May 31, 1999.

3.17.5 Waste Reduction

Waste reduction will be addressed as part of the ongoing treatment negotiations.

3.17.6 Variances, Exemptions, Time Extensions

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.

3.18 324 HIGH-LEVEL VAULT TANK WASTE

The 324 HLV is located in the 324 Building in the 300 Area of the Hanford Site. It consists of four tanks inside a shielded vault. The vault is lined with stainless steel and is equipped for leak detection. Only three tanks (TK-104, TK-105, and TK-107) contain mixed waste that was generated from materials left over from research operations.

3.18.1 Generation

The mixed waste in the 324 HLV was generated when process solutions remaining in the tanks from research operations were no longer needed. No further generation of mixed waste is expected. Current waste types and their volumes are as follows:

- Approximately 3.02 cubic meters of dilute nitrate solution contained in TK-104 and TK-105. The tanks contain high levels of cesium-137 and strontium-90. They contain of residual solutions used to demonstrate vitrification technology.

- Approximately 0.62 cubic meter of nitrate solution contained in TK-107. The tank contains high levels of cesium-137 and strontium-90. It also contains various other isotopes including plutonium-239/240 and plutonium-238. The solution remains from the demonstration of vitrification technology.

3.18.2 Characterization

This section covers the best available waste characterization information.

3.18.2.1 Sample Analysis. The 324 HLV waste was designated based on analytical testing results from 1990. The characterization information is as follows:

- Dilute nitrate solution contained in TK-104 and TK-105 (3.02 cubic meters)--D002, D008, WT02.

- Nitrate solution contained in TK-107 (0.62 cubic meter)--D002, D007, WT02.

3.18.2.2 Uncertainty of Waste Designation. The designations of the 324 HLV waste are considered accurate.

3.18.3 Storage

The 324 HLV does not receive any waste from other sources. It only stores waste that was generated from operations conducted in the HLV itself.

3.18.3.1 Storage Unit and Capacity. The 324 HLV is located in the 324 Building and consists of four tanks; only three are used for storing mixed waste (TK-104, TK-105, and TK-107). The total capacity of the three tanks is 36.6 cubic meters.

3.18.3.2 Amount in Storage. A detailed explanation of the volumes currently in storage is provided in Section 3.18.1.

3.18.3.3 Storage Compliance Assessment. The high radioactivity field in most of the 324 HLV precludes manned entry into the vault. Therefore, certain Ecology requirements (e.g., use of written labels, physical inspection, closure by removing all wastes to background levels) are not practicable. In an effort to bring the 324 HLV into compliance, negotiations with Ecology and the EPA took place as part of the 1994 Tri-Party Agreement negotiation sessions. As a result, a new milestone (M-89) has been proposed that includes both interim and final action to complete the closure of the 324 HLV. (Refer to Table 1-2 for a list of proposed milestones.)

3.18.4 Treatment

Waste stored in the 324 HLV Unit is not currently being treated. Negotiations with Ecology are under way to develop an approved approach for treating the stored waste. A new milestone (M-20-52) has been proposed that would require the submittal of a clean closure feasibility study by December 31, 1995. Additional treatment options may be addressed in the study.

3.18.4.1 Current Treatment. Waste stored in the 324 HLV is not currently being treated.

3.18.4.2 Proposed Treatment. Negotiations are under way with Ecology to develop an approved treatment program.

3.18.4.3 Treatment Alternatives and Accelerated Treatment. Proposed Milestone M-89-01 provides for the treatment of the mixed waste to reduce its hazards and for the removal of the waste from the HLV by October 31, 1996.

3.18.5 Waste Reduction

Waste reduction will be addressed as part of the ongoing treatment negotiations.

3.18.6 Variances, Exemptions, and Time Extensions

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.

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

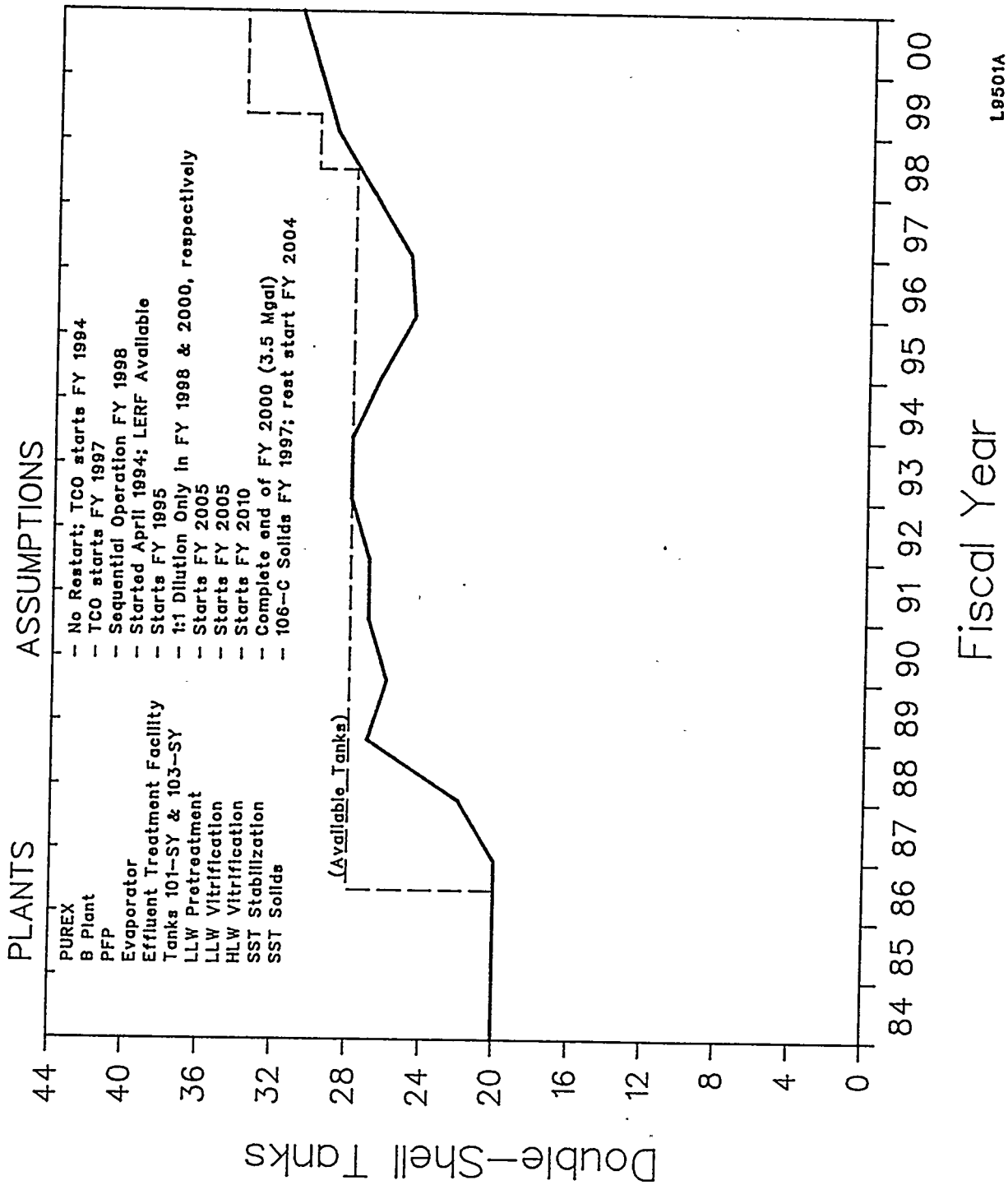


Figure 3-2. Waste Pretreatment Simplified Process Flow Diagram.

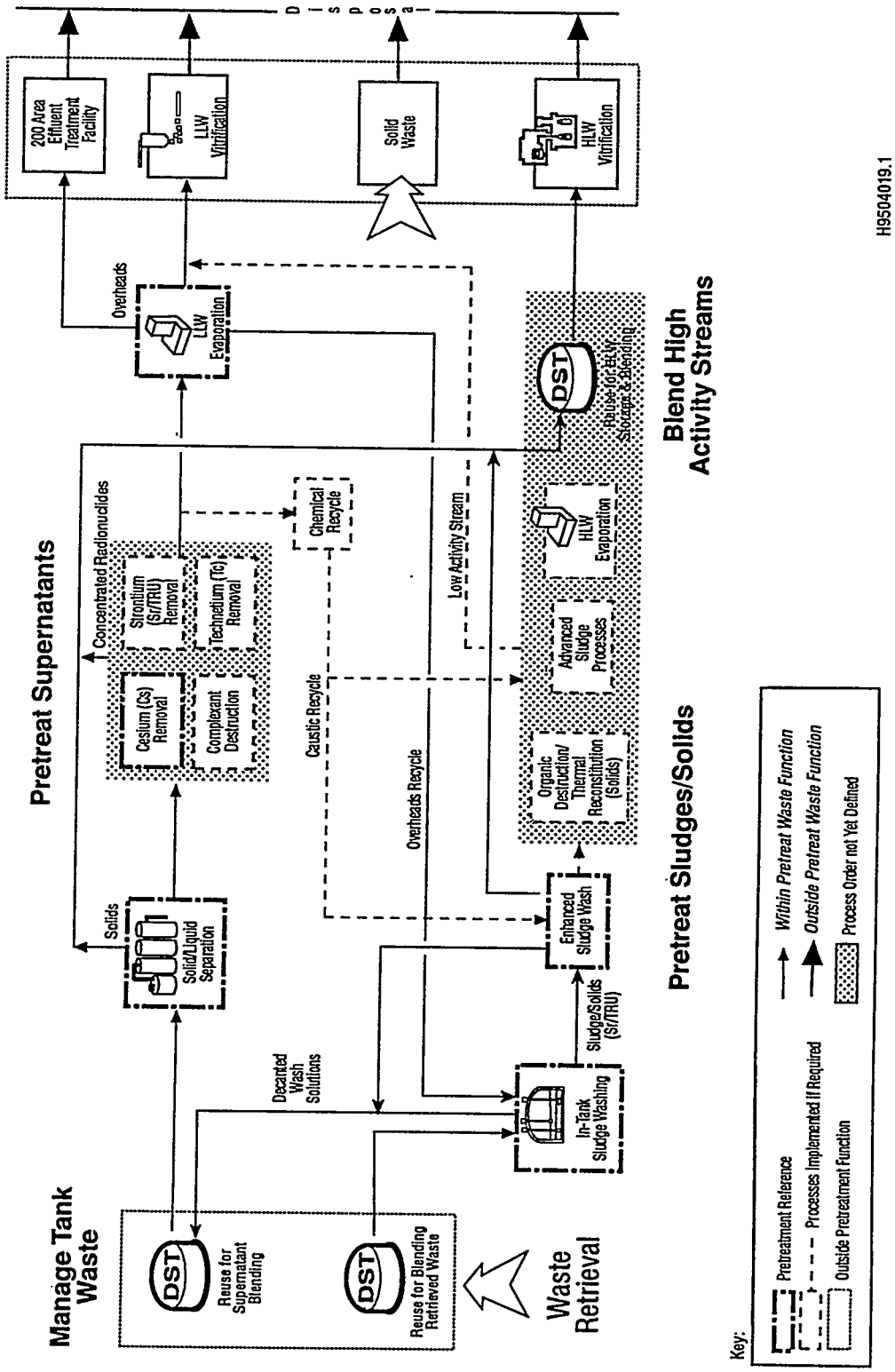


Figure 3-3. PUREX Aging Waste Transfers to Aging Waste Storage.

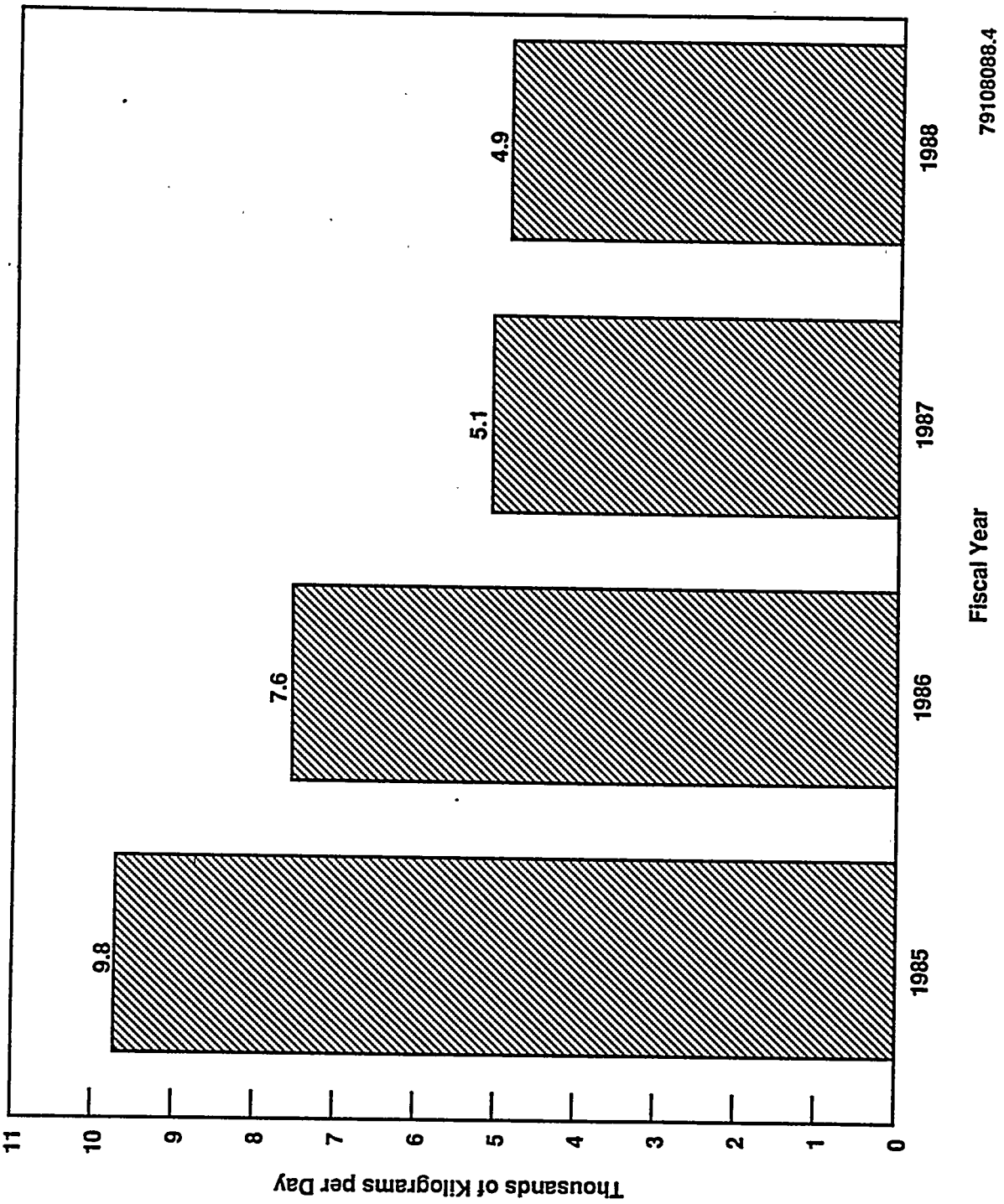


Figure 3-4. Relative Proportions of Supernatant, Sludge, and Salt Cake in Single-Shell Waste.

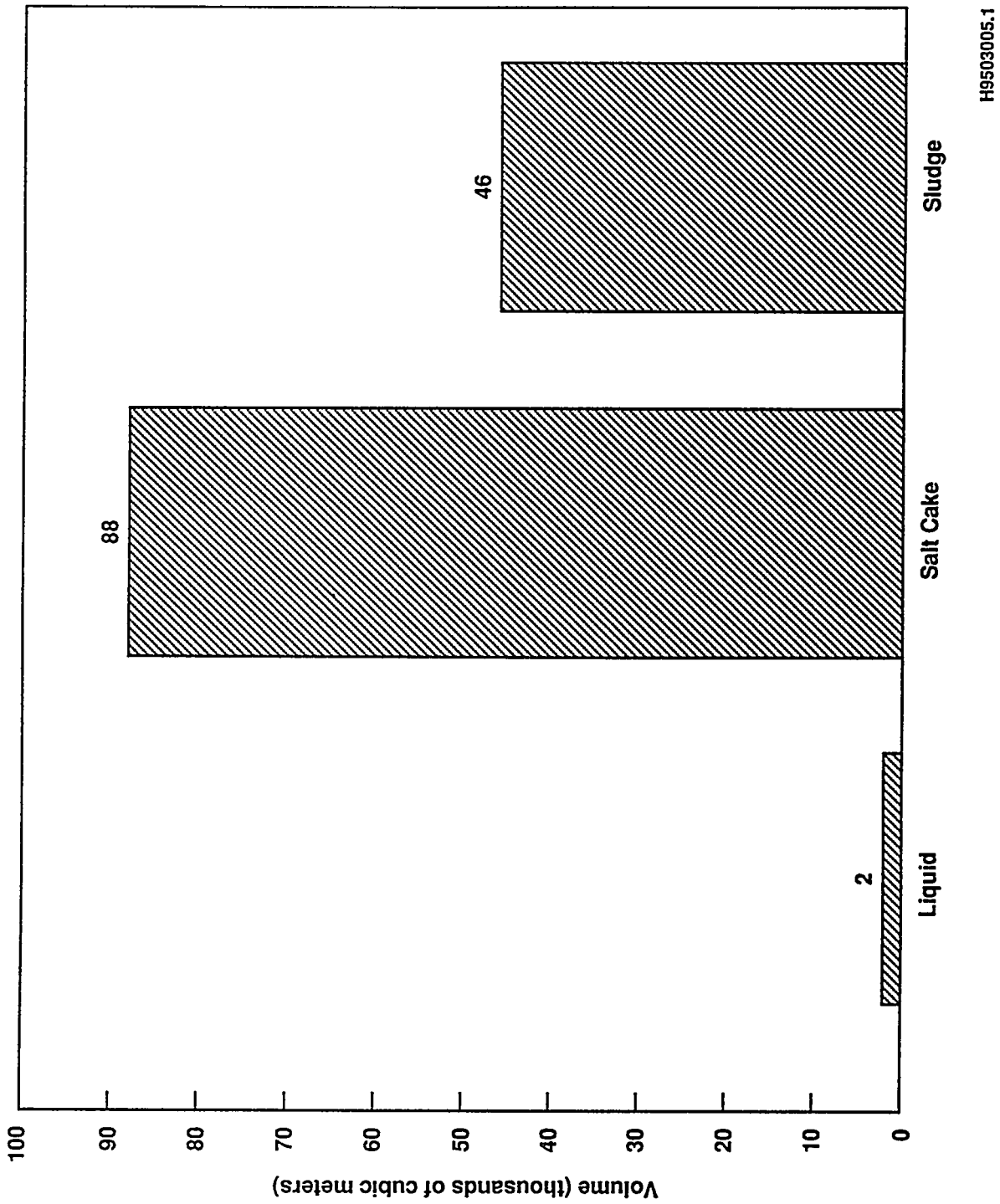


Figure 3-5. Single-Shell Tank Waste Inventory by Tank Farm.

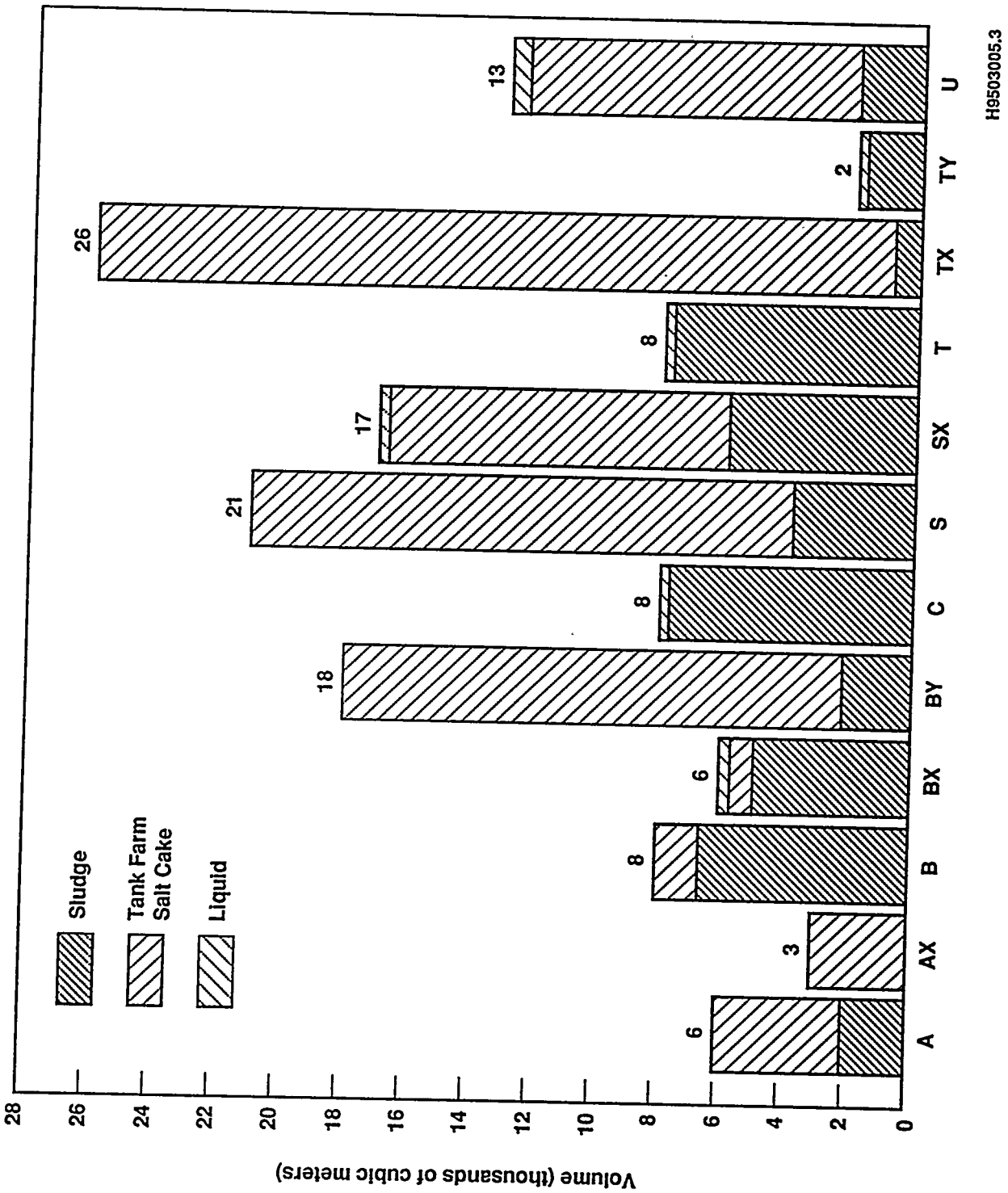


Figure 3-6. Process Flow Diagram for 242-A Evaporator.

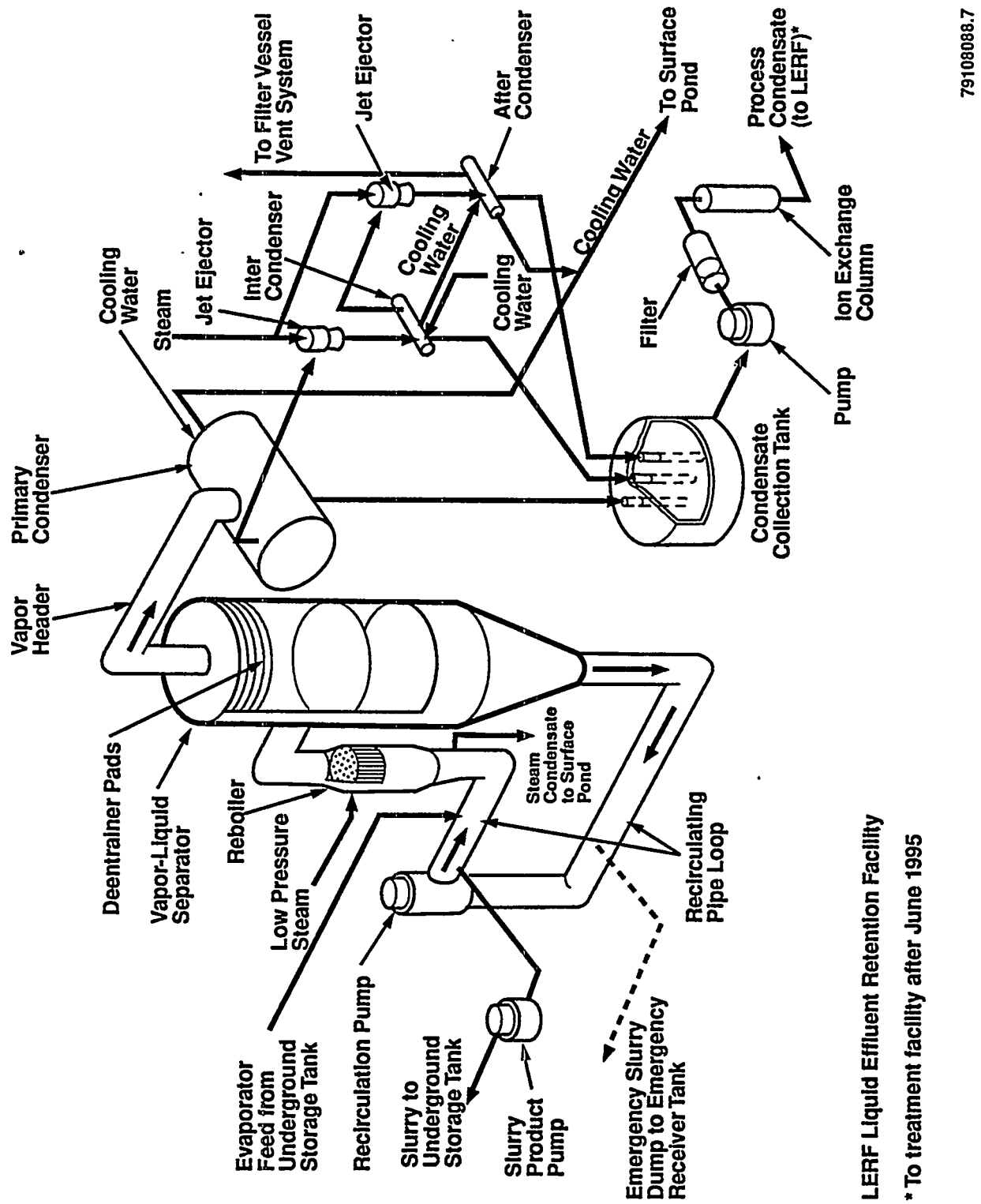
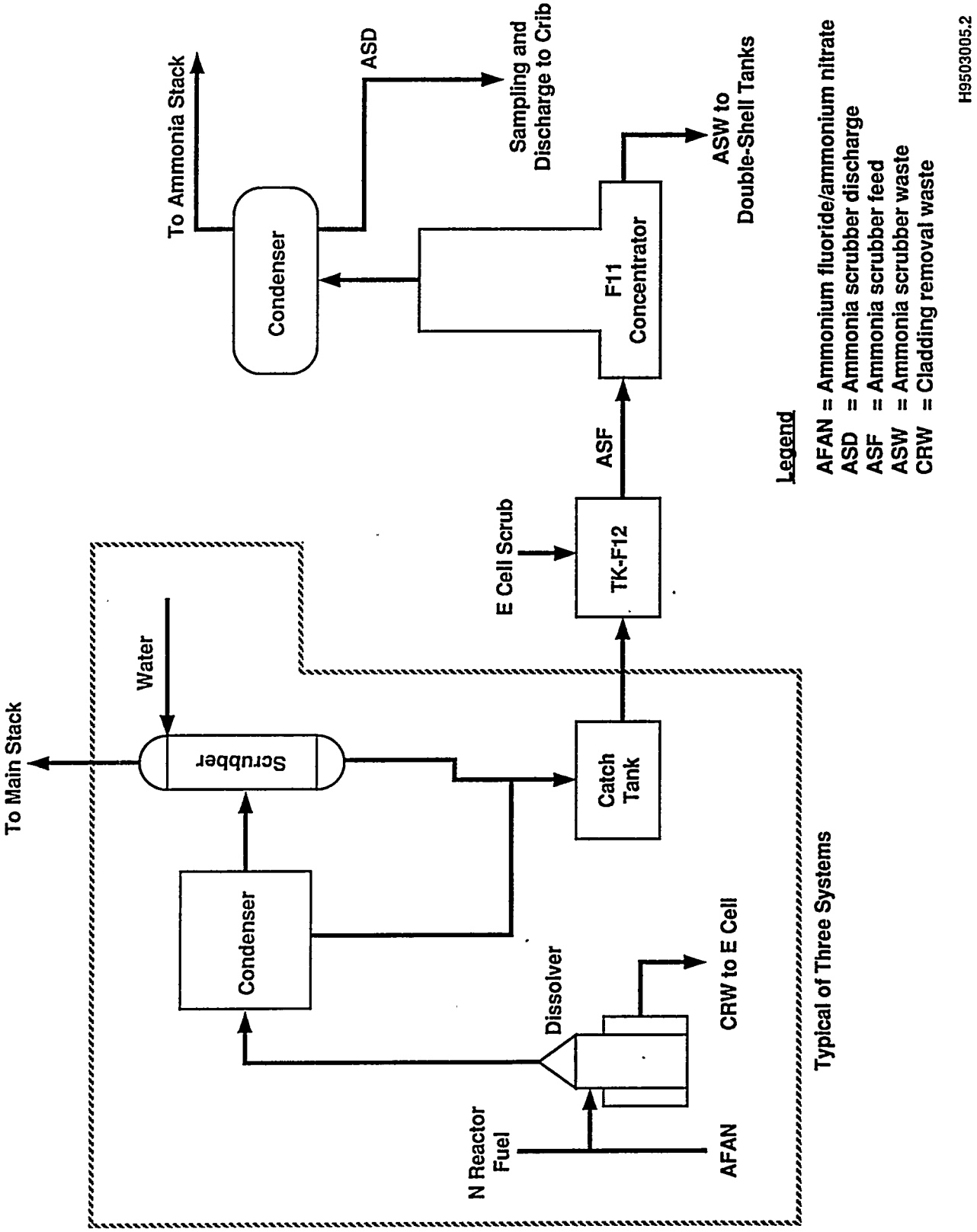


Figure 3-7. Historical Process Flow Diagram for PUREX Ammonia Scrubber Waste Generation.



F3-7.1

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

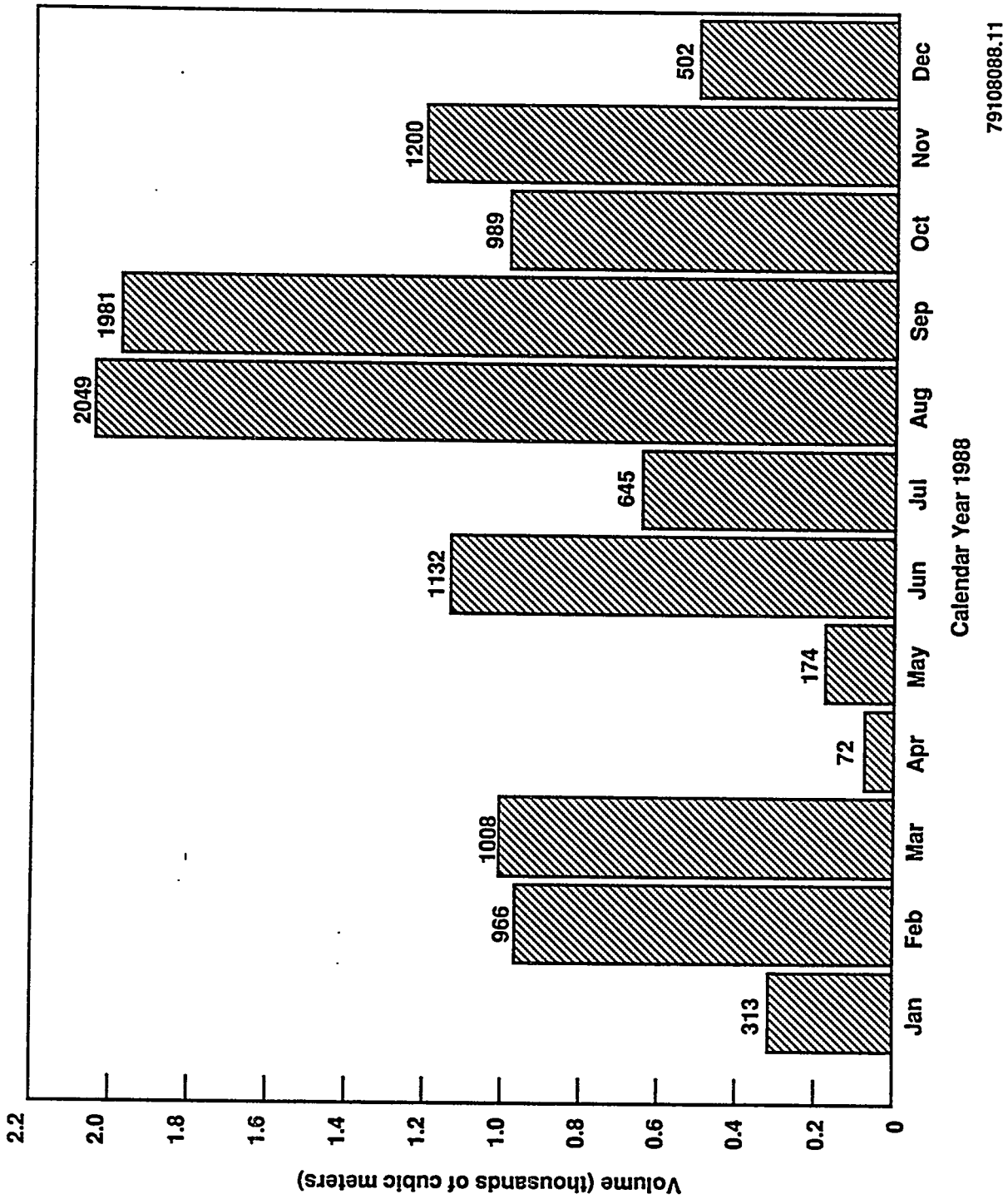
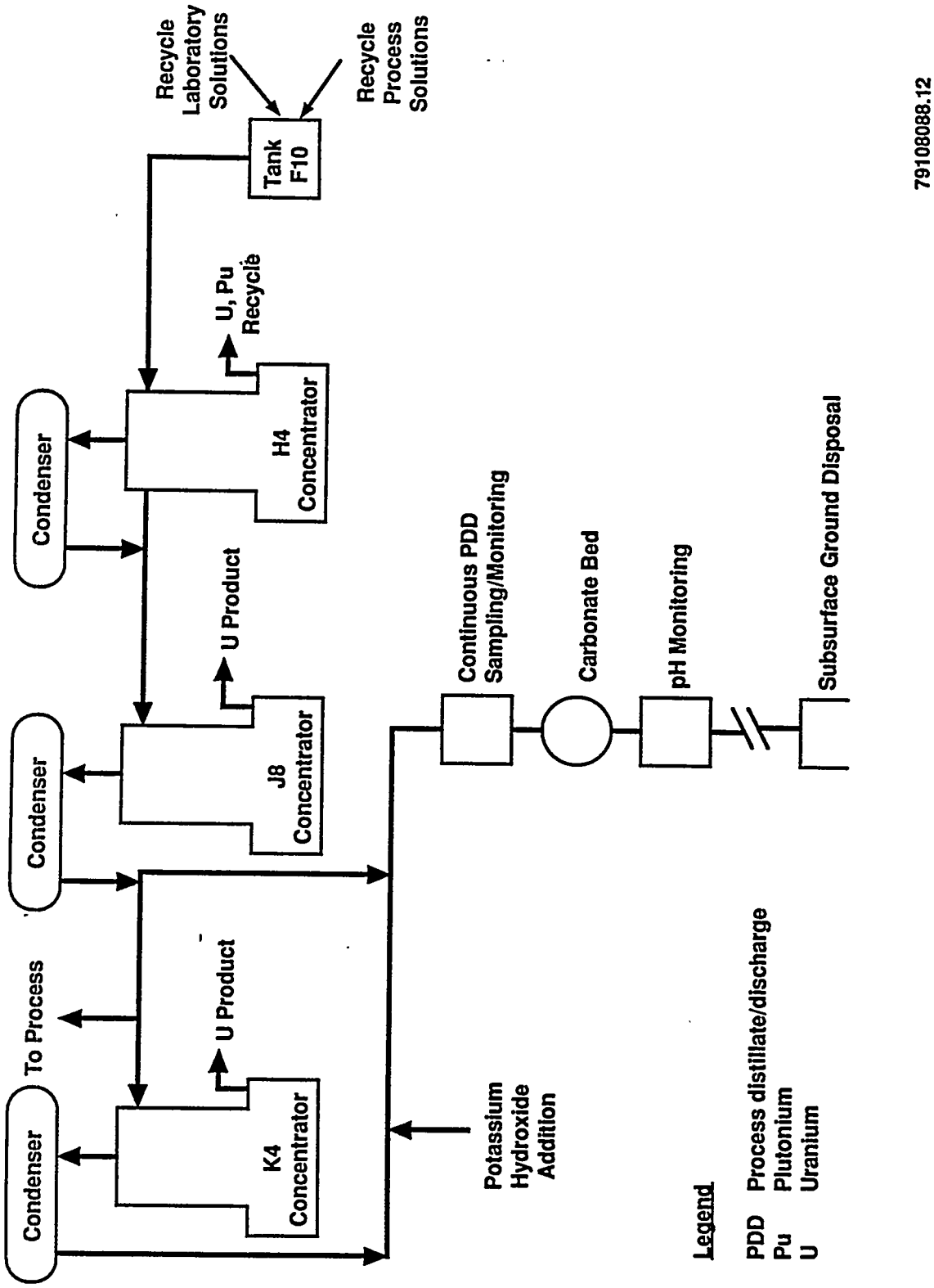


Figure 3-9. Historical Process Flow Diagram for PUREX Process Condensate.



F3-9.1

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

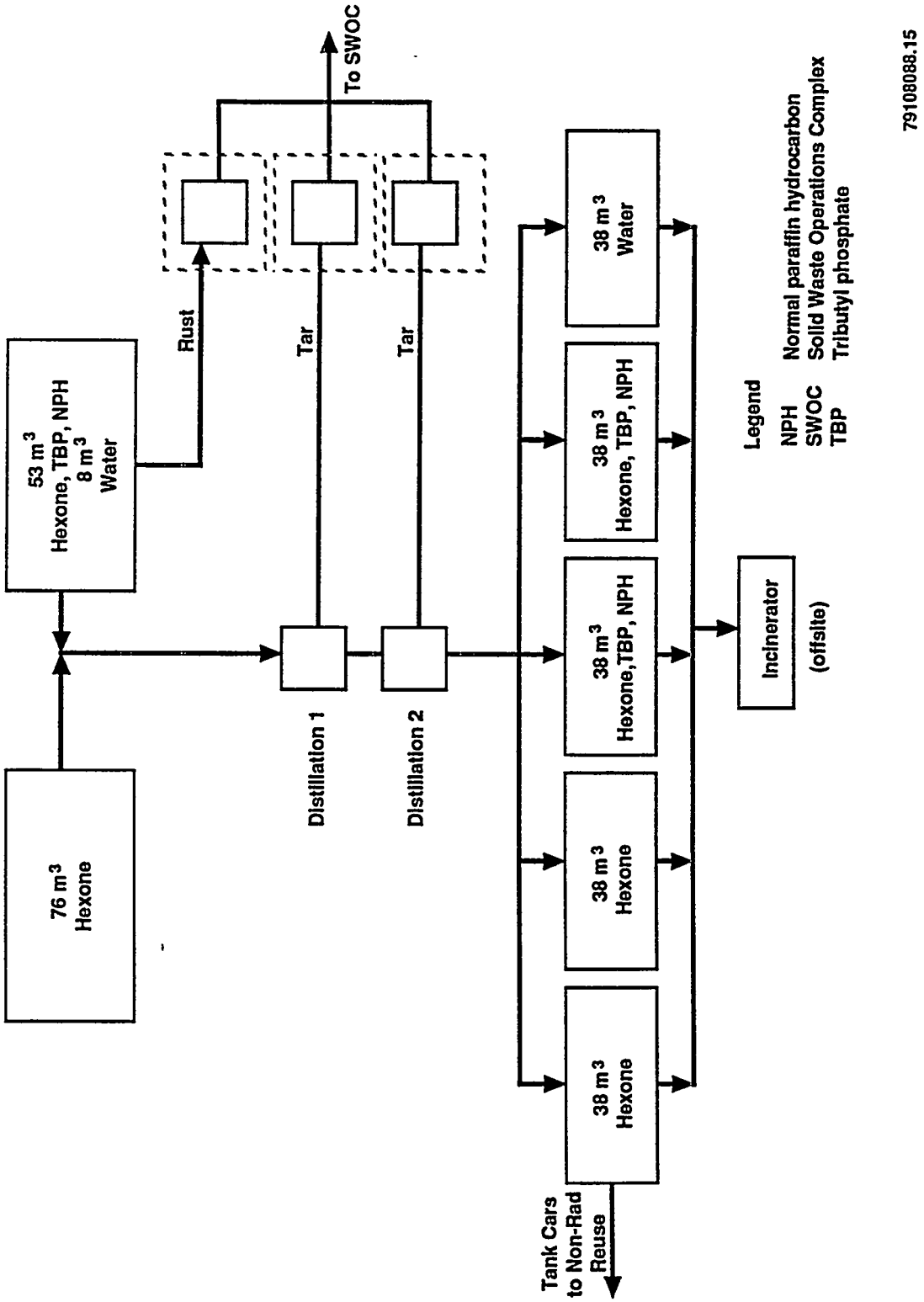


Figure 3-11. Plan View of Existing and Planned 200 West Area Facilities.

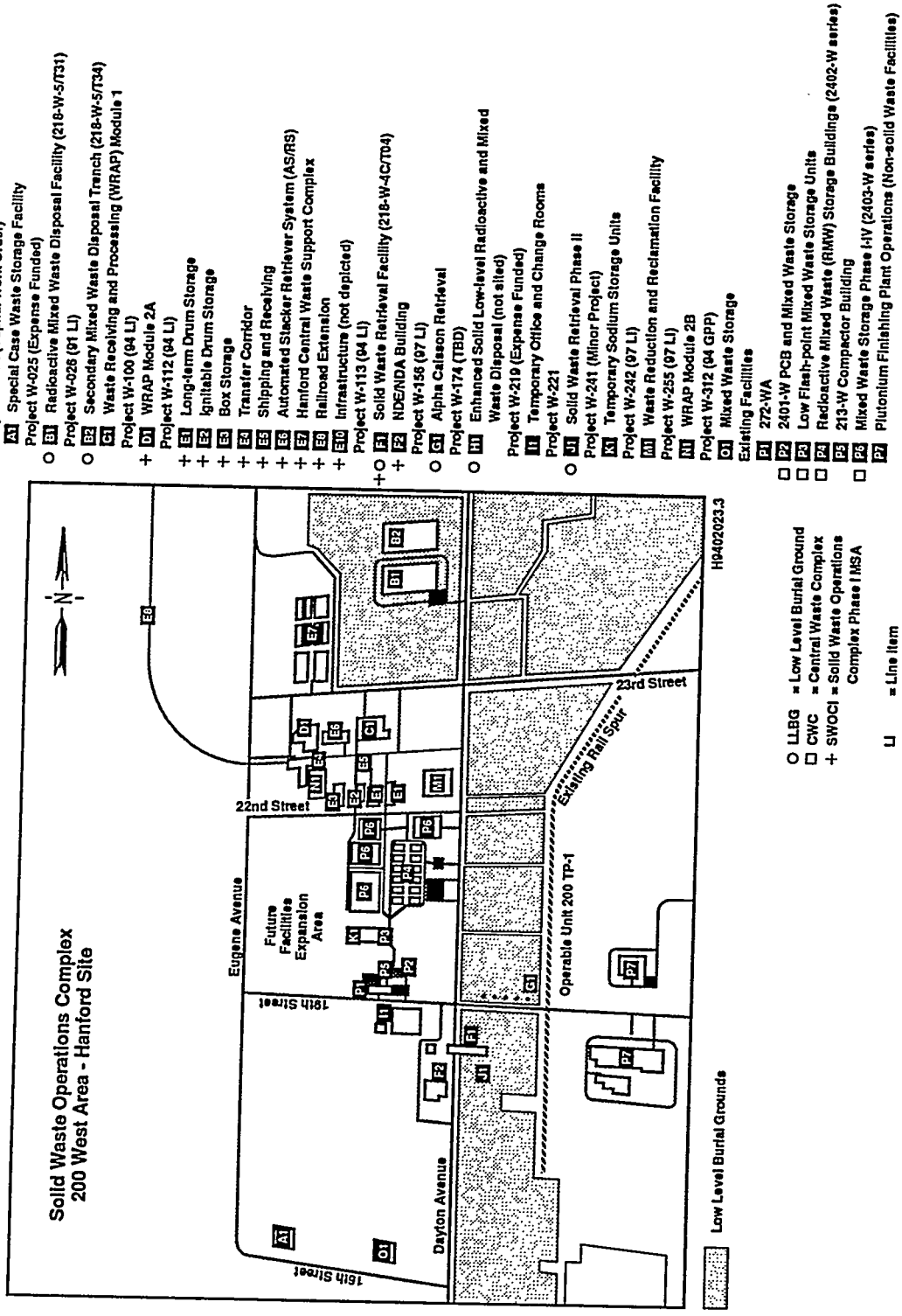


Figure 3-12. Process Flow Diagram for Proposed Waste Receiving and Processing Facility Module 2A.

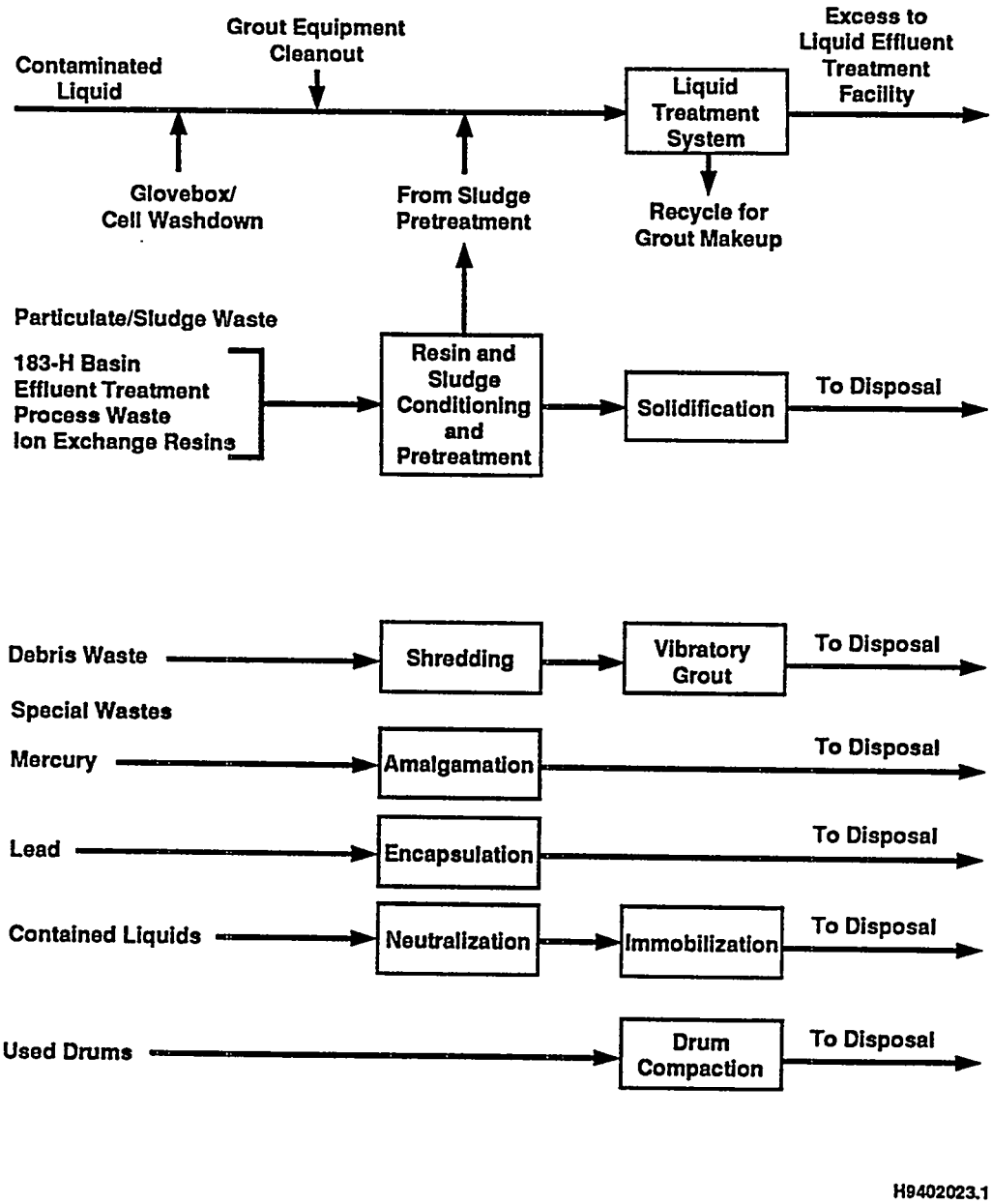


Figure 3-13. Waste Receiving and Processing Modules 1, 2A, and 2B.

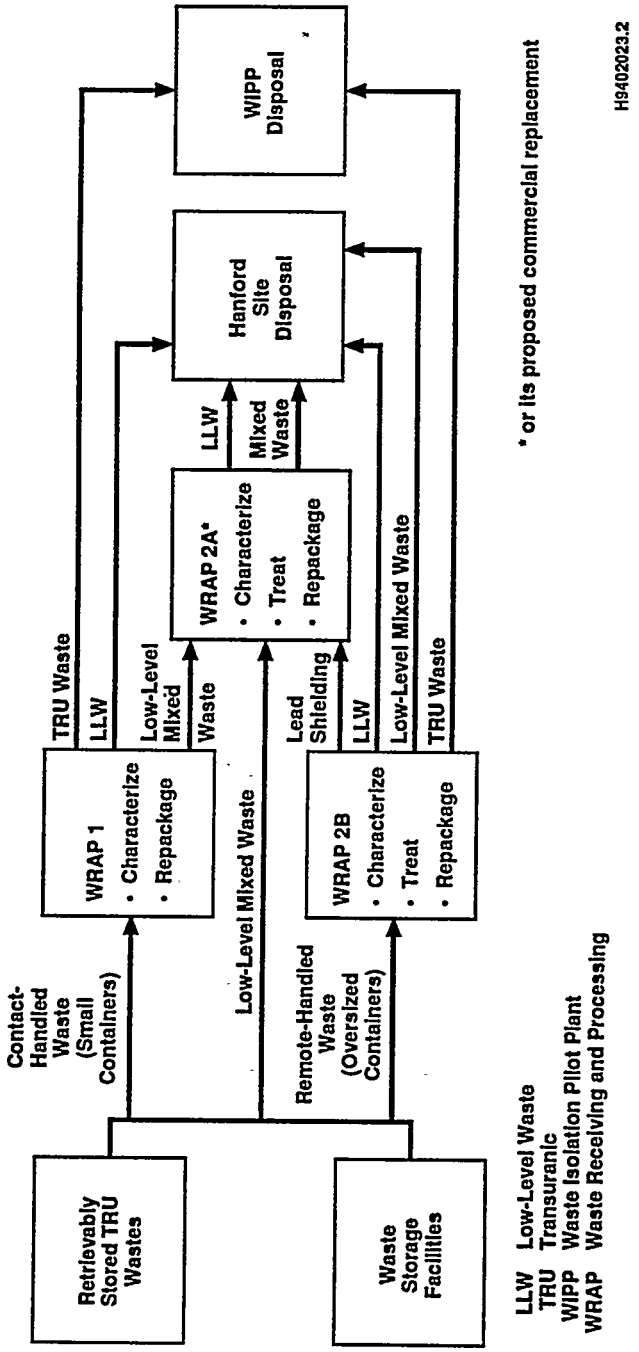


Figure 3-14. Typical Configuration of Retrievable Storage Unit for Contact-Handled Waste.

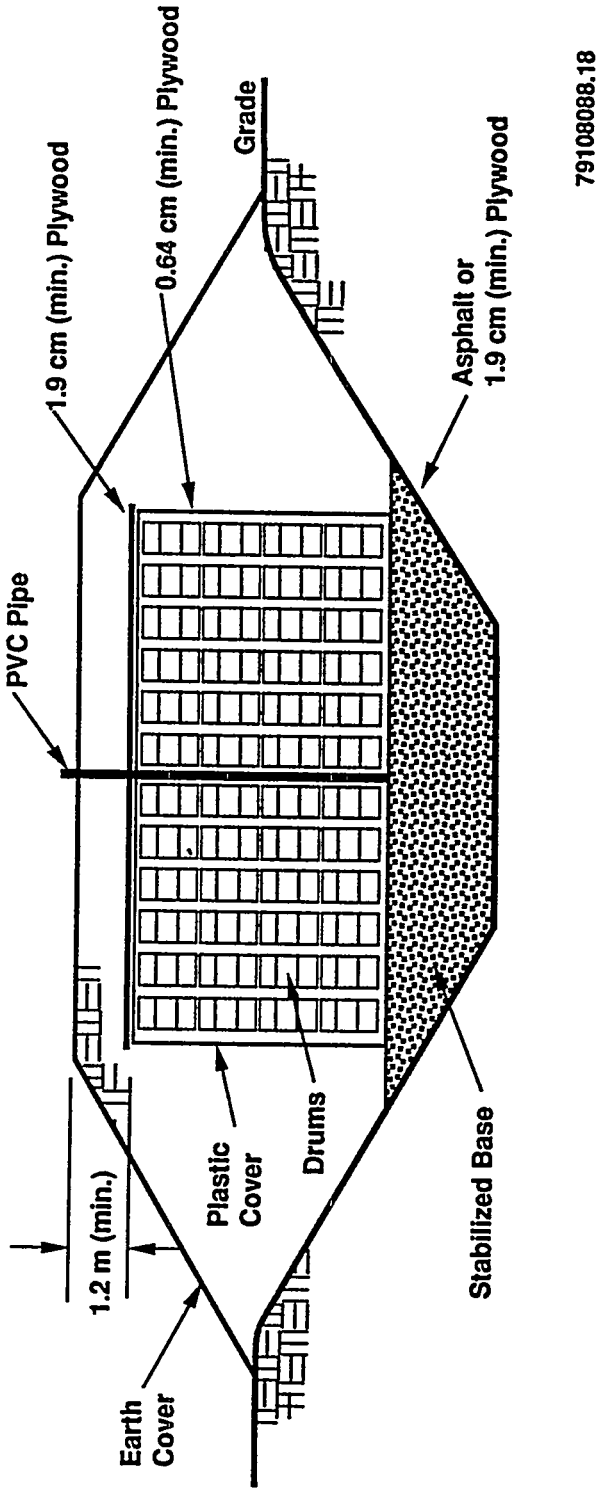
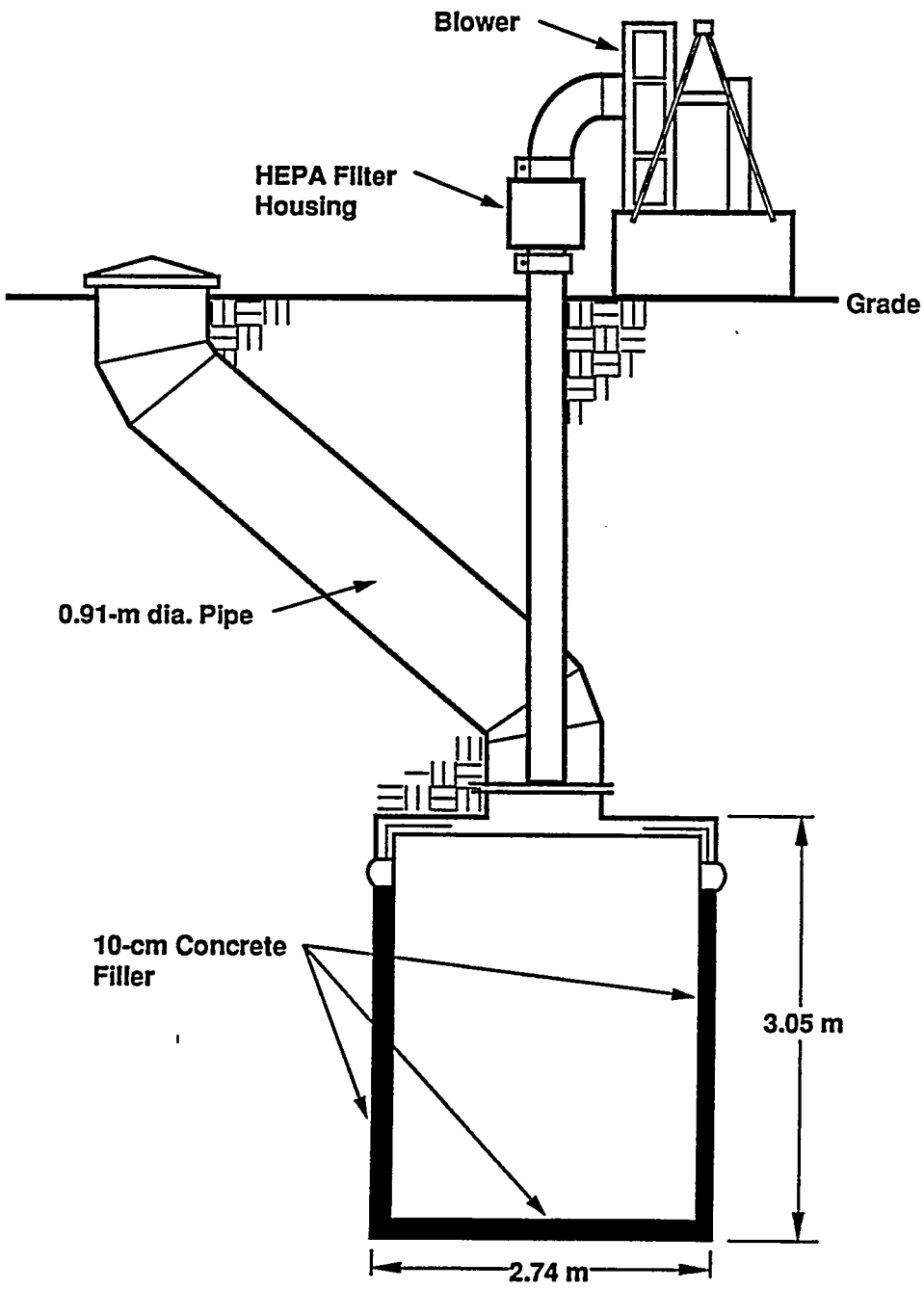


Figure 3-15. Typical Configuration of a Retrievable Storage Unit for Remote-Handled Waste.



HEPA High-efficiency particulate air

79108088.19

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

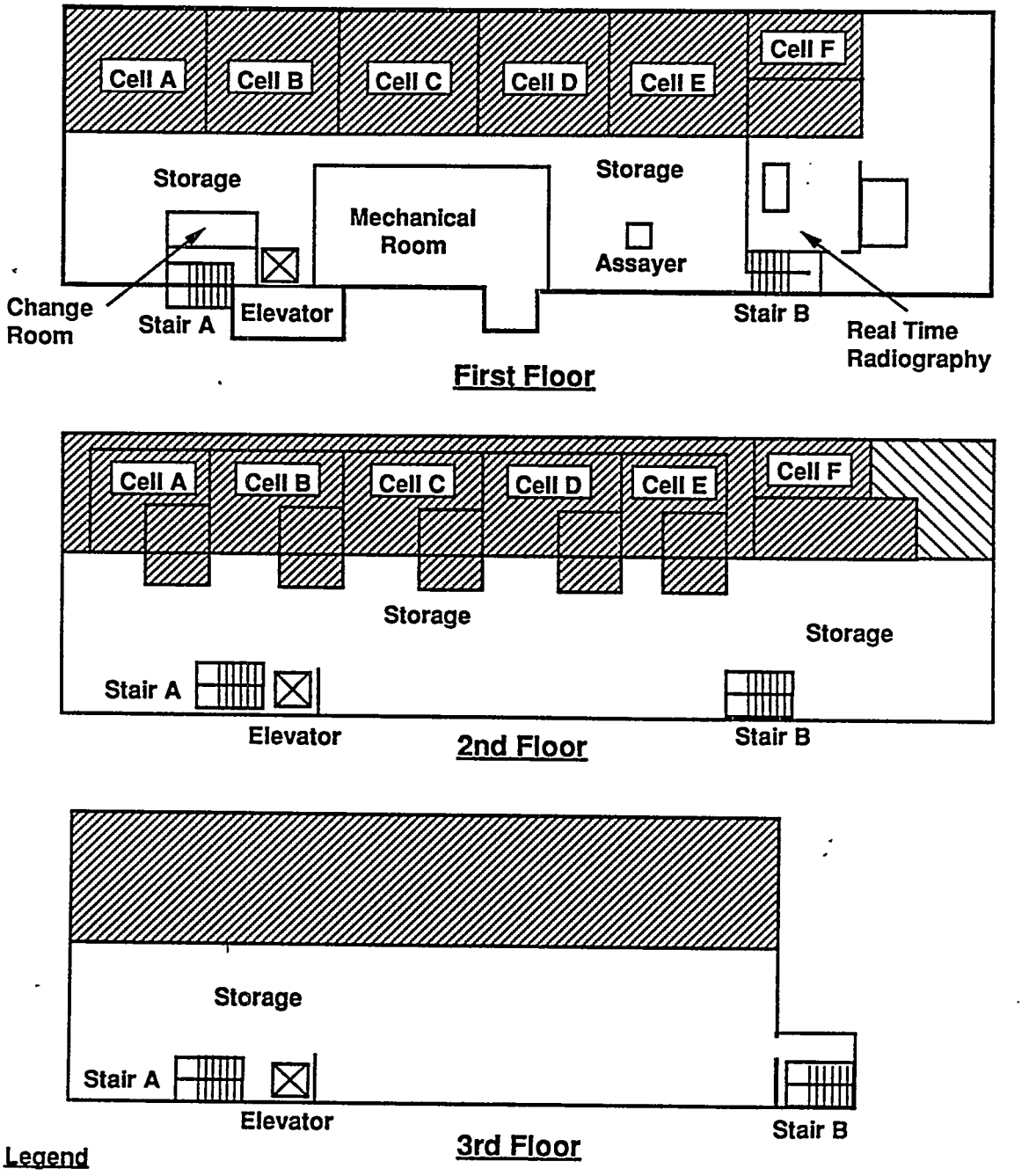


Table 3-1. Estimated Mass of Nonradioactive Chemical Components of Single-Shell and Double-Shell Tank Wastes.

Chemical metric tons	Single-Shell Tanks				Double-Shell Tanks		
	Sludge	Salt Cake	Interstitial Liquid	Total	Soluble	Insoluble	Total
Ag^{+}					3.28 E-01	1.38 E+00	1.70 E+00
$Al(OH)_4^-$	6.25 E+02	1.25 E+03	4.57 E+02	2.33 E+03	5.09 E+03		5.09 E+03
Al^{+3} (1)	1.99 E+03			1.99 E+03		6.78 E+01	6.78 E+01
As^{+5}					7.70 E-01	4.98 E-01	1.27 E+00
B^{+3}					5.19 E-01	9.94 E-01	1.51 E+00
Ba^{+2}					7.91 E-01	3.09 E+00	3.88 E+00
Be^{+2}					8.19 E-02	7.61 E-03	8.95 E-02
Bi^{+3}	2.61 E+02			2.61 E+02	2.26 E+00		2.26 E+00
Ca^{+2}	1.28 E+02			1.28 E+02	1.03 E+01	1.15 E+01	2.18 E+01
Cd^{+2}	3.84 E+00			3.84 E+00	1.67 E-01	6.01 E+00	6.18 E+00
Ce^{+3}	2.35 E+02			2.35 E+02	2.26 E-02	3.04 E+00	3.07 E+00
Cl^-	4.00 E+01			4.00 E+01	2.73 E+02	1.49 E+00	2.74 E+02
CO_3^{-2}	1.15 E+03	4.13 E+02	3.96 E+01	1.61 E+03	1.92 E+03	5.83 E+01	1.98 E+03
Cr^{+3}	8.63 E+01			8.63 E+01		3.41 E+01	3.41 E+01
CrO_4^{-2}			2.14 E+01	2.14 E+01	1.20 E+02		1.20 E+02
Cu^{+2}					1.77 E-01	7.46 E-01	9.23 E-01
F^-	8.00 E+02		5.00 E+01	8.05 E+02	3.52 E+02	1.91 E+01	3.71 E+02
$Fe(CN)_6^{-4}$	3.22 E+02			3.22 E+02			
Fe^{+3}	6.27 E+02			6.27 E+02	8.09 E+00	1.42 E+02	1.50 E+02
Hg^{+}	9.00 E-01			9.00 E-01	5.84 E-02		5.84 E-02
K^{+}					5.46 E+02	2.02 E+01	5.66 E+02
La^{+}					2.19 E-01	2.10 E+01	2.12 E+01
Li^{+}					5.77 E-03	2.46 E-02	3.04 E-02
Mg^{+2}					9.65 E-01	1.10 E+01	1.20 E+01
Mn^{+4}	1.20 E+02			1.20 E+02	7.69 E+00	1.80 E+01	2.57 E+01
Mo^{+6}					4.87 E+00	8.01 E-01	5.67 E+00
Na^{+}	1.58 E+04	3.39 E+04	2.30 E+03	5.48 E+04	1.40 E+04	2.30 E+02	1.43 E+04
Ni^{+2}	1.78 E+02			1.78 E+02	4.07 E+00	6.57 E+00	1.06 E+01
NO_2^-	2.00 E+03	1.53 E+03	1.27 E+03	4.80 E+03	4.80 E+03	8.42 E+00	4.81 E+03

Table 3-1. Estimated Mass of Nonradioactive Chemical Components of Single-Shell and Double-Shell Tank Wastes.

Chemical metric tons	Single-Shell Tanks				Double-Shell Tanks		
	Sludge	Salt Cake	Interstitial Liquid	Total	Soluble	Insoluble	Total
NO_3^-	1.48 E+04	8.03 E+04	1.71 E+03	9.68 E+04	1.03 E+03	3.91 E+01	1.03 E+04
OH^-	4.22 E+03	8.51 E+02	3.15 E+02	5.39 E+03	2.33 E+03	1.23 E+02	2.45 E+03
Pb^{+4}					1.96 E+00	3.28 E+00	5.24 E+00
PO_4^{-3}	3.89 E+03	6.43 E+02	8.58 E+01	4.62 E+03	3.29+E+02	2.16 E+01	3.15 E+02
SiO_2^{-2}	1.21 E+03			1.21 E+03	1.53 E+01	2.14 E+02	2.29 E+02
SO_4^{-2}	5.01 E+02	1.15 E+03		1.65 E+03	3.86 E+02	6.68 E+00	3.93 E+02
Sr^{+2}	3.60 E+01			3.60 E+01			
TOC[2]			2.00 E+02	2.00 E+02	1.26 E+03	6.84 E+01	1.33 E+03
UO_2^{+2}					3.54 E+00	2.68 E+01	3.03 E+01
V^{+5}					6.20 E-02	1.88 E-01	2.50 E-01
W^{+4}	1.44 E+01			1.44 E+01	7.47 E-01		7.47 E-01
Zn^{+2}					3.59 E+00	9.45 E-01	4.54 E+00
Zr^{+4}	2.46 E+02			2.46 E+02	4.48 E-01	2.77 E+02	2.77 E+02
Total w/o H_2O	4.93 E+04	1.23 E+05	6.40 E+04	1.79 E+05	4.18 E+04	1.45 E+03	4.32 E+04
H_2O	2.62 E+04	1.40 E+04	5.16 E+03	4.54 E+04	8.95 E+04		8.95 E+04
Total	7.55 E+04	1.37 E+05	1.16 E+04	2.24 E+05	1.31 E+05	1.45 E+03	1.33 E+05

[1] Al^{+3} includes the Al present in cancrinite and $Al(OH)_3$.

[2] TOC includes HEDTA, EDTA, hydroxyacetic acid, citric acid, and other degradation products.

Reference: WHC, 1995b

Table 3-2. 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]
FY 1994	53	276	140	836	0	26	76	76	0	110	42	1,635

Note: All generation quantities include the volume of any flush water.
[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.

Table 3-3. 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.

Table 3-4. 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

Table 3-4. Hanford Site Single-Shell Tank Releases.[a]
(sheet 2 of 3)

Tank	Volume (m^3)	Leak Reported
241-T-111	<3.8	1994
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

Table 3-4. 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.

Table 3-5. 242-A Evaporator Process Condensate (Sheet 1 of 2).

Analyte	Units	Sample Identifier and Collection Date				
		BOBTW4 5/4/94	BOBTW8 5/9/94	BOBTX2 5/16/94	BOBTX6 5/23/94	BOBTY0 6/6/94
acetone	µg/L	1,300 BD	1,100 BD	900 BD	700 BE	210 BE
2-butanone	µg/L	44 B	39	39	34	
4-methyl-2-pentanone (MlBk)	µg/L		5 J	3 J		
2-hexanone	µg/L			12		6 BJ
2-propanol	µg/L		740 JW	530 JW	2,200 JW	97 J
tetrahydrofuran	µg/L	90 JW	67 JW	72 JW		44 J
n-butanol	µg/L	2,500 JW	4,600 JW	3,500 JW	1,200 JW	1,200 J
2-butoxyethanol	µg/L	54 J	400 J	250 J	380 J	46 J
benzyl alcohol	µg/L	4 J			9 J	5 J
2-methylphenol	µg/L			12		
bis(2-ethylhexyl) phthalate	µg/L	3 BJ	3 J			
tetradecane	µg/L	160	130	340 E	11	270 E
tributyl phosphate	µg/L	38	21	30	12	13
tridecane	µg/L	84	54	160 E	3 J	150
Definition of qualifiers: J - estimated value W - indicates presumptive evidence of a compound B - analyte detected in blank E - concentration exceeds calibrated range D - result based on secondary dilution						
aluminum	µg/L	306	127	239	599	57.5
barium	µg/L	2.1			3.9	
calcium	µg/L	264	246	255	750	
iron	µg/L	36.3	16.9	15.1	50.4	
lead	µg/L		3	4.7		2.2
magnesium	µg/L				105	39
potassium	µg/L					1,120
sodium	µg/L	959	848	496	996	1,760
zinc	µg/L	10.1	24	10.3	32.5	5.4
strontium	µg/L	2		1.5	2.6	
ammonia	mg/L	35	114	45	29.4 J	0.1
nitrate/nitrite	mg/L	0.03	0.02	0.02		
pH		9.86 J	10.15 J	10.1 J	10 J	9.09 J

Table 3-5. 242-A Evaporator Process Condensate (Sheet 2 of 2).

Analyte	Units	Sample Identifier and Collection Date				
		BOBTW4 5/4/94	BOBTW8 5/9/94	BOBTX2 5/16/94	BOBTX6 5/23/94	BOBTY0 6/6/94
sulfate	mg/L		5.2			
nitrite	mg/L		0.54			
chloride	mg/L		1.3	0.5		
TOC	mg/L	3	4	4	4	2
^{241}Am	pCi/L	7.62 E-02	4.14 E-02	7.88 E-02	1.68 E-01	5.25 E-02
^{238}Pu	pCi/L					
$^{239/240}Pu$	pCi/L		8.79 E-02	1.04 E-01	1.01 E-01	5.75 E-02
^{58}Co	pCi/L		6.85 E-01		2.36 E+00	4.66 E+00
^{60}Co	pCi/L	3.89 E+00		3.01 E+00		
^{137}Cs	pCi/L	1.84 E+03	7.00 E+02	1.40 E+02	5.15 E+01	3.88 E-02
^{152}Eu	pCi/L	1.39 E+01	2.23 E+01	2.42 E+01	2.60 E+00	
^{154}Eu	pCi/L	4.49 E+00			9.27 E-01	5.10 E+00
^{155}Eu	pCi/L		5.58 E+00			4.28 E+00
^{59}Fe	pCi/L					
^{106}Ru	pCi/L		3.59 E+01	9.86 E+00	9.86 E+00	
strontium	pCi/L	4.63 E+01	2.04 E+01	1.52 E+01	3.07 E+00	4.76 E+01
H-3	pCi/L	3.99 E+06	3.31 E+06	3.48 E+06	4.52 E+06	4.37 E+06
Total alpha	pCi/L	4.17 E-02	9.29 E-02	4.11 E-02	6.33 E-02	4.95 E-01
Total beta	pCi/L	1.43 E+03	6.05 E+02	1.22 E+02	4.77 E+01	4.56 E+02

Table 3-6. 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.

Table 3-7. 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

Table 3-8. 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.

Table 3-9. Analyses of Hexone Waste.

Analysis Before Distillation in 1990.

Compound	Concentration (Weight Percent)		
	Tank 276-S-141	Tank 276-S-142	
		Organic Phase	Aqueous Phase
Hexone	99.0	65.2	1.0
N-alkanes (nC_{10} - nC_{15})	ND	14.2	ND
N-tributyl phosphate	ND	8.4	ND
Water	1.0	1.0	99.0
Mono- and di-butyl phosphates, and n-alkanes out of the C_{10} - C_{15} range	ND	12.2	ND
Total	100.0	100.0	100.0

ND = Not detected.

Analysis of Sludge/Tar Residual Composition for
Tanks 276-S-141 (950 Liters) and
Tanks 276-S-142 (950 Liters).

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 3-10. 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)

Table 3-11. 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	Mass (kg) of cadmium transferred	Mass (kg) of Fluorothene transferred
06-60	1	113.5	--	--	--	--
12-24-60	1	113.5	--	--	--	--
12-22-71	2	--	45	624	--	--
12-26-71	2	--	--	--	--	--
09-30-72	2	--	45	--	--	--
01-18-86	2	--	38	--	--	--
11-18-87	2	2,533	--	--	--	180
5-13-88	2	--	--	--	13	--
06-13-88	2	227	--	--	--	--
06-13-88	2	--	--	113	--	--
Total	N/A	2,987	129	737	13	180

Note: 2,987 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.
13 kg of cadmium have a volume of 1.5×10^{-3} m^3.
180 kg of Fluorothene have a volume of 0.08 m^3.
N/A = Not applicable.

Table 3-11. 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.

Table 3-12. Projected Generation of Solid Waste Operations Complex Stored Low-Level and Transuranic Waste.

Year	Total (cubic meters)
1995	4,273
1996	3,907
1997	3,964
1998	3,576
1999	3,961
2000	5,125
2001	4,958
2002	5,021
2003	4,277
2004	9,652
2005	13,141
2006	13,410
2007	5,871
2008	5,762
2009	6,054
2010	6,268
2011	6,480
2012	7,605
2013	7,944
2014	8,885
2015	9,903
2016	10,306
2017	10,284
2018	4,885
2019	4,629
2020	4,322
2021	4,661
2022	4,918
2023	4,643
Total	188,744

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4.0 REFERENCES

Adams, M. R., L. Jensen, and W. W. Schulz, 1986, *Preliminary Assessment of the TRAC Model Predictor of Key Radionuclides*, RHO-RE-EV-89-P, Rockwell Hanford Operations, Richland, Washington.

Babad, H., R. J. Cash, S. J. Eberlein, G. D. Johnson, J. E. Meacham, J. W. Osborne, M. A. Payne, and D. A. Turner, 1995, *Progress in Resolving Hanford Site High-Level Waste Tank Safety Issues*, WHC-SA-2369-FP, Westinghouse Hanford Company, Richland, Washington.

Bell, K. E., 1994, *Fiscal Year 1994 Tank Waste Remediation System Tank Waste Analysis Plan*, WHC-SD-WM-PLN-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

DOE, 1987, *Final Environmental Impact Statement - Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes*, DOE/EIS-0013, Vol. 1, U.S. Department of Energy, Washington, D.C.

DOE, 1990, *National Report on Prohibited Wastes and Treatment Options*, U.S. Department of Energy, Washington, D.C.

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

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

RHO, 1985, *Hanford Defense Waste Disposal Alternatives: Engineering Support Data for the Hanford Defense Waste Environmental Impact Statement*, RHO-RE-ST-30P, Rockwell Hanford Operations, Richland, Washington.

RL, 1989a, *Hanford Site Dangerous Waste Part A Permit Application*, DOE/RL-88-21, Vol. 1-3, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

RL, 1989b, *Single-Shell Tank System Closure/Corrective Action Work Plan*, DOE/RL-89-16, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

RL, 1990b, *PUREX Storage Tunnels Dangerous Waste Permit Application*, DOE/RL-90-24, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

RL, 1990c, *303-K Radioactive Mixed-Waste Storage Facility Closure Plan*, DOE/RL-90-004, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

RL, 1991a, *Double-Shell Tank System Dangerous Waste Permit Application*, DOE/RL-90-39, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

RL, 1991c, *183-H Solar Evaporation Basins Closure/Postclosure Plan*, DOE/RL-88-04, Rev. 3, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

RL, 1992a, *Tank Waste Remediation System Integrated Technology Plan*, DOE/RL-92-61, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

RL, 1993a, *Waste Analysis Plan for Confirmation or Completion of Tank Farms Backlog Waste Designations*, DOE/RL-93-70, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

RL, 1994, *1993 Annual Report on Waste Generation and Waste Minimization Progress as Required by DOE Order 5400.1, Hanford Site*, DOE/RL-94-0130, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

RL, 1994a, *Tank Waste Remediation System Integrated Technology Plan*, DOE/RL-92-61, Rev. 2 (February 28, 1994), U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Sasaki, L. M., 1990, *Waste Characterization Plan for the Hanford Site Single-Shell Tanks*, WHC-EP-0210, REV. 2, Westinghouse Hanford Company, Richland, Washington.

Weiss, R. L., 1986, *TY Tank Farm Waste Characterization Data*, RHO-WM-TI-1P, Rockwell Hanford Operations, Richland, Washington.

WHC, 1989a, *Characterization Plan for Stored Contact Handled Transuranic Waste*, WHC-EP-0223, Westinghouse Hanford Company, Richland, Washington.

WHC, 1989b, *Sampling Plan for Retrievably Stored Contact Handled Transuranic Waste at Hanford*, WHC-EP-0226, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990a, *Double-Shell Tank Waste Disposal Integration Plan*, WHC-EP-0229, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990b, *Engineering Study for Waste Receiving and Processing (WRAP) Facility*, Module 2, WHC-SD-W100-ES-001, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990c, *Functional Requirements Baseline for the Closure of Single-Shell Tanks-Draft*, WHC-EP-0338, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990d, *Hanford Site LDR RMW Stream Data Package*, WHC-MR-0224, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990e, *A History of the 200 Area Tank Farms*, WHC-MR-0132, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990f, *PUREX Plant Ammonia Scrubber Distillate Stream-Specific Report*, Addendum 14-Final, WHC-EP-0342-14, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990g, *PUREX Plant Process Condensate Stream-Specific Report*, WHC-EP-0342-12, WHC, Richland, Washington.

WHC, 1990h, *Single-Shell Tank Waste Retrieval Study*, WHC-EP-0352, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990i, *Solid Waste Management Program Plan*, WHC-EP-0363, Rev 1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990j, *242-A Evaporator Process Condensate Stream-Specific Report*, Addendum 15-Final, WHC-EP-0342-15, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991c, *Tank Wastes Discharged Directly to Soil at the Hanford Site*, WHC-MR-0227, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991f, *1991 Borehole Completion Package for the Low-Level Burial Grounds*, WHC-SD-EN-DP-044, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992c, *Tank Waste Technical Options Report*, WHC-EP-0616, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992d, *1992 Borehole Completion Package for the Low-Level Burial Grounds*, WHC-SD-EN-DP-049, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993a, *Alternative Pretreatment Technologies for Removal of Transuranic Elements from Selected Hanford Site Wastes*, WHC-EP-0577, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993d, *Annual Report of Tank Waste Treatability*, WHC-EP-0365-03, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993e, *Hanford Site Solid Waste Acceptance Criteria*, WHC-EP-0063-4, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994a, *Tank Waste Remediation System Facility Configuration Study*, WHC-SD-WM-ES-2955D, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994b, *TWRS Process Flowsheet*, WHC-SD-WM-TI-6135D, Westinghouse Hanford Company, Richland, Washington.

WHC, 1995, *Summary Report for Month Ending December 31, 1994*, WHC-EP-0182-81, Westinghouse Hanford Company, Richland, Washington.

WHC, 1995b, *Single-Shell and Double-Shell Tank Waste Inventory Data Package for the Tank Waste Remediation System Environmental Impact Statement*, WHC-SD-WM-EV-102, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

4.2 CODE OF FEDERAL REGULATIONS AND FEDERAL REGISTER

40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," Title 40, *Code of Federal Regulations*, Part 265, as amended, U.S. Environmental Protection Agency, Washington, D.C.

40 CFR 268, "Land Disposal Restrictions," Title 40, *Code of Federal Regulations*, Part 268, as amended, U.S. Environmental Protection Agency, Washington, D.C.

40 CFR 761, "Polychlorinated Biphenyls (PCB) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," Title 40, *Code of Federal Regulations*, Part 761, as amended, U.S. Environmental Protection Agency, Washington, D.C.

55 FR 22520, 1990, "Land Disposal Restrictions for Third Scheduled Wastes; Final Rule," *Federal Register*, Vol. 55, pp. 22627, (June 1, 1990).

58 FR 29800, 1993, "Land Disposal Restriction for Ignitable and Corrosive Characteristic Wastes Whose Treatment Standards Were Vacated," *Federal Register*, Vol. 58, pp. 29860, (May 24, 1993).

59 FR 47982, 1994, "Universal Treatment Standards," *Federal Register*, Vol. 59, pp. 47982.

60 FR 242, 1994, "Technical Correction to Universal Treatment Standards," *Federal Register*, Vol. 60, pp. 242.

4.3 FEDERAL AND STATE ACTS

Atomic Energy Act of 1954, as amended, 42 USC 2011.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 USC 9601 et seq.

Federal Facility Compliance Act of 1992, as amended, 42 USC 6901, et seq.

National Environmental Policy Act of 1969, as amended, 42 USC 4321, et seq.

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

State of Washington Hazardous Waste Management Act of 1976, as amended, Revised Code of Washington, Chapter 70.105, Olympia, Washington.

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-173-303-140, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended. (WAC 173-303-140 covers land disposal restrictions.)

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APPENDIX A

DATA IN THE NATIONAL PROPOSED SITE TREATMENT PLAN DATABASE

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APPENDIX A

DATA IN THE NATIONAL PROPOSED SITE TREATMENT PLAN DATABASE

Under the Federal Facilities Compliance Act, Hanford is exempt from preparing a site treatment plan. This is because the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) and specifically the *Site Land Disposal Restriction Report* fulfill this requirement. Nevertheless, the Hanford Site does support the submission of waste data and information to databases that support both the *Mixed Waste Inventory Report* and the proposed site treatment plans. The scope and objective of each national database are as follows:

- The *Mixed Waste Inventory Report* database contains inventories and detailed characteristics of each waste stream. The objective of the report is to determine the required land disposal restrictions treatment technologies for each waste stream.

- The proposed site treatment plan database captures the inventories and required treatment technologies from the *Mixed Waste Inventory Report* database. The objective of this database is to establish the national treatment configuration for low-level mixed waste.

A one-to-one correspondence exists between the *Mixed Waste Inventory Report* and the proposed site treatment plan database for the Hanford Site waste streams.

This appendix summarizes the data that are presented in both the *Mixed Waste Inventory Report* and the Proposed Site Treatment Plan databases. This information is presented in two sections: Assumptions and data summary. The assumptions specify the technologies required to meet land disposal restrictions. These assumptions are based on a detailed analysis of each waste stream in the *Mixed Waste Inventory Report*. The data summary provides inventories and projections of mixed waste, organized by treatment technologies. In addition, the appendix compares the inventories with the national waste minimization report and the no-migration variance petition for transuranic waste.

1.0 ASSUMPTIONS FOR THE 1993 UPDATE TO THE NATIONAL PROPOSED SITE TREATMENT PLAN DATABASE

The treatment and processing assumptions for the Hanford Site's input to the Proposed Site Treatment Plan database are presented below. The inventories in the database are current as of December 31, 1993. The 5-year projection period is 1994 to 1998; the 30-year projection period is 1994 to 2023. As already stated, the U.S. Department of Energy, Headquarters will use the proposed site treatment plan database as a tool to establish the national treatment configuration.

The assumptions are organized by waste management program or waste-generating facility, as follows:

A. Mixed high-level and tank waste
B. Transuranic (TRU) mixed waste
C. Mixed low-level waste (LLW)
D. Liquid effluents
E. Wastes managed by the generator.

The assumptions for each program or facility are presented separately.

A. OPTIONS FOR MIXED HLW AND TANK WASTE STREAMS

The technical strategy for treatment and disposal of tank waste is based on the January 1994 amendments to the Tri-Party Agreement. The details of this strategy are summarized in Paragraphs A.1 and A.2.

A.1. Future generation of tank waste at the Hanford Site is based on the following assumptions:

- The fuel reprocessing plant [Plutonium-Uranium Extraction (PUREX) Plant] is not restarted
- The irradiated fuel remains in wet storage
- Pumpable liquids are transferred from single- to double-shell tanks
- Double-shell tanks will continue to receive any newly generated waste
- Volume reduction of stored wastes through evaporation will continue.

A.2. Plans are to retrieve waste from both single- and double-shell tanks, pretreat as necessary, and immobilize by vitrification. Waste retrieval will begin in December 2003. Pretreatment for cesium removal from supernatants will begin in December 2004 in preparation for operations at a LLW vitrification facility to begin in June 2005. Operations at a high-level waste (HLW) vitrification facility are planned to begin in December 2009. Vitrification of all waste from tanks is expected to be completed by December 2028.

Pretreatment maximizes routing of the radioactivity of retrieved waste to the HLW vitrification facility, while directing the bulk of the tank waste material to the LLW vitrification facility. The planned pretreatment processes are enhanced (caustic) sludge washing, liquid/solid separation, and cesium removal for liquids. Other enhancements that will be evaluated in the environmental impact statement for the Tank Waste Remediation System Program (to be prepared in accordance with 59 *Federal Register* 4052) are acid dissolution, advanced separations of wastes, and organic destruction.

B. OPTIONS FOR MIXED TRU WASTE STREAMS

The assumption is that the Waste Isolation Pilot Plant's (WIPP) land withdrawal petition will be approved. If the assumption is correct, mixed TRU

waste that meets the WIPP's waste acceptance criteria will be shipped directly to WIPP. Thus, the preferred option for these wastes is disposal at the WIPP. Waste will be repackaged and processed as necessary at the Waste Receiving and Processing Facility Module 1.

C. OPTIONS FOR CONTAINERIZED MIXED LOW-LEVEL WASTE STREAMS

C.1 LDR Technology Specification Assumptions

- Technology needs are driven by matrix and concentration of hazardous contaminants.
- When needed, deactivation technology is achieved by thermal treatment or stabilization technologies required because of other contaminants. Need is determined by the Ignitable/Corrosive/Reactive-contaminant parameter.
- Where organics, or polychlorinated biphenyls (PCB), and metals containing mercury are the contaminants present, thermal treatment technology would serve to both remove and/or destroy organics and remove mercury.
- Technology for metal-contaminated soil is stabilization rather than soil washing, etc.
- Debris matrices may be treated via destruction, immobilization, or removal technologies. Pretreatment via sorting/separation will likely be needed first.

C.2 LDR Technology Specification

The physical forms of mixed waste at the Hanford Site are as follows:

- Inorganic and organic process homogeneous solids, including particulates and sludges (homogeneous solids)
- Contaminated soils (soils)
- Labpacks
- Debris
- Elemental mercury
- Elemental lead
- Lead acid and cadmium batteries.

The treatment requirements for the first three physical forms are discussed together because the required technologies are similar. The treatment requirements for each of the other four physical forms are presented separately.

C.2.1 Homogeneous Solids, Soils, and Labpacks.

C.2.1.1. Labpacks containing organic solvents, oils, or PCBs will require, as a minimum, thermal treatment.

C.2.1.2. Organic contaminants are characterized by the following:

- Matrices laden with organics, i.e., absorbed oils and labpacked organics
- Solid or soil matrices contaminated with *Resource Conservation and Recovery Act of 1976*- (RCRA)-regulated organic contaminants
- Toxic Substance Control Act- (TSCA)-regulated levels of PCB contamination.

C.2.1.3. Homogeneous solids, soils, and labpacks contaminated with RCRA metals and organic contaminants will be treated by thermal treatment and stabilization technologies. The following waste streams make up this category.

RL-W021	RL-W029	RL-W031	RL-W042	RL-W043
RL-W044	RL-W045	RL-W051	RL-W053	RL-W054
RL-W061	RL-W063	RL-W064	RL-W114	RL-W119
RL-W122	RL-W124	RL-W125	RL-W132	RL-W144
RL-W149	RL-W153			

C.2.1.4. Homogeneous solids, soils, and labpacks containing organic contaminants but not RCRA metals will be treated by a thermal treatment technology. Stabilization of the residues from thermal treatment is not planned. The following waste streams make up this category.

RL-W017	RL-W027	RL-W039	RL-W040	RL-W046
RL-W049	RL-W050	RL-W052	RL-W087	RL-W065
RL-W066	RL-W067	RL-W092	RL-W096	RL-W099
RL-W090	RL-W100	RL-W108	RL-W110	RL-W123
RL-W130	RL-W140	RL-W143	RL-W145	RL-W148
RL-W154				

C.2.1.5. Homogeneous solids, soils, and labpacks contaminated with RCRA metals, ignitable/corrosive/reactive materials, and/or contaminants that fall under Washington State codes, will be treated by applying stabilization technology. The following waste streams make up this category.

RL-W018	RL-W019	RL-W022	RL-W047	RL-W048
RL-W094	RL-W098	RL-W089	RL-W121	

C.2.1.6. Inorganic homogeneous solids and soils contaminated with mercury will be treated by stabilization technology. Additional characterization of the waste will be performed to verify that the mercury concentration in the waste matrix is less than the regulated level of 260 mg/L. A treatability variance will be requested for residues and soils that exceed 260 mg/L. The following waste streams make up this category.

RL-W020 RL-W038 RL-W120

C.2.1.7. Stabilization will be used to process containerized, dewatered fuel-fabrication sludge from the 183-H dewatering basins. This is a listed waste containing low concentrations of formic acid. A petition to waive the formic acid incineration LDR treatment standard using a demonstration of equivalent treatment is planned. Sample and analysis of the waste are in progress in preparation of this petition. The following waste streams make up this category.

RL-W068 RL-W069 RL-W070

C.2.2 Debris. Debris waste, including debris contaminated with low concentrations of organic solvents, oils, or PCBs, will be treated by stabilization. The planned technology is shred-grout immobilization. Debris waste that contains no or low concentrations of these hazardous constituents will be pretreated by screening to remove particulates. The following waste streams make up this category.

RL-W023	RL-W024	RL-W025	RL-W026	RL-W028
RL-W030	RL-W032	RL-W041	RL-W033	RL-W036
RL-W055	RL-W056	RL-W057	RL-W058	RL-W059
RL-W060	RL-W093	RL-W095	RL-W097	RL-W113
RL-W115	RL-W116	RL-W117	RL-W118	RL-W126
RL-W127	RL-W128	RL-W129	RL-W131	RL-W141
RL-W142	RL-W146	RL-W150	RL-W151	

C.2.3 Elemental Mercury. Waste containing elemental mercury will be treated by amalgamation followed by encapsulation. The following waste stream makes up this category.

RL-W037

C.2.4 Elemental Lead. Elemental lead will be macroencapsulated. Decontamination and recycling technologies are not planned. The following waste streams make up this category.

RL-W035 RL-W062 RL-W152

C.2.5 Batteries. Lead acid and cadmium batteries will be encapsulated in a shred-grout form. The following waste streams make up this category.

RL-W034 RL-W091 RL-W147

C.3 Preferred Treatment Option

C.3.1. Two options are available for wastes that require thermal treatment. The preferred option is to have them processed by a commercial facility. The second option is to ship them to the planned Idaho Waste Processing Facility (IN-015) at the Idaho National Engineering Laboratory. Under either option, the facility will provide additional treatment, as required, to ensure that the waste residues are returned in an acceptable form for disposal. The schedule for commercial thermal treatment service contract support is planned for FY 1999.

C.3.2. Waste that does not require thermal treatment will be processed in a commercial facility providing non-thermal mixed-waste treatment capability. These services are planned to be available by September 1999.

D. OPTION FOR PROCESS CONDENSATE

The assumption for process condensate from the 242-A Evaporator is that the delisting petition filed with the U.S. Environmental Protection Agency (EPA) will be approved. Under this assumption, after treatment, the process condensate is not a mixed waste and therefore is not included in the national mixed waste inventory for strategic planning purposes.

E. OPTIONS FOR WASTES STORED BY GENERATOR

Some mixed waste is stored by the waste generator. These are wastes that, because of radiological, hazardous, or other unique conditions associated with the waste form, will be stored indefinitely by the waste generators. These waste streams are the following:

- Hexone
- Alkali metal waste
- Waste in the PUREX tunnels and canyon.

Pacific Northwest Laboratories (PNL) also provides long-term (greater than 5 years) management of waste that were formerly categorized as materials.

The detailed waste stream data for the national Mixed Waste Inventory Report and the Proposed Site Treatment Plan databases have yet to be compiled. The present plan is to compile this waste stream data for the next Hanford update to the Mixed Waste Inventory Report database. This update is planned to be submitted to the national Mixed Waste Inventory Report database in June 1995.

The treatment plan and technology strategy for each waste stream are presented in the following paragraphs.

E.1 Hexone

The spent distillate bottoms are being incinerated at an offsite facility. Therefore, for practical purposes, the waste stream no longer exists.

Residues in vessels used in the previous distillation campaign will be packaged and sent to the Central Waste Complex for storage. Therefore, this residue is included in the projections for the mixed LLW streams. The waste is assumed to be debris because glass is present. Therefore, the planned treatment for the waste is stabilization in WRAP 2A or through a commercial treatment service contract (Section C.3.2).

E.2 Alkali Metal Waste

The plan is that the waste will be packaged as containerized mixed LLW, and then shipped to the Hanford Site's storage facility for mixed LLW. Therefore, the waste will be treated at the WRAP 2A facility or through a commercial treatment service contract (Section C.3.2).

E.3 Waste in the PUREX Tunnels and Canyon

E.3.1. The specified LDR technology for PUREX tunnels silver waste and PUREX canyon/tunnels lead waste is encapsulation. The plan and schedule for implementation of a treatment facility has yet to be determined.

E.3.2. The specified LDR technology for PUREX tunnels mercury waste is amalgamation. The plan and schedule for construction of the treatment facility have yet to be determined. Treatment of waste in the PUREX tunnel is beyond the scope of the PUREX deactivation project to be completed in September 1997. Waste from the tunnels will be handled along with the similar materials currently in the PUREX canyon when the PUREX Plant is dispositioned. The dispositioning of PUREX, along with treatment of the tunnel waste, is contingent on completion of the following:

- The sitewide land use plan
- The sitewide decontamination and decommissioning priority schedule
- The environmental impact statement, closure plans, and public participation.

A basis for the treatment plan of the waste associated with PUREX storage will be developed after these are implemented.

F. REFERENCES

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

59 FR 4052, "Notice of Intent to Prepare the Hanford Site Tank Waste Remediation System Environmental Impact Statement," *Federal Register*, Washington, D.C.

2.0 HANFORD SITE WASTE STREAM SUMMARY

This section summarizes the HLW, mixed TRU waste, and mixed LLW, as presented in the update to the proposed site treatment plan database. Because the waste types either are managed or will be processed differently, each is discussed separately.

This section uses the terms "inventory" and "projection." Inventory is the volume of waste as of December 31, 1993. The 5-year projection covers the waste generation period from January 1, 1994 to December 31, 1998.

1. HIGH-LEVEL WASTE

At the Hanford Site, waste in single- and double-shell tanks consists of HLW, TRU waste, and mixed LLW. However, the tanks are managed as if they contain HLW and are reported in the high-level category.

The inventory and 5-year projection for each double-shell tank waste stream are presented as a material balance in Table 1. The projections show that much of the dilute tank waste in storage will be reduced in volume by evaporation. To balance the waste in these tanks on December 31, 1998 to the Site's 1994 update to the *Integrated Data Base*, a new waste stream, "DST withdrawals to the Evaporator," has been added to the proposed site treatment plan database. The 5-year projection for this stream is reported as a negative number to match the output from the double-shell tank farms.

Table 1. Double-Shell Tank Waste 5-Year Material Balance (m^3).

FFCA waste stream name	Inventory 12/31/93	5-year transactions		Projection 12/31/98
		Inputs	Outputs	
PUREX aging waste	7,211	0		7,211
DST miscellaneous waste	44,823	40,364	78,864[a]	6,323
DST double-shell slurry feed	15,701	22,976		38,677
DST dilute complexed	3,373	1,855		5,228
DST concentrated phosphate	4,258	0		4,258
DST PFP TRU solids	269	299		568
DST complex concentrate	11,045	0		11,045
DST double-shell slurry	7,782	0		7,782
DST PUREX CRW solids	2,498	0		2,498
Total	96,960	65,494	78,864	83,590[b]

[a]Calculated by difference
[b]Value is consistent with the *Integrated Data Base*, Rev. 10
CRW = (fuel) cladding removal waste, DST = double-shell tank,
FFCAct = Federal Facilities Compliance Act, PFP = Plutonium Finishing Plant
TRU = transuranic
Note: The inventory of waste in single-shell tanks is reported as 136,600 m^3 in Table 2-5 of this report as of 12/31/94. Including drainable liquid, the volume would be 163,860 m^3 as of 12/31/93 and 138,600 m^3 without drainable liquid as of 12/31/93. This change is made to take credit for the pumping of drainable liquids from single-shell tanks to double-shell tanks. The 5-year projection for single-shell tanks, which reflect drainable liquid pumping, is -12,340 m^3.

2. MIXED TRU WASTE

A volume of designated mixed TRU waste at the Hanford Site is slightly more than 1 percent of the stored TRU waste volume. Designation for mixed waste has occurred only recently and is related to the Byproduct Material Rulemaking of 1987. About one-fourth of the TRU waste generated between January 1, 1987, and December 31, 1993, has been designated as mixed waste.

The total inventory of mixed TRU waste in the proposed site treatment plan database is presented in Table 2.

Table 2. Hanford Site Mixed TRU Waste Inventory.

Inventory as of December 31, 1992	180.097 m^3
Revisions/Corrections (+/-)	-0.196 m^3
Annual additions in Calendar Year 1993	8.363 m^3
Inventory as of December 31, 1993	189.097 m^3

The annual rate for 1993 is slightly more than the annual rate of 5.40 m^3 reported in the Westinghouse Hanford Company 1993 waste minimization report. The difference is because the waste minimization report covers only waste generated by Westinghouse Hanford; the proposed site treatment plan database also covers contributions from Pacific Northwest Laboratory.

Table 3 compares mixed transuranic waste inventories and projections between the proposed site treatment plan database and the Waste Isolation Pilot Plant No-Migration Variance Petition. The existing TRU waste inventory in the No-Migration Variance Petition is expected to be less than the inventory in the proposed site treatment plan database; this is reflected in Table 4. This is because the inventories in the No-Migration Variance Petition cover only the period to 12/31/88. Given the uncertainty of projections over several years, the projected quantities of mixed TRU waste in the proposed site treatment plan database are relatively consistent with the No-Migration Variance Petition.

A major difference between the detailed characterization data contained in the Mixed Waste Inventory Report, May 1994 and the No-Migration Variance Petition is the waste descriptions and associated contaminants. The waste descriptions and contaminants for both are presented in Table 5. The Mixed Waste Inventory Report database includes many more waste types and contaminants. This is because the data for the No-Migration Variance Petition were based on specific, continuous sources of mixed waste. The Mixed Waste Inventory Report database also covers debris and failed equipment from maintenance and cleanup activities. This waste is generated infrequently, in some cases only once.

Table 3. Data Comparison between the Proposed Site Treatment Plan Database and the Waste Isolation Pilot Plant No-Migration Variance Petition.

m3/yr Existing Inventory (mm3)		Annual Average Projection (	
PSTP[a]	WIPP No Mitigation Petition Variance	PSTP[a]	WIPP No Mitigation Petition Variance
mid 87 to 12/31/93	through 12/31/88	1/1/94 to 12/31/2023	1988 to 2013
189.10	25	21.6	11.12

PSTP = Proposed Site Treatment Plan Database.

Inventories of mixed remote-handled TRU waste are not presented in either the proposed site treatment plan database or the No-Migration Variance Petition. No remote-handled TRU waste has been received for storage since the Washington State Department of Ecology received authorization to regulate the RCRA components of mixed waste at the Hanford Site (November 23, 1987). In addition, projections of remote-handled TRU waste have not been reported to either the proposed site treatment plan database or the No-Migration Variance Petition.

3. MIXED LOW-LEVEL WASTE

Mixed LLW at the Hanford Site encompasses the following:

- Mixed waste in storage under the cognizance of Westinghouse Hanford Solid Waste Programs
- Small amounts of mixed waste that are stored by generators.

Waste storage by generator accounts for only 11.141 m^3 of the mixed LLW inventory. Of the waste under the cognizance of Westinghouse Hanford Solid Waste Programs, only one waste stream is a "direct process"[1] waste stream. This waste is solidified, dewatered fuel fabrication sludge and is commonly known as "183-H basin waste." The other waste streams under Westinghouse Hanford Solid Waste Programs are "less proximate to the physical processes of producing or utilizing special nuclear material,"[1] therefore they are organized by treatability groups in the proposed site treatment plan database.

[1]Supplemental information to the Byproduct Material Rulemaking, May 1, 1987. The updated reference mixed LLW inventory is presented in Table 5. The inventory excludes contributions of those waste streams regulated under the Toxic Substance Control Act.

Table 4. Mixed Transuranic Waste Description Comparison.

Waste Isolation Pilot Plant sNo-Migration Variance Petition		Mixed Waste Inventory Report Database	
Waste Description	Chemical Contaminants	Waste Description	Chemical Contaminants
Organic cleanup of solvent extraction system and analytical laboratory waste	Xylene	Clean-up activities Maintenance activities Spent equipment Miscellaneous inorganic spent materials Contaminated soil Contaminated adsorbents Lead acid batteries packaged with soil or absorbent Drained spent lead acid batteries contaminated with Mercury Radioactive contaminated lead packaged with soil and various solid debris Lead glass packaged with various solid debris Cellulose material Plastic Rubber Cloth	Lead chromate TC-metals Sodium hydroxide Cadmium Phosphoric acid Sulfuric acid Mercury Beryllium Tri-chloro-ethene Methylene chloride PCB's (with other RCRA contaminants Lead
Neutralized rags used to clean PUREX and Plutonium Finishing Plant equipment	Sodium hydroxide		
Gloves containing lead shielding	Lead		

Table 5. Referenced Hanford Site Mixed Low-level Waste Inventory.

Referenced inventory as of December 31, 1992	3,102.005 m^3
Revisions/Corrections (+/-)	+0.420 m^3
Annual additions in Calendar Year 1993	773.260 m^3
Referenced inventory as of December 31, 1993	3,875.685 m^3

The total volume of mixed LLW waste received in 1993, including TSCA regulated waste, was 776.786 m^3. Of this amount, 464.135 m^3 were received from Westinghouse Hanford Company generators and 312.651 m^3 were received from offsite generators and Pacific Northwest Laboratory. The value of 464.135 m^3 is consistent with the value of 463 m^3 reported in the Westinghouse Hanford Company 1993 waste minimization report.

The 5-year projected generation of mixed LLW waste at the Hanford Site is 4,373 m^3.

The distribution of LLMW inventory by LDR technology is presented in Table 6. Direct process waste streams (fuel fabrication sludge) make up more than half of the mixed LLW inventory.

Table 6. Distribution of Hanford Site Mixed LLW Inventory.

Waste Stream Name or Category	Specified LDR Technology	Inventory, m3 (through 12/31/93)
Hexone	Stabilization	1.900
Alkali metal waste	Stabilization	8.500
PUREX canyon/storage tunnel lead waste	Encapsulation	0.561
PUREX storage tunnels silver waste	Encapsulation	0.170
PUREX storage tunnel mercury waste	Amalgamation	0.010
Solidified fuel fabrication dewatered sludge	Stabilization[a]	2,309.614
Homogeneous solids, soils, and labpacks with organic contaminants and metals	Thermal treatment plus stabilization	126.492
Homogeneous solids, soils, and labpacks with organic contaminants but no metals	Thermal treatment	329.545
Homogeneous solids, soils, and labpacks with metals but without mercury or organic contaminants	Stabilization	172.052
Homogeneous solids and soils with metals including mercury but without organic contaminants	Stabilization[b]	47.608
Debris	Stabilization	706.621
Elemental mercury	Amalgamation	1.450
Elemental lead	Encapsulation	169.514
Batteries	Encapsulation	1.648
Referenced Hanford Site Mixed LLW Inventory		3,875.685

[a]A major fraction of the solidified fuel fabrication dewatered sludge is a listed waste containing low concentrations of formic acid. A petition to waive the formic acid incineration LDR treatment standard using a demonstration of equivalent treatment is planned. Sampling and analysis of the waste are in progress in preparation of this petition.

[b]Inorganic homogeneous solids and soils contaminated with mercury will be treated by stabilization technology. Additional characterization of the waste will be performed to verify that the mercury concentration in the waste matrix is less than the regulated level of 260 mg/L. A treatability variance will be requested for residues and soils that exceed 260 mg/L.

APPENDIX B

COST AND SCHEDULE INFORMATION

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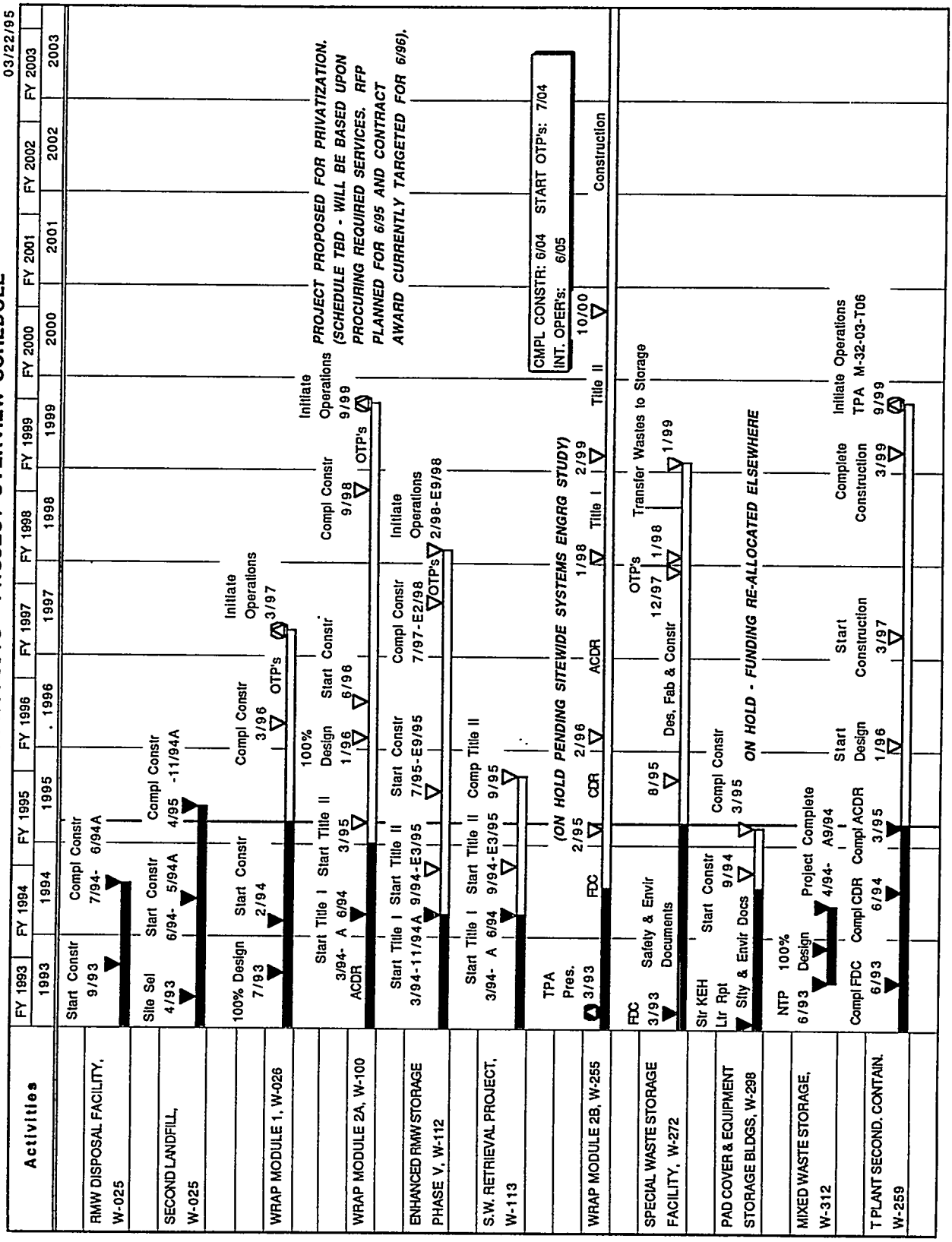
APPENDIX B

COST AND SCHEDULE INFORMATION

This cost and schedule information was provided to the U.S. Department of Energy-Headquarters, Office of Hanford Waste Management Operations (EM-36) at their request in February 1995. This action was part of the Federal Facility Compliance Act process. The purpose was to compile baseline cost and schedule requirements for future mixed waste treatment facilities on a national basis. Some portions have been updated to current status, while the majority represents a snapshot in time. Cost and schedule information is difficult to accurately freeze during this time of budget shortfalls and task reprioritization. This appendix includes data on Hanford Site planned mixed waste treatment facilities for currently stored and forecasted mixed waste. These facilities include the Waste Receiving and Processing Facility (WRAP 1), Waste Receiving and Processing Facility (WRAP 2A) or an equivalent commercial service for low-level mixed waste stabilization treatment, commercial thermal treatment, the 200 Area Liquid Effluent Treatment Facility, and Tank Waste Remediation System projects. This appendix is provided for information only.


WRAP & SOLID WASTE PROJECTS - PROJECT OVERVIEW SCHEDULE
03/22/95
Activities
FY 1993
FY 1994
FY 1995
FY 1996
FY 1997
FY 1998
FY 1999
FY 2000
FY 2001
FY 2002
FY 2003
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
RMW DISPOSAL FACILITY, W-025
Start Constr 9/93
Compl Constr 7/94- 6/94A
SECOND LANDFILL, W-025
Site Sel 4/93
Start Constr 6/94- 5/94A
Compl Constr 4/95 -11/94A
WRAP MODULE 1, W-026
100% Design 7/93
Start Constr 2/94
Compl Constr 3/96
OTP's
Initiate Operations 3/97
WRAP MODULE 2A, W-100
Start Title I 3/94- A 6/94 ACDR
Start Title II 3/95
100% Design 1/96
Start Constr 6/96
Compl Constr 9/98
OTP's
Initiate Operations 9/99
PROJECT PROPOSED FOR PRIVATIZATION. (SCHEDULE TBD - WILL BE BASED UPON PROCURING REQUIRED SERVICES. RFP PLANNED FOR 6/95 AND CONTRACT AWARD CURRENTLY TARGETED FOR 6/96).
ENHANCED RMW STORAGE PHASE V, W-112
Start Title I 3/94-11/94A
Start Title II 9/94-E3/95
Start Constr 7/95-E9/95
Compl Constr 7/97-E2/98
OTP's
Initiate Operations 2/98-E9/98
S.W. RETRIEVAL PROJECT, W-113
Start Title I 3/94- A 6/94
Start Title II 9/94-E3/95 9/95
Comp Title II
TPA Pres. 3/93
(ON HOLD PENDING SITEWIDE SYSTEMS ENGRG STUDY)
FDC 2/95
CDR 2/96
ACDR 1/98
Title I 2/99
Title II 10/00
CMPL CONSTR: 6/04 START OTP's: 7/04
INT. OPER's: 6/05
Construction
WRAP MODULE 2B, W-255
SPECIAL WASTE STORAGE FACILITY, W-272
FDC 3/93
Safety & Envir Documents 8/95
Des, Fab & Constr 12/97
OTP's 1/98
Transfer Wastes to Storage 1/99
PAD COVER & EQUIPMENT STORAGE BLDGS, W-298
Str KEH Ltr Rpt 3/93
Start Constr 9/94
Silty & Envir Docs
Compl Constr 3/95
ON HOLD - FUNDING RE-ALLOCATED ELSEWHERE
MIXED WASTE STORAGE, W-312
NTP 6/93
100% Design
Project Complete 4/94- A9/94
Start Construction 3/97
Complete Construction 3/99
Initiate Operations TPA M-32-03-T06 9/99
T PLANT SECOND. CONTAIN. W-259
Compl FDC 6/93
Compl CDR 6/94
Compl ACDR 3/95
Start Design 1/96

Data as of Date: 10/21/94

Operations Office: Richland

Option: RL-07

Description: Process, repackage as necessary for shipment to the Waste Isolation Pilot Plant (WIPP)

Treatment System No.: WP-S001

Treatment System Name: Waste Receiving and Processing (WRAP) Facility Module 1, Project W-026

Treatment Location: OnSite

Current Budget Impact: Currently under construction

Outyear Budget Impact: None.

For Approved Projects	For Unapproved Projects:
ADS#: RL-2220-1 LIP#: 91L-EWW-026	Date (or anticipated date) of Short Form Submittal:

Regulator Feedback:
This is currently TPA Milestone M-18-00 under the Hanford Site Federal Facility Agreement and Consent Order.

Receiving Site Feedback:

Receiving State Feedback:

Comments:
This facility is under construction and planned for operations by FY1996.

Data as of Date: 3/23/95 *DRAFT*

Operations Office: Richland

Option: RL-07

Description: Process, repackage as necessary for shipment to the Waste Isolation Pilot Plant (WIPP)

Option Costs by Fiscal Year

Fiscal Year		Operating 94 Dollars (K)	Capital 94 Dollars (K)	Included in Curent Planning Cycle Anticipated Baseline
Sunk Costs		$6,100	$2,700	
FY1992		$6,600	$7,400	
FY1993		$4,900	$21,800	
FY1994		$5,100	$17,700	
FY1995		$3,100	$4,000	
FY1996		$5,100		
FY1997*		$16,911		
FY1998		$13,950		
FY1999		$14,150		
FY2000		$14,450		
FY2001		$14,600		
FY2002**		$31,165		
FY2003		$31,165		
FY2004		$31,165		
FY2005		$31,165		
FY2006		$31,165		
FY2007		$31,165		
FY2008		$31,165		
FY2009		$31,165		
FY2010		$31,165		
FY2011		$31,165		
FY2012		$31,165		
FY2013		$31,165		
FY2014		$31,165		
FY2015		$31,165		
FY2016		$31,165		
FY2017		$31,165		
FY2018		$31,165		
FY2019		$31,165		
FY2020		$31,165		
FY2021		$31,165		
FY2022		$31,165		
FY2023		$31,165		
FY2024		$31,165		
FY2025		$31,165		
FY2026		$31,165		
FY2027		$31,165		
FY2028		$31,165		
FY2029		$31,165		
FY2030		$31,165		
FY2031		$31,165		
FY2032	D&D	$500		
	Totals	$1,040,411	$53,600	

* Combined startup and operations costs.

** FY2002 through FY2031 includes $3,300/FY CENRTC cost included in operating expense dollars.

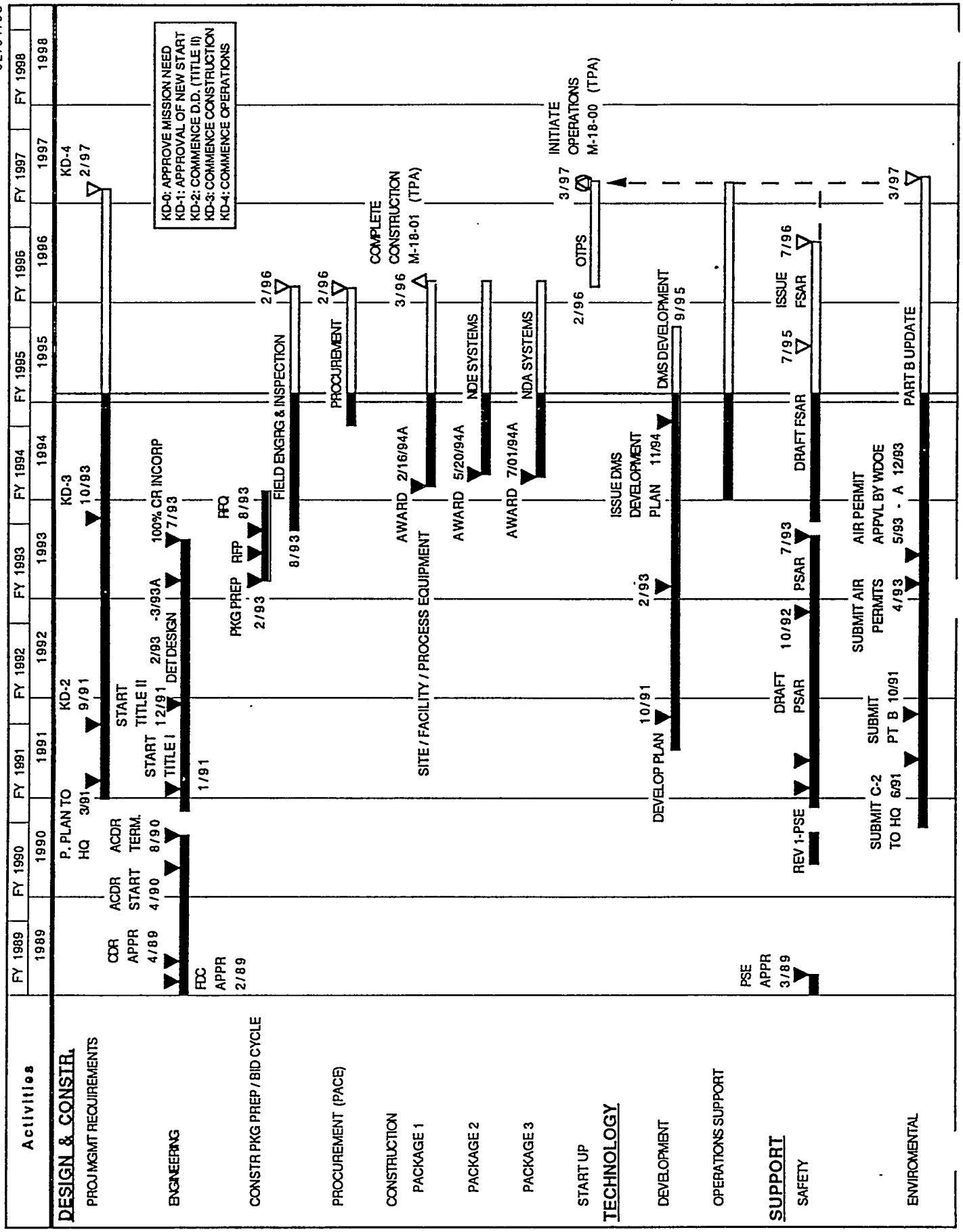
WRAP MODULE 1
(ESTIMATED SPEND PROFILE)
BUDGET AUTHORIZATION / BUDGET OUTLAY SCHEDULE ($000)

02/03/95

Description:	TOTAL COST	PRIOR YEAR	FY 1991				FY 1992				FY 1993				FY 1994				FY 1995				FY 1996				FY 1997			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Plant Engr Design & Insp	12140		2500/1800				4100/4680				2750/2600				2305/1234				485/1112				0/714							
Construction	35263						2900/0				18120/0				13131/9162				1112/21021				0/5080							
Construction Management	3996						100/90				500/270				1518/669				1878/1859				0/1108							
Procurement	468														468/0				0/200				0/268							
Project Management	1733		200/150				300/250				430/400				278/409				525/359				0/165							
TEC	53600		2700/1950				7400/5020				21800/3270				17700/11474				4000/24551				0/7335				0/0			
OPC	37600	2266	3941				6640				4883				5000				3100				7870				3900			
TPC	91200	2266	6641/5891				14040/11660				26683/8153				22700/16474				7100/27651				7870/15205				3900/3900			

NOTE: TPC Increase Incorporates CR#W-026-067 ($91.2M) and CR# W026-141 Rebaselining the TEC.

WRAP 1 SUMMARY SCHEDULE



Data as of Date: 10/21/94

Operations Office: Richland

Option: RL-03

Description: Treat mixed low-level waste

Treatment System No.: RL-S007

Treatment System Name: Waste Receiving and Processing (WRAP) Facility Module 2A, Project W-100

Treatment Location: OnSite

Current Budget Impact: Awaiting KD-2

Outyear Budget Impact:

For Approved Projects	For Unapproved Projects:
ADS#: RL-2230-1	Date (or anticipated date) of
LIP#: 94-D-411	Short Form Submittal:

Regulator Feedback:
This is currently TPA Milestone M-19-00 under the Hanford Site Federal Facility Agreement and Consent Order.

Receiving Site Feedback:

Receiving State Feedback:

Comments:
Plans are for this facility to be operational by FY1999.

WRAP MODULE 2A (W-100)

BASELINE (BA)/TARGET PROFILES

Total Project Costs (BA) ($K) (WRAP Module 2A)	Prior Years	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	Total Project Cost
Total Estimated Costs Baseline	$4,700	$9,700	$38,500	$25,900	$3,100	$0	$81,900
Other Project Costs Baseline	$21,000	$8,700	$7,000	$5,600	$7,700	$8,000	$58,000
BASELINE TOTAL	$25,700	$18,400	$45,500	$31,500	$10,800	$8,000	$139,900
TARGET TEC	$4,700	*$1,300	$0	$0	$0	$0	$6,000
TARGET OPC	$21,000	$546	$0	$0	$0	$0	$21,546

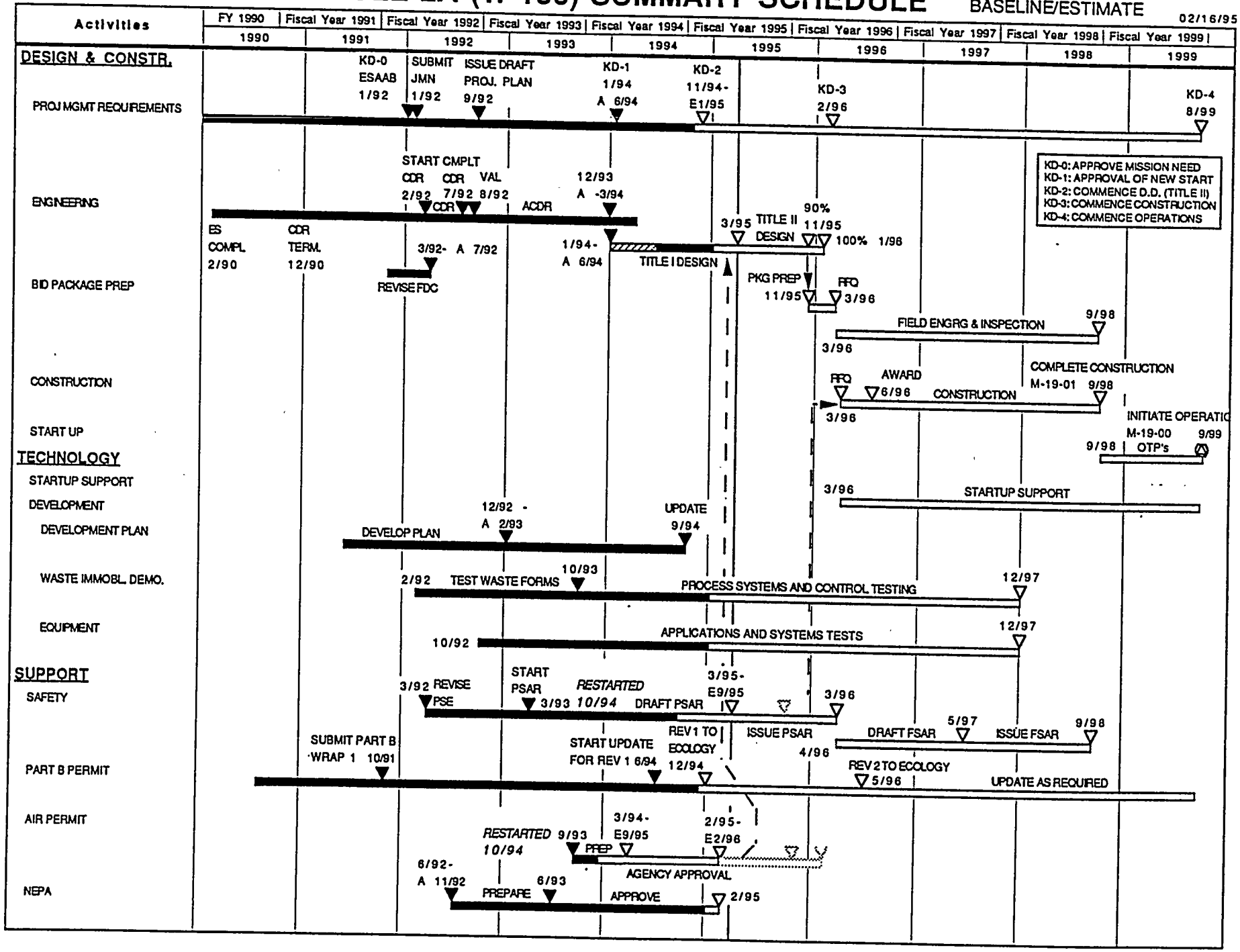
* **Termination costs estimated to be approximaely $1M.**

Status Date: 3/31/95

WRAP MODULE 2A (W-100) SUMMARY SCHEDULE

BASELINE/ESTIMATE

02/16/95



W-100 SUBPROJECT *
BASELINE
BUDGET AUTHORIZATION SCHEDULE ($000)

3/23/95

DESCRIPTION:	TOTAL COST		PRIOR YEAR 1	2	3	4	FY 1995 1	2	3	4	FY 1996 1	2	3	4	FY 1997 1	2	3	4	FY 1998 1	2	3	4	FY 1999 1	2	3	4
1.1 TITLE I DESIGN	4600		4400				200																			
1.2 TITLE III ENGR & INSP	0																									
2.0 CONSTRUCTION	0																									
3.0 PROJECT MANAGEMENT	400		300				100																			
3.1 A/E CONTRACT TERM.	1000						1000				0															
TOTAL ESTIMATED COST	6000		4700				1300				0				0				0				0			
OTHER PROJECT COST	21000		21000				0				0				0				0				0			
TOTAL PROJECT COST	27000		25700				1300				0				0				0				0			

* Schedule stopped at Title II.

Data as of Date: 10/21/94

Operations Office: Richland

Option: RL-08

Description: 200 Area Effluent Treatment Facility

Treatment System No.: RL-S005

Treatment System Name: 200 Area Effluent Treatment Facility

Treatment Location: OnSite

Current Budget Impact: Currently under construction

Outyear Budget Impact: None.

For Approved Projects	For Unapproved Projects:
ADS#: RL-2300-1	Date (or anticipated date) of
LIP#: 89-D-172	Short Form Submittal:

Regulator Feedback:
The state and EPA concur with this concept through the Hanford Federal Facility agreement and consent order.

Receiving Site Feedback:

Receiving State Feedback:

Comments:
The facility will provide wastewater treatment to comply with LDR limits for discharge to the ground.

Operations Office: Richland
Option: RL-08
Description: 200 Area Effluent Treatment Facility

Option Costs by Fiscal Year

Fiscal Year	Operating 94 Dollars (K)	Capital 94 Dollars (K)	Included in Current Planning Cycle Anticipated Target Budget
1994	12,776	250	yes
1995	22,712	150	yes
1996	25,267	4,150	yes
1997	26,205	4,100	yes
1998	26,075	4,100	yes
1999	27,987	3,200	yes
2000	28,651	100	yes
2001	28,650	500	n/a
2002	28,650	100	n/a
2003	28,650	100	n/a
2004	28,650	100	n/a
2005	28,650	4,500	n/a
2006	28,650	100	n/a
2007	28,650	100	n/a
2008	28,650	100	n/a
2009	28,650	100	n/a
2010	28,650	4,500	n/a
2011	28,650	100	n/a
2012	28,650	100	n/a
2013	28,650	100	n/a
2014	28,650	100	n/a
2015	28,650	2,500	n/a
2016	28,650	100	n/a
2017	28,650	100	n/a
2018	28,650	100	n/a
2019	28,650	100	n/a
2020	28,650	100	n/a
2021	28,650	2,000	n/a
2022	28,650	100	n/a
2023	28,650	100	n/a
2024	28,650	100	n/a
2025	28,650	100	n/a
2026	28,650	100	n/a
2027	28,650	500	n/a
2028	28,650	100	n/a
2029	28,650	100	n/a
2030	55,000	0	n/a
	1,055,523	32,850	

Data as of Date: 10/21/94

Operations Office: Richland

Option: RL-01

Description: PRETREATMENT AS NECESSARY, TREATMENT AT A HLW OR LLW VIT FACILITY

Treatment System No.: RL-S004

Treatment System Name: Hanford Waste Vitrification Plant (HWVP)

Treatment Location: OnSite

Current Budget Impact: New Line Item Required

Outyear Budget Impact: New Line Item Required

For Approved Projects	For Unapproved Projects:
ADS#: _____	Date (or anticipated date) of
LIP#: _____	Short Form Submittal: _____

Regulator Feedback:
This is currently TPA Milestone M-02-00, M-03-00, under the Hanford Site Federal Facility Agreement and Consent Order.

Receiving Site Feedback:

Receiving State Feedback:

Comments:
The initiation of operations for the HLW Vitrification facility and the LLW Vitrification facility is December 31, 2009 and June 30, 2005, respectively. The cost breakdown is $3.8 billion for the LLW Vitrification facility and $7.4 billion for the HLW Vitrification facility.

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Tank Waste Remediation System Program Sum

T·W·R·S
Tank Waste Remediation System

Cale

Activity	94	95	96	97	98	99	00	01	02	03	04	05	06	07
Manage Program														
Program Management	Establish Baseline	Draft Final TWRS EIS	Final TWRS EIS	Issue ROD										
Manage Tank Waste														
Store Waste in SSTs (149 tanks)		3/95 Establish Emergency Pumping Capability					9/00 Complete Interim Stabilization				11/04 Submit SST Closure Plan			
Store Waste in DSTs (28 tanks)														
Concentrate Wastes		9/94 DST Space Eval Rpt Annually		12/97 2 New Tanks - 200W	12/98 4 New Tanks - 200E									
Mitigate/Resolve Safety Issues		Restart 242-A Evaporator								12/04 Hot Startup of New Evaporator (Constructed as Part of LLW Pretreatment Facility)				
Upgrade Tank Waste Systems		9/94 Close USQ on Criticality	3/95 Install Perm. Mixer Pump in 101-SY	6/95 Complete Removal of 103-C Floating Organic		9/98 All USQs Closed for SSTs/DSTs		9/01 Complete Mitigation/Resolution of Safety Issues						
Retrieve Wastes		12/96 Complete AY/AZ Tank Farm Ventilation Upgrades		2/98 Complete Cross Site Transfer System				6/02 Complete DST Ventilation and SST/DST Instrumentation Upgrades		6/04 Complete Waste Transfer System Upgrades		6/05 Complete Tank Farm Upgrades		
Characterize Wastes		9/94 Develop SST Retrieval Tech	9/97 Complete Subsurface Barrier Testing & Evaluation	10/96 Start 106-C Retrieval	10/97 Initiate Full Scale Demo of Waste Retrieval	10/98 Start 101-SY Retrieval				12/03 Initiate Tank Waste Retrieval From One SST				
Store Cs/Sr Capsules (~1900 capsules)						9/99 Issue Tank Characterization Reports on All Tanks						Waste Sampling and Analysis as Requi		
Process Waste														
Pretreat Waste						Determine if Overpacked Capsules are Acceptable at Repository								
Immobilize HLW/TRU Waste														
Store & Transfer HLW/TRU Immobilized Waste														
Manage System Generated Waste														
Immobilize and Dispose LLW														
Disposition Solid Waste														
Disposition Liquid Waste														

Continue Storing Waste

Continue Receiving and Storing Waste

Continue Storing Capsules (in WESF or New Facility)

3/98 Determine if Advanced Sludge Separations Needed

11/98 Start Construction of LLW Pretreatment Facility (Cs/Sr Removal)

12/96 Initiate Def. Design of LLW Pretreatment Fac

06/01 Start Construction of HLW Pretreatment Facility

12/03 Complete Constr of LLW Pretreatment Facility

12/04 Hot Startup of LLW Pretreatment Facility

6/08 HLW

3/98 Comp. Eval of Enhanced Sludge Wash

9/98 Select Ref. Melter

11/98 Initiate Def. Design

6/02 Start Construction of HLW Vitrification Facility

12/97 Start Construction of LLW Vitrification Facility

6/96 Select Ref. Melter

2/98 Terminate Grout Program

12/03 Complete Constr LLW Vitrification Facility

6/05 Startup LLW Vitrification Facility

6/95 Submit Plan for Acquiring Facilities for Storing, Processing, and Storing Solid Waste Material

Acquire Facilities and Use

6/95 Startup 242-A Evaporator Condensate Treatment Facility

Tri-Party Agreement TWRS Major Milestone

Tri-Party Agreement TWRS Target Milestone

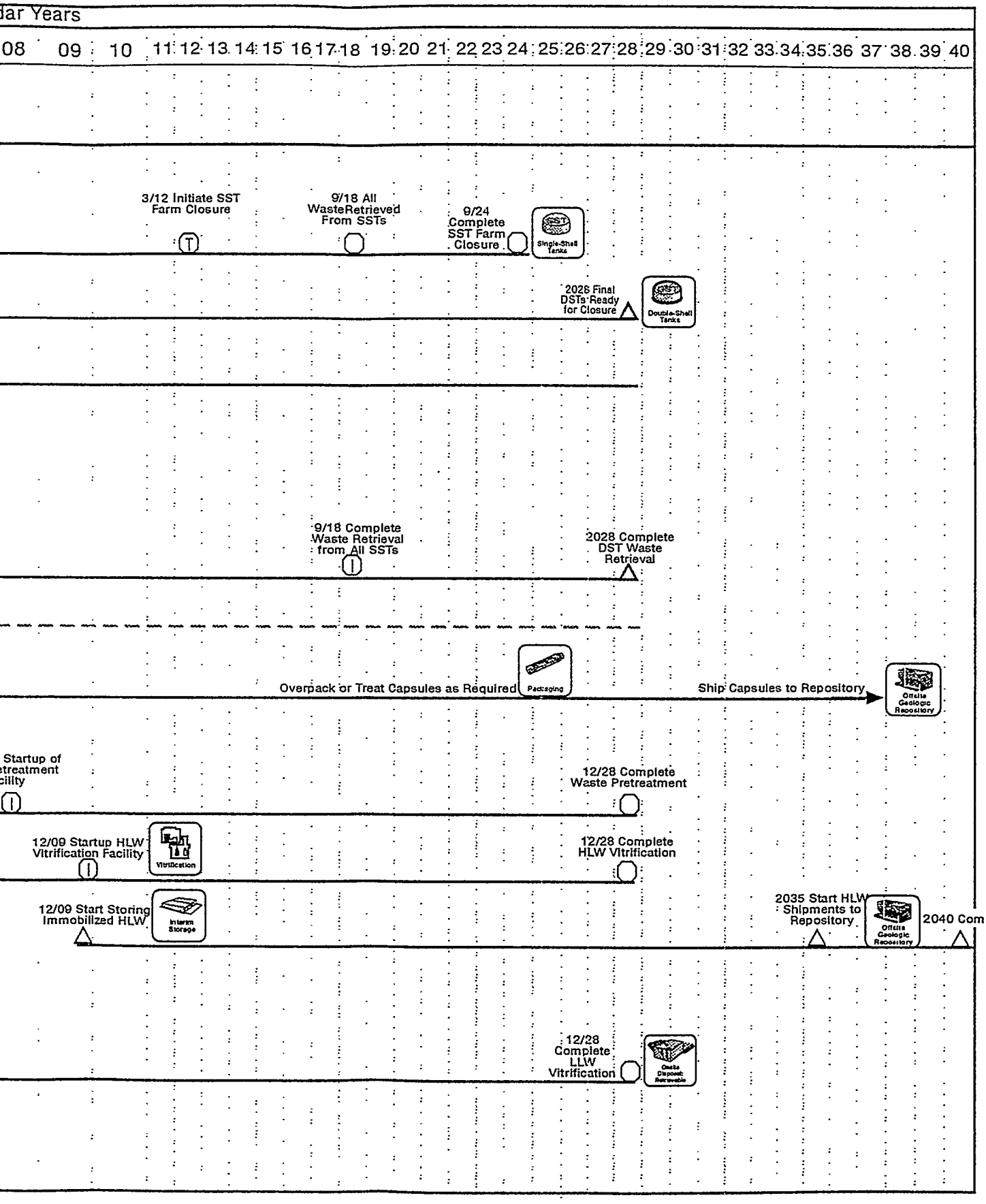
Tri-Party Agreement TWRS Interim Milestone

Non-TPA Milestones

nary Schedule — For Information Only — Draft

dar Years

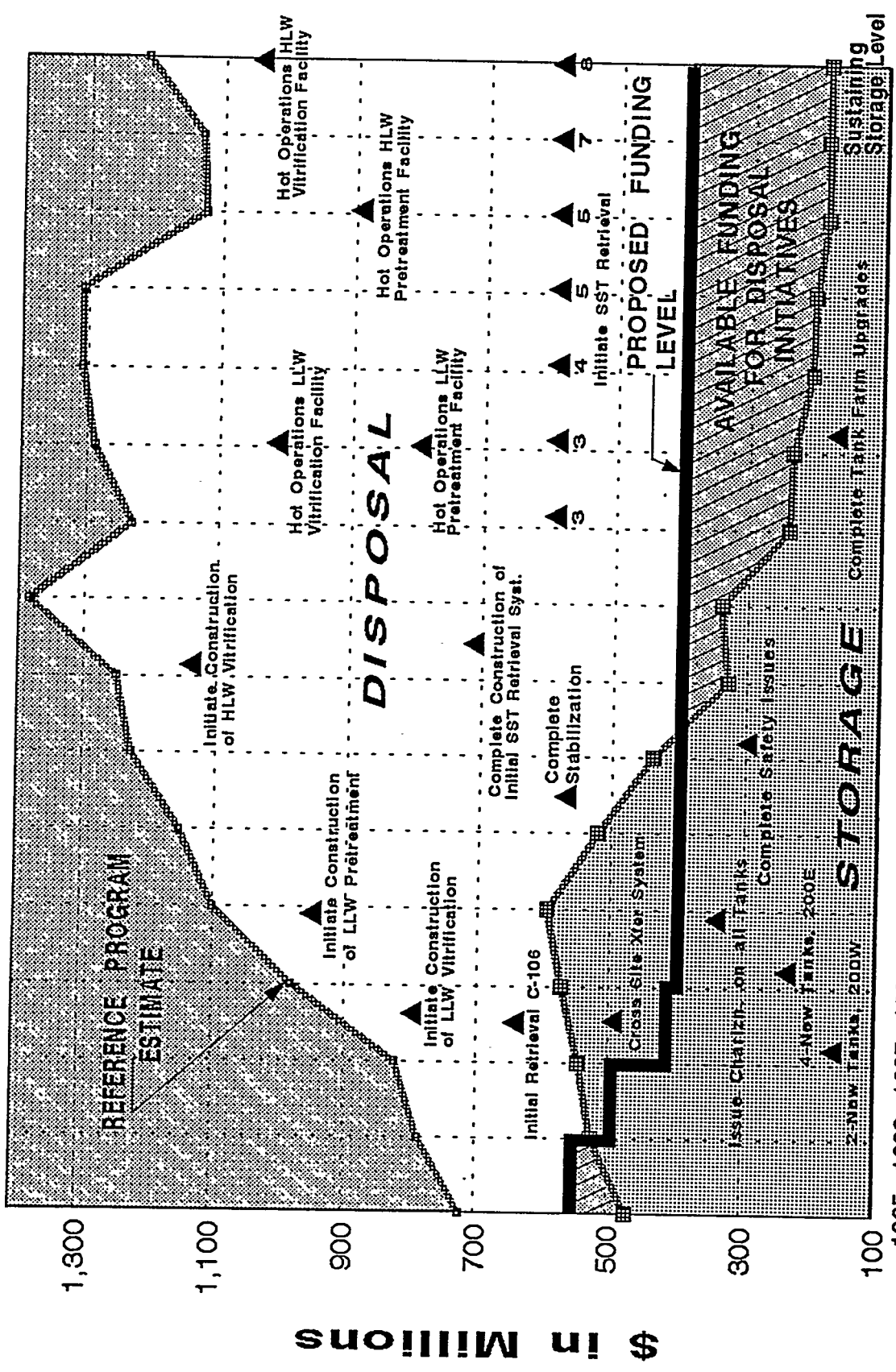
08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40



6/13/94 BTF100093.3b

TWRS REFERENCE PROGRAM ESTIMATE vs PROPOSED FUNDING LEVEL

FY 1995 - 2010



Tank Waste Remediation System
Technical, Cost, and Schedule Baseline

Program Element Cost Summary

WBS	Activity	Element	Amount ($K)
1.1.1.1	Manage Program Level III	Labor	695,130
		Mat'ls / Svcs	691,454
		Total	1,386,584
1.1.1.1.01	Program Management & Administration Level IV	Labor	695,130
		Mat'ls / Svcs	691,454
		Total	1,386,584
1.1.1.2	Manage Tank Waste Level III	Labor	5,791,876
		Mat'ls / Svcs	7,979,975
		Total	13,771,851
1.1.1.2.01	Tank Farm Operations Level IV	Labor	3,243,565
		Mat'ls / Svcs	1,823,670
		Total	5,067,235
1.1.1.2.02	Waste Tank Safety Level IV	Labor	181,893
		Mat'ls / Svcs	304,721
		Total	486,613
1.1.1.2.03	Tank Farm Upgrades Level IV	Labor	78,903
		Mat'ls / Svcs	1,658,335
		Total	1,737,238
1.1.1.2.04	Waste Tank Characterization Level IV	Labor	570,348
		Mat'ls / Svcs	507,563
		Total	1,077,911
1.1.1.2.05	Waste Retrieval Level IV	Labor	1,717,167
		Mat'ls / Svcs	3,685,687
		Total	5,402,853
1.1.1.3	Process Tank Waste Level III	Labor	7,656,941
		Mat'ls / Svcs	16,570,639
		Total	24,227,579
1.1.1.3.01	Waste Pretreatment Level IV	Labor	1,357,095
		Mat'ls / Svcs	2,364,152
		Total	3,721,247
1.1.1.3.02	Low Level Waste Level IV	Labor	2,930,286
		Mat'ls / Svcs	4,828,872
		Total	7,759,158
1.1.1.3.03	High Level Waste Level IV	Labor	3,369,560
		Mat'ls / Svcs	9,377,615
		Total	12,747,174

SUM_2.WK3 / GKH

TWRS Multi-Year Work Plan.

TBL7_SUM.WK3 / GKH

21-Feb-95

WBS		FUND TYPE	FY 95	FY 96	FY 97
1.1.1.1.01	Program Mgmt. & Administration	OE	47,066	46,565	43,640
1.1.1.2.01	Tank Farm Ops. & Maintenance	OE	143,406	159,172	162,260
		C/E	2,240	890	200
		Total	145,646	160,062	162,460
1.1.1.2.02	Waste Tank Safety	OE	49,015	57,207	63,910
		C/E	15,165	34,417	35,654
		Total	64,180	91,624	99,564
1.1.1.2.03	Waste Tank Upgrades	OE	37,281	27,993	28,179
		C/E	7,277	4,126	6,450
		GPP	5,596	6,527	6,703
		LI	83,666	146,131	176,343
		Total	133,820	184,777	217,675
1.1.1.2.04	Characterization	OE	77,761	86,694	65,887
		C/E	6,396	6,293	162
		Total	84,157	92,987	66,049
1.1.1.2.05	Waste Retrieval	OE	43,992	45,287	33,356
		C/E	3,334	956	474
		LI	15,449	14,957	30,679
		Total	62,775	61,200	64,509
1.1.1.3.01	Waste Pretreatment	OE	56,651	59,190	47,845
		C/E	5,538	453	93
		LI	0	0	22,783
		Total	62,189	59,643	70,721
1.1.1.3.02	Low Level Waste	OE	50,389	55,242	27,175
		C/E	703	300	338
		LI	0	0	16,697
		Total	51,092	55,542	44,210
1.1.1.3.03	High Level Waste	OE	16,718	21,081	27,483
		C/E	1,823	2,617	1,680
		LI	6,198	0	0
		Total	24,739	23,698	29,163
	Program Reserve	OE	58		
	Tank Waste Remediation Systems	OE	522,336	558,431	499,735
		C/E	42,476	50,052	45,051
		GPP	5,596	6,527	6,703
		LI	105,313	161,088	246,502
	TOTAL REVISED BASELINE BUDGET		675,721	776,098	797,991

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