1996 Hanford Site Report on Land Disposal Restrictions for Mixed Waste

D. G. Black

Date Published
April 1996

United States
Department of Energy

P.O. Box 550
Richland, Washington 99352

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96-SWT-108

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Mr. Douglas R. Sherwood
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Dear Messrs. Wilson and Sherwood:

COMPLETION OF HANFORD FEDERAL FACILITY AGREEMENT AND CONSENT ORDER MILESTONE
M-26-01F

Attached for your review are two copies of the DOE/RL-96-08, 1996 Hanford Site Report on Land Disposal Restrictions for Mixed Waste. This Land Disposal Restrictions Report is submitted to fulfill the Hanford Federal Facilities Agreement and Consent Order Milestone M-26-01F. The U.S. Department of Energy, Richland Operations Office would also welcome any comments you may have that may be applicable to the next annual update.

Should you have any questions regarding this subject, please contact
Joe Waring, on (509) 373-7687.

Sincerely,

George H. Sanders
Hanford TPA Administrator

WPD:KDB

Attachment

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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-26-01F. This milestone requires the preparation of an annual report that covers characterization, treatment, storage, minimization, and other aspects of land-disposal-restricted mixed waste management 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 the *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 sixth update of the plan first issued in 1990.

Tri-Party Agreement negotiations completed in 1993 and approved in January 1994 changed some milestones and added many new ones. Most of the changes were related to the Tank Waste Remediation System. 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, where available, a schedule for providing the characterization information 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), generator process knowledge necessary to identify the waste and make LDR determinations, quantities stored, generation rates, location and

¹Ecology, 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 U.S.C. 6901, et seq.

³*Atomic Energy Act of 1954*, as amended, 42 U.S.C. 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 planned or completed variances, treatment equivalencies, or time extensions necessary to achieve LDRs compliance.
- **Progress**—Identifies progress made in achieving compliance since the previous LDRs report.

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 the following:

- Nuclear fuel fabrication activities
- Process laboratory activities
- Equipment and structure cleaning and decontamination
- Process and storage unit closure
- 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 12,733 cubic meters per year to 24,858 cubic meters per year. These rates are for the years 2000 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 or 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 knowledge 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 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 is 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.

Total storage capacity for LDR waste at Hanford Site facilities is approximately 574,000 cubic meters. About 381,000 cubic meters of this capacity are in units such as SSTs that no longer actively receive waste. Approximately 255,700 cubic meters of waste are currently in storage. The DSTs are expected to be full by 1998 under the current planning baseline. To alleviate the space shortages, DST contents will be concentrated through the 242-A Evaporator. This has allowed DOE to indefinitely postpone the construction of new DSTs. The storage space currently available at the Central Waste Complex was anticipated to be filled in 1996; however, through the use of waste minimization techniques and better space management, this has been delayed until mid-1997. Also, a shift in programmatic requirements has postponed reaching the forecast waste volumes. (Volumes have not been reduced for outyears. Additional buildings will be constructed as required to store waste generated in the future. Additional storage space is currently under construction and is anticipated to provide 2,766 cubic meters of storage by January 1997.) The 242-A Evaporator processed 10,300 cubic meters of waste into the Liquid Effluent Retention Facility basins (included in total storage capacity) in 1995.

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 adjusting pH and adding corrosion inhibitors (DSTs), and using sorbents and solidifying agents (requisites placed on generators before receiving the waste into the Central Waste Complex). Surface decontamination (i.e., washing, grit blasting, CO₂ pellet blasting) is performed at T Plant facilities. Planned waste treatment processes include developing neutralization and toxic constituent destruction processes; developing waste separation, pretreatment, and stabilization processes (commercial facilities); 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 Facility 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 Hanford Facility from having to develop a site treatment
| plan. This exemption is supported by written exemptions from the Washington State Department
| of Ecology and the U.S. Environmental Protection Agency. Both agencies determined that this
| *Hanford Site Land Disposal Restrictions Report for Mixed Waste*, required by the Tri-Party
| Agreement, meets the requirements of a site treatment plan.

ACRONYMS AND ABBREVIATIONS

ALARA	as low as reasonably achievable
BDAT	best demonstrated available technology
BEMR	baseline environmental management report
CAW	current acid waste
CCW	constituent concentrations in waste
CCWE	constituent concentration in the waste extract
CERCLA	<i>Comprehensive Environmental Response Compensation and Liability Act of 1980</i>
CFR	<i>Code of Federal Regulations</i>
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	<i>Federal Register</i>
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
LBNL	Lawrence Berkeley National Laboratory
INEL	Idaho National Engineering Laboratory
LDR	land disposal restriction
LERF	Liquid Effluent Retention Facility
LLBG	low-level burial grounds
LLW	low-level waste

ACRONYMS AND ABBREVIATIONS (cont)

LSA	low specific activity
LSW	low-salt waste
MBP	mono-butyl phosphate
NA	not applicable
National Report	<i>National Report on Prohibited Wastes and Treatment Options</i> (DOE 1990)
NCAW	neutralized current acid waste
NCRW	neutralized cladding removal waste
NEPA	<i>National Environmental Policy Act of 1969</i>
ORNL	Oak Ridge National Laboratory
PCB	polychlorinated biphenyl
PFP	Plutonium Finishing Plant
PNNL	Pacific Northwest National Laboratory
PRF	Plutonium Reclamation Facility
PUREX	Plutonium-Uranium Extraction (Plant)
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
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	<i>Hanford Federal Facility Agreement and Consent Order</i>
TRU	transuranic
TRUEX	transuranic extraction
TRUPACT	transuranic package transporter
TRUSAF	Transuranic Waste Storage and Assay Facility
TSCA	<i>Toxic Substances Control Act of 1976</i>
TWRS	Tank Waste Remediation System
WAC	<i>Washington Administrative Code</i>
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 sixth 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, 1995, to March 31, 1996.

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 again 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 Facility Compliance Act of 1992* (FFCA). 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 FFCA process by providing data and cost information to support a complex-wide effort to prioritize treatment projects. This report includes an appendix with the treatment facility cost data as submitted to DOE-HQ and an appendix that contains site treatment plan inventory data prepared to support the FFCA.

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 major 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).

Washington State promulgated new regulations that affect designation of waste generated after November 20, 1995, [WAC 173-303-070(3)(a) and 173-303-070(5)]. Federal waste codes (e.g., D001) are assigned to a waste first, followed by state codes (e.g., WT01). The state code should not be assigned if it duplicates the federal code. (For waste generated before the effective date, but not treated or moved to a new storage location after the effective date, the state codes have not been removed.)

By passing the FFCA, 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 sites 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 results in the definition of 17 groups or streams of LDR waste. The 17 stream names used for this plan are shown in Table 1-1. Where a "stream" is actually in a storage unit, the waste streams that make up the storage unit are discussed in this report as applicable.

The 17 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) system and double-shell tank (DST) system waste retrieval and characterization and replacement of the grout treatment system with a 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 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.

RL has negotiated changes to the Tri-Party Agreement Milestones M-50-00 and M-60-00, described in the following paragraph, to allow for the privatization of Tank Waste Pretreatment and Low-Activity Waste Pretreatment and Immobilization. Change requests M-50-95-01 and M-60-95-03 were issued on December 15, 1995. They are currently in the approval process. These change requests will not affect the major milestones for the processing of tank waste by 2028. The Tri-Party Agreement milestone that provides for additional DST capacity (M-42-00) was delayed indefinitely by change request M-42-95-01, which was approved December 1, 1995. This change request changes the due date for M-42-00 from December 31, 1998, to "TBD" and deletes all supporting uncompleted M-42 interim milestones and target dates.

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).
- 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) required 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 required commencement of local commercial laboratory operations in October 1995 and this milestone was met.
- Complete Waste Receiving and Processing (WRAP) Facility, Module 1, construction and initiate operations by June 1997 (M-18-00).
- Complete WRAP Facility, Module 2A, construction and initiate operations by September 1999 (M-19-00). 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.
- Complete closure of the non-permitted mixed waste units in the 324 Building Radiochemical Engineering Cells (REC) B Cell, REC D Cell, and the HLV (M-89-00). A date for completion of this milestone will be established immediately following Ecology approval of the REC/HLV closure plan (M-20-55).
- Complete removal of the 324 Building HLV tank mixed waste, with the exception of residues that may remain following flushing and draining to the extent possible, by October 31, 1996 (M-89-01).
- Complete removal of 324 Building Radiochemical Engineering Cells (B Cell) mixed waste and equipment by May 31, 1999, (M-89-02).

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 will be available to support DST and SST waste disposal activities.

- 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 deactivation, no new PUREX aging waste, PUREX process condensate, or PUREX ammonia scrubber waste will be generated. As part of the cleanup activities in PUREX, waste may be sent to aging waste tank storage. In calendar year (CY) 1995, no waste was transferred to the aging waste tanks.
- Liquid waste from SSTs will continue to be transferred to DSTs as part of the stabilization program for the SSTs.
- Liquid effluents from tank waste pretreatment and vitrification will be treated in the 200 Area ETF.

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. No new milestones are proposed in this report for this reporting period.

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 milestone review meetings.

1.5 ACTIVITIES AND ACHIEVEMENTS

This section summarizes major activities and accomplishments related to compliance with LDRs from about April 1, 1995, through March 31, 1996.

- Completed processing of 10,300 cubic meters of process condensate into the Liquid Effluent Retention Facility (LERF) basins from the 242-A Evaporator. The evaporator was restarted in April 1994 after upgrades were completed.
- The 200 Area ETF started hot operation in November 1995. The ETF treats process condensate stored and treated in the LERF.

- Numerous local and complex-wide activities related to the FFCAct of 1992 were completed in 1995. The Mixed Waste Inventory Report update was prepared and issued. 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.
- Completed readiness review of Project W-025A, the 218-W-5, T-34 trench and received all documentation to start operations of T-31, 218-W-5. Because of the F039 waste code potentially applicable to the leachate from the trenches, any leachate collected after operations commence may have to be sent to the DST system TSD unit or the 200 Area ETF.
- Eleven additional submarine reactor compartments were received for storage in the 200 West Area, bringing the total to 54.
- WRAP Module 1, Project W-026, Tri-Party Agreement Milestone M-18-00 is being prepared for operational readiness review. Construction of WRAP 1, 2336-W, is currently on schedule (in accordance with the revised 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 x 2.8 m, 0.9 m x 1.2 m x 1.8 m) were shipped in the spring of 1995. A final box was shipped in May 1995. The boxes contained a small heat-exchanger, a cold trap, a steel hot trap, and two stainless steel tanks from other Hanford Site operations.
- On May 9, 1995, a manifest discrepancy notification was provided to Ecology. The CWC received two containers of waste from Lawrence Berkeley National Laboratory (LBNL) that had contents other than those stated on the manifest. The manifest discrepancies included the following:
 - Physical properties. Solids were present, but only liquids were reported.
 - Chemical properties. Field analysis indicated constituents that were not included in the waste codes listed on the manifest.

On May 15, 1995, Ecology issued a voluntary compliance letter to WHC. The letter referenced alleged noncompliances of WAC 173-303 in acceptance and storage of potentially incompatible waste types in the CWC. The voluntary compliance letter cited eight corrective actions to be completed within 90 days. All corrective actions were completed on time. (See Section 3.12.3.4 for additional details about this waste.)

- In March 1996, a draft occurrence report was received from LBNL indicating the possibility that mixed waste was buried as low-level waste in the Low-Level Burial Grounds on the Hanford Site's 200 West Area. Apparently, this waste was buried improperly because the contents of the waste packages were misrepresented by the LBNL. All indications are that the waste presents no imminent danger to personnel safety or the environment. Further evaluation will be required and the occurrence report will be updated as more information becomes available.
- A contract was awarded to Allied Technology Group, Inc. for the treatment of CWC waste that requires thermal treatment and currently are in storage or are projected for receipt. Treatment must begin by the year 2000.
- The decision was made to privatize the proposed WRAP 2A facility (M-19-00). A solid waste stabilization contract that meets the requirements of M-19-00 is scheduled for award in June 1996, with treatment scheduled to begin September 30, 1999.
- Construction began on Project W-112, "Enhanced Radioactive and Mixed Waste Storage Facility, Phase V." Construction is scheduled for completion in January 1997. The facility comprises three buildings with a total compliant storage capacity of about 2,800 cubic meters.
- All mixed waste was removed from the 303-K facility in fiscal year (FY) 1994. The 303-K facility closure plan was revised and transmitted to Ecology in July 1995.
- The ongoing cleanout of B Cell in the 324 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 series of milestones was established. The milestones 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, completion of a clean closure feasibility study and submittal of a closure plan for the waste management units. A feasibility study for clean closure and a closure plan (PNNL 1995) were submitted to satisfy M-89-04 and M-20-55, respectively. The feasibility study was not formally published. In addition, a compliance agreement was negotiated to address the compliance of 324 REC and HLV units with regulatory requirements. Based on this agreement, the units are in compliance with interim-status facility standards, which satisfied Milestone M-89-03. Equipment was procured to process HLV tank waste under Milestone M-89-02.
- Thirty tank characterization reports for high-level waste tanks were completed in accordance with Milestone M-44-08. Core samples have been taken from 116 of the 177 DSTs and SSTs.

- 242-A Evaporator Campaign 95-1 was completed, reducing the waste volume by 8.18 million liters
- The cross-site transfer of 1.65 million liters of tank waste from DSTs in the 200 West Area to DSTs in the 200 East Area was completed. This waste originated from saltwell pumping of SSTs.
- Work continues on the RCRA DST Part B Permit Application. During 1995, workshops were held with the Washington State Department of Ecology (Ecology) on the *DST Waste Analysis Plan*, Chapter 7, "Contingency Plan" and its appendix, "Tank Farms Building Emergency Plan," Chapter 8, "Personnel Training," and its appendix, "Tank Farms Dangerous Waste Training Plan," and Chapter 13, "Other Relevant Laws." Notices of deficiency relating to these chapters were tentatively closed out pending incorporation of changes into the DST Part B Permit Application.
- Removal of concentrated (recovered) 203-A nitric acid at PUREX (M-80-00-T04) was completed in November 1995. This milestone involved shipping recovered nitric acid to England for reuse instead of disposing of it as dangerous waste.

Table 1-1. Stream Names for the *Hanford Land Disposal Restrictions Plan for Mixed Wastes*. (3 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 ^a	Waste sodium from FFTF operations, now at the CWC.
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 solids retrieved from 100H Area solar evaporation basins generated from 300 Area fuel fabrication wastes, 1973 to 1985. Additional waste was generated from closure of the basins.

**Table 1-1. Stream Names for the *Hanford Land Disposal*
Restrictions Plan for Mixed Wastes. (3 sheets)**

Stream name	Waste source
10. PUREX Storage Tunnel Waste a. mercury b. lead c. silver d. cadmium e. Chromium f. Barium g. Selenium	Mercury sealed in discarded PUREX fuel dissolvers (Tunnel 2) Lead from discarded equipment and shielding (Tunnels 1 and 2) Silver from discarded silver reactors (Tunnel 2) Cadmium associated with shielding and moderators (Tunnel 2) Chromium as corrosion byproduct (Tunnel 12) Dispersible debris from 324 Building Waste Dispersible debris from 324 Building Waste
11. PUREX Containment Building	Discarded lead and cadmium shielding and weights; chromium- and cadmium- contaminated debris from E Cell floor.
12. Central Waste Complex Stored Low-Level, Transuranic, and PCB Waste	Onsite and offsite solid wastes from many generators, primarily from routine operations after 1987.
13. Excavated Suspect-Transuranic and Transuranic Waste and Other Regulated Low-Level Burial Ground Waste (inventory) ^a	Containers of contaminated debris generated on site and off site up to 1987.
14. 224-T TRUSAF Stored Waste	Transuranic waste from onsite and offsite, packaged for eventual WIPP disposal.
15. 303-K Stored Waste ^a	Temporary storage of 300 Area fuel fabrication solid and liquid wastes. (Facility undergoing closure.)
16. 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.

Table 1-1. Stream Names for the *Hanford Land Disposal Restrictions Plan for Mixed Wastes*. (3 sheets)

Stream name	Waste source
17. 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.

*Waste stream no longer being generated.

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

CWC = Central Waste Complex

DST = Double-shell tank.

FFTF = Fast Flux Test Facility.

HLV = High-Level Vault

PCB = Polychlorinated biphenyl.

PPF = 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.

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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 Facility. It also discusses the variances, surface impoundment exemptions, treatment equivalency petitions, and time extensions required to manage this waste within the requirements established by the Tri-Party Agreement, FFCAct, and 40 CFR 268.

2.1 WASTE GENERATION

The projected volumes of 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 in the following list.

- 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 the quantity of mixed waste that will be added to TSD 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 1996. 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 or contained-in determinations may 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

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 as necessary until the waste is disposed of. 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 waste stream. The assigned dangerous waste codes are based on the generation process and analyses of the waste streams. Dangerous waste, as defined by Washington State regulations, encompasses more waste types than are covered under the federal hazardous waste program. Therefore, in some cases, the waste designations will include federal and state-only waste codes based on the best available information. Future waste characterization and complete implementation of the WAC 173-303 amendments may show that additional or fewer waste codes are applicable to a waste stream. Any changes resulting from future characterization will be included in updates to this report. Washington State-only information is included in this report for completeness only because state-only LDRs are not subject to the RCRA statutory requirements.

The waste stored in the SSTs and DSTs, and the silver nitrate waste stored in PUREX Tunnels 1 and 2 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 them reacting with other materials.

The F001 through F005 waste codes (spent halogenated and nonhalogenated solvents) have been assigned to the SST- and DST-system waste, not because the waste contains significant quantities of spent solvents, but because of the mixture rule from the introduction of spent solvents. The past discharges of spent solvents to SSTs and DSTs and resultant tank-to-tank transfers have mixed 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 Hanford Facility waste designated F001 through F005. The SST and DST waste is primarily inorganic in nature with trace contamination by F001 through F005 solvents.

The F039 waste code was added to the DST, LERF, 242-A Evaporator, Low-Level Burial Ground, CWC, WRAP Module 1 and other Hanford Facility TSD units' 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. The 200 Area ETF can delist F039 waste streams if they are only derived from F001 through F005 sources. Currently, no F039 waste is being generated or stored at the Hanford Facility.

Washington State promulgated new regulations that affect designation of waste generated after November 20, 1995 [WAC 173-303-070(3)(a) and 173-303-075(5)]. First, federal waste codes (e.g., D001) are assigned to a waste, then state codes are assigned (e.g., WT01). The state code should not be assigned if it duplicates a federal code. (For waste generated before the effective date, but not treated or moved to a new storage location after the effective date, the state codes have not been removed.)

The schedule and means for reporting waste characterization data are outlined in the Tri-Party Agreement (Ecology et al. 1992) as amended by 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 216 days for SST analyses, 176 days for hot cell analyses, and 126 days for low-level and mixed waste. (All time limits are computed from the date of sampling.)

2.3 WASTE STORAGE

The Hanford Facility has 17 streams, as defined by this report, that currently are stored in TSD units. These streams can be divided into two groups: 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, excavated suspect-TRU and TRU waste and other regulated low-level burial ground waste, the 303-K Facility, 324 Building REC, and 324 Building HLV) and 6 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 PUREX storage tunnels, the PUREX containment building, the CWC, and the 224-T Transuranic Waste Storage and Assay Facility [TRUSAF]). The key characteristics of these waste streams are summarized in Table 2-4.

The storage unit capacity for solid 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). 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 as needed.

The ETF has started treating the process condensate stored and treated in the LERF. The LERF has been granted a treatment exemption that allows the 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 consolidate and evaporate DST waste, which will postpone the projected date that the DSTs are filled to capacity to after 1998. This will allow for their continued use for waste storage until after 1998. Change request M-42-95-01, which changes the Tri-Party Agreement Milestone M-42-00 (providing for additional DST capacity) due date to "TBD" and deletes all supporting uncompleted M-42 interim milestones, was approved December 1, 1995. This change request postpones the construction of new DSTs indefinitely.

Except for the SST system 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. Although the amount of hazardous constituents released from the 183-H Solar Basins has not been estimated, the data evaluation report for this unit characterized the soil contamination associated with the release.

The latest 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, 1995, the Hanford Site stores approximately 255,700 cubic meters of radioactive mixed waste. The bulk of this waste (96.3 percent) is stored in the SSTs (53.4 percent) and DSTs (29.0 percent), and LERF (13.9 percent). The table also indicates how much waste is LLW, TRU waste, or HLW.

2.4 WASTE TREATMENT

The LDRs apply to each type of 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 types to which technology-based standards apply must be treated 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) unless 40 CFR 268.9(a) applies. 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 certain 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 Facility waste; discussions of the following waste streams 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 Tunnels Waste (Chapter 3.0, Section 3.10)
- PUREX Containment Building Storage (Chapter 3.0, Section 3.11)
- CWC Stored LLW, TRU Waste, and PCB Waste (Chapter 3.0, Section 3.12)
- Excavated Suspect-TRU and TRU Waste and Other Regulated Low-Level Burial Ground Waste (Chapter 3.0, Section 3.13)
- 224-T Transuranic Waste Storage and Assay Facility (TRUSAF) Stored Waste (Chapter 3.0, Section 3.14)
- 303-K Stored Waste (Chapter 3.0, Section 3.15).
- 324 REC Waste (Chapter 3.0, Section 3.16)

- 324 HLW Waste (Chapter 3.0, Section 3.17).

The applicable treatment standards (required by 40 CFR 268 and WAC 173-303-140) and the proposed treatments for the Hanford Facility 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.

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 and thermal treatment and vitrification of SST and DST waste, are planned to be privatized.

The Tri-Party Agreement specifies the required dates for construction and startup of, 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 an 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 at the Hanford Facility. Figure 2-2 depicts the DST separation, treatment, and disposal processes.

Several Hanford Facility TSD units 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 generated and 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, is being 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. Waste has not been introduced into the SST system since 1980; no additional waste will be generated and stored in the SST system.

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) until the 200 Area Effluent Treatment Facility (ETF) treats the waste for disposal via delisting. The ETF destroys organic constituents and cyanides and removes radioactive and certain inorganic constituents. The ETF treats the process condensate and in the future will treat other waste streams to allow discharge to the ground. A petition was submitted to delist the process condensate after it is treated. The EPA finalized this petition on June 13, 1995, in 60 FR 31115, allowing properly treated waste to be delisted at the ETF. The EPA issued a letter in December 1994 stating that the waste treatment in LERF was consistent with the LDR treatment specified in 40 CFR 268. This has allowed 242-A Evaporator process condensate waste to remain in the LERF until final treatment at the ETF.

2.4.5 4843 Sodium Storage Facility Waste

The 4843 Sodium Storage Facility TSD unit presently is not receiving additional mixed waste. Forty-four drums of alkali metal mixed waste were shipped from the 4843 Sodium

| Storage Facility to the CWC on December 16, 1994. Three U.S. Department of Transportation (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) were shipped in the spring of 1995. The boxes contain a small heat-exchanger, a cold trap, a steel hot trap, and two stainless steel tanks from other Hanford Site operations. 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. No additional 4843 Sodium Storage Facility waste is expected to be generated.

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 of in a crib. The remaining ammonia scrubber waste was transferred to the DST system.

| 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 in the DST system.

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 Hexone Storage and Treatment Facility 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 offsite 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 spent distillation vessels. A closure plan has been submitted to Ecology, and the Hexone Storage and Treatment Facility 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 Solar Evaporation Basins storage and treatment unit. The contaminants and residues remaining in the unit were placed in containers and transported to the CWC for storage. The waste will be treated at a proposed commercial facility and disposed of in a near-surface disposal unit at the Hanford Facility. The required treatment technology for formic acid is combustion and cyanides must be destroyed. A treatment equivalency petition was submitted to EPA on October 17, 1995, to address the combustion treatment standard. (The total amount of formic acid was 1 kilogram diluted in 9,500 cubic meters total waste volume.) Soil and debris waste also are 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, mercury, silver, cadmium, chromium, barium, and selenium waste stored in the PUREX tunnels and lead, chromium, and cadmium solid waste stored in the PUREX Containment Building. The specified treatment for radioactive lead solids not used as lead shielding is macroencapsulation. The required treatment for mercury waste is amalgamation or retorting and recovery. Any treatment that achieves the constituent concentration limits of less than 5.0 milligrams per liter is acceptable for the silver waste. Any treatment that achieves the constituent concentration limits of 1.0, 5.0, 100, and 5.7 milligrams per liter are acceptable for cadmium, chromium, barium, and selenium waste, respectively, in accordance with 40 CFR 268.40. PUREX tunnels are receiving 324 Building waste. PUREX Containment Building waste may be generated during PUREX deactivation activities.

2.4.11 Central Waste Complex Stored Low-Level, Transuranic, and Polychlorinated Biphenyl Waste; 224-T TRUSAF Stored Waste; and Excavated Suspect-Transuranic, Transuranic, and Other Regulated LLBG Waste

Waste stored in the CWC consists of low-level and TRU mixed waste, some of which is co-contaminated with PCBs. The excavated 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 proposed commercial replacement for the terminated WRAP Module 2A facility. Excavated suspect-TRU and TRU waste is primarily contained in 0.21-cubic-meter drums, metal boxes, wood boxes, and fiberglass-reinforced plywood boxes. They are located in various configurations in the Low-Level Burial Grounds. After excavation, the waste will be processed/treated for permanent disposal. The proposed treatment methods comply with 40 CFR 268 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. Table 2-7 shows which treatment facilities or methods are applicable various categories of solid waste.

2.4.12 303-K Stored Waste

All mixed waste has been removed from the 303-K building. 303-K is awaiting closure. Current plans are to include the 303-K closure plan in Modification C of the Hanford Facility RCRA 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 (deactivated 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 1995, more than 74 percent of the floor area had been cleared of potentially dispersible mixed waste. This dispersible waste was consolidated and containerized within B-Cell. Some has been shipped to permitted storage at the PUREX storage tunnels. 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 mixed waste in FY 1994. An Ecology-supported treatment alternative is being pursued to reduce the radioactivity to contact-handled limits that would allow the waste to be consolidated with other Hanford Facility waste and recover strontium for medical isotope use. The waste solutions will be transferred to D Cell in the REC where after treatment the remaining mixed waste can be sent to the permitted Hanford Facility storage units.

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 underutilization of raw materials found in the waste stream, management of the waste generated, waste disposal, and 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 regularly. 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.
- Where allowed by regulation, mixed waste is treated to remove the dangerous constituents.
- Where allowed by regulation, corrosive materials are neutralized to remove their corrosive characteristics or are packaged in a manner that ensures the 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 2-8 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 ETF reduces the volume of process condensate designated as dangerous waste by more than 99 percent.

Next to the 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. In 1995, a new system that recycles some of the process condensate was installed at the 242-A Evaporator. With the new system operating, only about 13 liters of process condensate are generated for every 11 liters that the DST volume is reduced.

The waste currently stored at the CWC will be processed at one of the WRAP facilities (described in Chapter 3.0, Section 3.12) or in commercial entities 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 *1994 Annual Report on Waste Generation and Waste Minimization Progress as Required by DOE Order 5400.1, Hanford Site* (DOE-RL 1995).

2.6 VARIANCES, SURFACE IMPOUNDMENT EXEMPTIONS, EQUIVALENT TREATMENT PETITIONS, 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, surface impoundment exemptions, equivalent treatment petitions, 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 and/or applicable regulations.

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 following:

- 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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F2-1.1

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

DOE/RL-96-08

FEDERAL FACILITY AGREEMENT AND CONSENT ORDER

ACTION PLAN WORK SCHEDULE

DOE/RL-96-08

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

FEDERAL FACILITY AGREEMENT AND CONSENT ORDER

ACTION PLAN WORK SCHEDULE

MILESTONE LEGEND MAJOR ☒ TARGET DATE ☐ INTERIM ☐ INTERVENTION ☐	CY 1996												CY 1997				1998	1999	2000	2001	2002
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1 QTR	2 QTR	3 QTR	4 QTR					
M-42-00 MITIGATE/RESOLVE TANK SAFETY ISSUES FOR HIGH PRIORITY WATCH LIST TANKS SEPTEMBER 2001																					
M-42-01 COMPLETE TANK 241-C-101 LOW-SPEED MIXER PUMP TEST																					
M-42-02 UPGRADE TEMPERATURE MONITORING CAPABILITIES IN FERROCENIDE TANKS																					
M-42-02A DEVELOP CRITERIA FOR UPGRADED TEMPERATURE MONITORING CAPABILITIES IN FERROCENIDE TANKS																					
M-42-02B INSTALL SIX NEW THERMOCOUPLES																					
M-42-03 PERFORM VAPOR CHARACTERIZATION FOR ALL FERROCENIDE WATCH LIST TANKS																					
M-42-04 COMPLETE REMOVAL OF FLOATING ORGANIC LAYER FROM TANK 241-C-103																					
M-42-05 COMPLETE SAFETY ALTERNATIVE TEST IN HIGH-HEAT TANK 241-C-106																					
M-42-06 COMPLETE VAPOR SAMPLING CHARACTERIZATION OF TANK 241-C-103																					
M-42-07 COMMENCE OPERATION OF A MAJOR TREATMENT SYSTEM IN TANK 241-C-103																					

OM

M-42-00
MITIGATE/RESOLVE TANK SAFETY ISSUES FOR HIGH PRIORITY WATCH LIST TANKS

Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 3 of 13)

FEDERAL FACILITY AGREEMENT AND CONSENT ORDER

ACTION PLAN WORK SCHEDULE

Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 4 of 13)

F2-1.5

Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 5 of 13)

DOE/RL-96-08

ACTION PLAN WORK SCHEDULE

Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 6 of 13)

DOE/RL-96-08

F2-1.7

17 GN

DOE/RL-96-08

F2-1.8

DOE/RL-96-08

FEDERAL FACILITY AGREEMENT AND CONSENT ORDER

ACTION PLAN WORK SCHEDULE

LS-04A

F2-19

Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (Sheet 9 of 13)

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FEDERAL FACILITY AGREEMENT AND CONSENT ORDER

ACTION PLAN WORK SCHEDULE

FEDERAL FACILITY AGREEMENT AND CONSENT ORDER
ACTION PLAN WORK SCHEDULE

ACTION PLAN WORK SCHEDULE

Figure 2-1. Operating Schedules for Units Managing Land Disposal Restricted Waste. (sheet 12 of 13)

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

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Figure 2-2. Hanford Tank Waste Remediation System.

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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
 EST = Excavated Suspect TRU
 and TRU Waste
 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)				
	1996	1997	1998	1999	2000
1. DST Waste (before evaporation)	15,300	14,200	9,600	5,000	2,600
2. PUREX Aging Waste	0	0	0	0	0
3. SST Waste	0	0	0	0	0
4. 242-A Evaporator Process Condensate	7,700	7,600	7,600	7,600	7,600
5. 4843 Sodium Storage Facility Waste	0	0	0	0	0
6. PUREX Ammonia Scrubber Waste	0	0	0	0	0
7. PUREX Process Condensate	0	0	0	0	0
8. Hexone Waste	0	0	0	0	0
9. 183-H Solar Evaporation Basins Waste	0	0	0	0	0
10. PUREX Storage Tunnels Waste ^b	0.08 ^d	0	0	0	0
11. PUREX Containment Building ^b	0	0	0	0	0
12. CWC Stored Low-Level, TRU, and PCB Waste ^c	1,588	1,898	1,878	2,325	2,267
13. Excavated Suspect-TRU and TRU Waste	0	0	0	0	0
14. 224-T TRUSAF Stored Waste	266	266	266	266	266
15. 303-K Stored Waste	0	0	0	0	0
16. 324 REC ^c	1.3	1.3	1.3	0	0
17. 324 HLV	3	0	0	0	0
Total Projected Generation	24,858	23,965	19,345	15,191	12,733

^aThese 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.

^bGeneration rate depends upon the need to move failed equipment containing mercury, barium, selenium, chromium, lead, cadmium, and/or silver into the PUREX tunnels or containment building.

^cThese generation estimates are based on the assumption that used HEPA filters in the cells may contain hazardous waste.

^dThis generation estimate is based on the assumption that 324 Building waste will be stored in the storage tunnels. The storage of the 324 Building waste causes barium and selenium to be added to the list of stored waste.

^eSubmarine reactor compartments not included in estimates.

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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • NA—waste stream no longer generated or managed separately from DST waste.
3. SST Waste	1994-1999 (M-44-00)	<ul style="list-style-type: none"> • 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 LERF/ETF waste analysis plan	<ul style="list-style-type: none"> • A waste analysis plan was developed for sampling process condensate in the LERF basins for processing at the 200 Area ETF.
5. 4843 Sodium Storage Facility Waste	No future characterization is planned	NA
6. PUREX Ammonia Scrubber Waste	No future characterization is planned	<ul style="list-style-type: none"> • Any further sampling will be conducted with other DST waste.

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

Waste stream	Schedule	Method, protocol, specific analyses
7. PUREX Process Condensate	No further characterization is planned	<ul style="list-style-type: none"> Any further sampling will be conducted with other DST waste.
8. Hexone Waste	No further characterization is planned	<ul style="list-style-type: none"> Distillation residue has been characterized. Distillation vessels shipped to radioactive mixed waste 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.	<ul style="list-style-type: none"> 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. "Contained-in" determination received for waste concrete and soils at 183-H in 1995. Reference—Direct Disposal Team report (RL 1995a).
10. PUREX Storage Tunnels Waste	Waste characterization complete	<ul style="list-style-type: none"> Characterization details contained in RL (1990b).
11. PUREX Containment Building	No further characterization is planned	NA
12. CWC Stored, Low-Level, TRU, and PCB Waste	Waste will be characterized before treatment beginning 1997 (WRAP, Module 1)	<ul style="list-style-type: none"> 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 listed in the engineering development plan for the various solid waste projects. Engineering studies on raman spectroscopy and x-ray fluorescence have been completed.

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

Waste stream	Schedule	Method, protocol, specific analyses
13. Excavated Suspect-TRU and TRU Waste	<ul style="list-style-type: none"> • In situ characterization 1991-1994 • Waste will be characterized before disposal after processing 	<ul style="list-style-type: none"> • 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.
14. 224-T TRUSAF Stored Waste	Characterization to be done at WRAP 1 before shipment	<ul style="list-style-type: none"> • To be certified and shipped to the Waste Isolation Pilot Plant.
15. 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
16. 324 REC	Complete	All known waste streams characterized based on analysis or process knowledge.
17. 324 HLV	Complete	All waste was designated based on analysis of waste streams and process knowledge.

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 (part of 224-T Building).

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,d}	D001 (ignitable) ^{a,c} D002 (corrosive) D003 (reactive) ^c 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 (o-cresol, p-cresol) F005 (methyl ethyl ketone) F039 (multisource leachate) WP01 (persistent extremely hazardous waste) ^c WP02 (persistent dangerous waste) ^c WT01 (toxic, extremely hazardous waste) ^c WT02 (toxic, dangerous waste) ^c
2. PUREX Aging Waste	D001 (ignitable) ^{a,c} D002 (corrosive) D006 (TCLP cadmium) D007 (TCLP chromium) D008 (TCLP lead)

Table 2-3. Dangerous Waste Designations.* (sheet 2 of 6)

Waste stream	Designated waste code(s)
3. SST Waste ^b	D001 (ignitable) ^c D002 (corrosive) D003 (reactive) ^c 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 (o-cresol, p-cresol) F005 (methyl ethyl ketone) WT01 (toxic, extremely hazardous waste) WT02 (toxic, dangerous waste) WP01 (persistent extremely hazardous waste) WP02 (persistent dangerous waste)
4. 242-A Evaporator Process condensate ^d	F001 (1,1,1-trichloroethane) F002 (methylene chloride) F003 (acetone, hexone, and butyl alcohol) F004 (o-cresol, p-cresol) F005 (methyl ethyl ketone and pyridine)
5. 4843 Sodium Storage Facility Waste Note: This waste has been moved to the CWC	
6. PUREX Ammonia Scrubber Waste	D002 (corrosive) WT01 (toxic, extremely hazardous waste)
7. PUREX Process Condensate	D002 (corrosive) WT02 (toxic, dangerous waste)
8. Hexone Waste Note: This waste has been shipped off site and treated	
9. 183-H Solar Evaporation Basins Waste Note: This waste has been moved to the CWC	

Table 2-3. Dangerous Waste Designations.* (sheet 3 of 6)

Waste stream	Designated waste code(s)
10. PUREX Storage Tunnels Waste	D001 (ignitable) D005 (TCLP barium) D006 (TCLP cadmium) D007 (TCLP chromium) D008 (TCLP lead) D009 (TCLP mercury) D010 (TCLP selenium) D011 (TCLP silver) WT01 (toxic, extremely hazardous waste) WT02 (toxic, dangerous waste)
11. PUREX Containment Building	D006 (TCLP cadmium) D007 (TCLP chromium) D008 (TCLP lead) WT01 (toxic, extremely hazardous waste)

Table 2-3. Dangerous Waste Designations.* (sheet 4 of 6)

Waste stream	Designated waste code(s)
<p>12. CWC Stored Low-Level, TRU, and PCB Waste^d</p> <p>NOTE: Because of 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.</p>	<p>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) D012 (TCLP Endrin) D016 (TCLP 2,4-D) D039 (perchloroethylene) F001 (spent halogenated degreasing solvents) F002 (spent halogenated solvents) F003 (spent solvents) F004 (spent solvents) 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) WP01 (persistent extremely hazardous waste) WP02 (persistent dangerous waste) WT01 (toxic, extremely hazardous waste) WT02 (toxic, dangerous waste)</p>

Table 2-3. Dangerous Waste Designations.* (sheet 5 of 6)

Waste stream	Designated waste code(s)
13. Excavated Suspect-TRU and TRU Waste	D001 (ignitable)* 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 (spent solvents) F005 (spent non-halogenated solvents) P015 (beryllium dust) WP01 (persistent extremely hazardous waste) WT01 (toxic, extremely hazardous waste) WT02 (toxic, dangerous waste)
14. 224-T TRUSAF Stored Waste	D002 (corrosive) D005 (TCLP barium) D006 (TCLP cadmium) D007 (TCLP chromium) D008 (TCLP lead) D009 (TCLP mercury) WP01 (persistent extremely hazardous waste) WT01 (toxic, extremely hazardous waste)

Table 2-3. Dangerous Waste Designations.* (sheet 6 of 6)

Waste stream	Designated waste code(s)
15. 303-K Stored Waste Note: This waste has been moved to the CWC.	
16. 324 REC	D006 (TCLP cadmium) D007 (TCLP chromium) D008 (TCLP lead) WT01 (toxic, extremely hazardous waste) WT02 (toxic, dangerous waste)
17. 324 HLW	D002 (corrosive) D005 (barium) D006 (cadmium) D007 (TCLP chromium) D008 (TCLP lead) WT02 (toxic, dangerous waste)

*Further information is given in Section 2.2.

^bTCLP waste codes D018, D019, D022, D028, D029, D030, D033, D035, D036, and D038 through D043 are listed in the DST System Part A Form 3 Permit application, but are not listed in this table or in Table 2-6. Analysis of tank waste has not yet confirmed these to be present, although analysis alone cannot determine LDR status.

^cDesignation is based on process knowledge and dilution prohibition. Waste in storage does not display characteristic.

^dThe F039 waste code has been added to these facilities' Part A Form 3 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	TSD Unit	Capacity (m ³)	Anticipated capacity fill date	Part B/Closure Plan (Latest Revision)	Known Release of hazardous constituents
1. DST Waste	DST system	111,800	1998	6/91	none
2. PUREX Aging Waste	DST system	7,400	NA ^b	6/91	none
3. SST Waste	SST system	357,500 ^a	NA ^b	9/89 ^c	yes (Table 3-6)
4. 242-A Evaporator Process Condensate	LERF	49,000	NA ^a	6/91	none
5. 4843 Sodium Storage Facility Waste	4843 Building, now in CWC	84,000 kg	NA ^b	6/91 ^e	none
6. PUREX Ammonia Scrubber Waste	DST system	111,800	NA ^b	6/91	none
7. PUREX Process Condensate	DST system	111,800	NA ^b	6/91	none
8. Hexone Waste	Hexone Storage and Treatment Facility	178 ^a	NA ^b	11/92 ^e	none
9. 183-H Solar Evaporation Basins Waste	183-H Solar Evaporation Basins/CWC	8,200 ^a	NA	6/91 ^f	yes (Section 3.9.3)
10. PUREX Storage Tunnels Waste	PUREX Tunnels 1 and 2	d	NA ^a	11/95	none
11. PUREX Containment Building	PUREX Plant	h	NA ^a	Preclosure Work Plan due 7/96	none
12. CWC Stored Low-Level, TRU, and PCB Waste	Various	23,898	1996 ^f	12/94	none
13. Excavated Suspect-TRU and TRU Waste	Various	15,440 ^a	NA	10/91	none

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

Waste stream	TSD Unit	Capacity (m ³)	Anticipated capacity fill date	Part B/Closure Plan (Latest Revision)	Known Release of hazardous constituents
14. 224-T TRUSAF Stored Waste	224-T TRUSAF	420	NA	6/92	none
15. 303-K Stored Waste	303-K Building	42	NA*	7/95 ^a	none
16. 324 REC	324 Building	46.6	NA	12/95 ^a	none
17. 324 HL V	324 Building	56.7	NA	12/95 ^a	none

*This unit is no longer used for active storage; capacity noted is for information only.

*No future generation of this waste.

*Closure plan. Revised SST closure plan is due 4/95. The 4843 Building closure activities in accordance with RL (1990c) are under way.

*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 21 rail cars or 1,797 cubic meters of stored equipment. The total capacity of both tunnels is 24,007 cubic meters.

*Capacity is currently sufficient for future generation.

*New facilities are planned to be on line in 1996.

*The LERF and ETF will be operated together. Liquids transferred to the LERF basin will be treated in the ETF within 1 year (flow-through mode).

*The PUREX containment building has a current permit capacity of 434 m³. It currently contains 0.12 m³ of contaminated discarded canyon process equipment and other material from various onsite sources, and concrete and tank dunnage corrosion products.

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 3)

Waste stream	TSD Unit	Amount in storage (m ³)	Date first waste in storage	Liquid (%)	Solid (%)	Sludge (%)	LLW (%)	TRU/LLW (%)	HLW (%)
1. DST Waste	DST system	67,065 ^a	1975	80	11	9	b	b	b
2. PUREX Aging Waste	DST system	7,117 ^a	1975	93	0	7	0	0	100
3. SST Waste	SST system	136,600	1944	31	44	25	b	b	b
4. 242-A Evaporator Process Condensate	LERF	35,500	1994	100	0	0	100	0	0
5. 4843 Sodium Storage Facility Waste	CWC	none ^f	1987	0	0	0	100	0	0
6. PUREX Ammonia Scrubber Waste	DST system	NA ^a	1987	100	0	0	100	0	0
7. PUREX Process Condensate	DST system	NA ^a	1989	100	0	0	100	0	0
8. Hexone Waste	Hexone Storage and Treatment Facility	1.9	1951	8	0	92	100	0	0
9. 183-H Solar Evaporation Basins Waste	183-H Solar Evaporation Basins	none ^e	1973	20 ^c	80 ^c	0	100 ^c	0	0
10. PUREX Storage Tunnels Waste mercury lead silver cadmium chromium	Tunnel 2 Tunnels 1 and 2 Tunnel 2 Tunnel 2 Tunnel 2	0.01 ^d 0.43 ^a 0.07 ^d 6.5×10^{-34} 1.1×10^{-24}	1960	100 0 0 0 0	0 100 100 100 100	0	100	0	0

Table 2-5. Stored Waste Characteristics. (sheet 2 of 3)

Waste stream	TSD Unit	Amount in storage (m ³)	Date first waste in storage	Liquid (%)	Solid (%)	Sludge (%)	LLW (%)	TRU/LLW (%)	HLW (%)
11. PUREX Containment Building lead cadmium chromium	PUREX Plant	0.12 ^d 2.3 x 10 ^{-4d} 1.4 x 10 ^{-4d}	1987	0	100	0	100	0	0
12. CWC Stored Low-Level, TRU, and PCB Waste	Various	6,873	1988	0	100	0	95	5	0
13. Excavated Suspect-TRU and TRU Waste	Various	2,184	1970	0	100	0	78	22	0
14. 224-T TRUSAF Stored Waste	224-T TRUSAF	333	1985	0	100	0	0	100	0
15. 303-K Stored Waste	CWC	None ^f	1943	0	100	0	100	0	0

Table 2-5. Stored Waste Characteristics. (sheet 3 of 3)

Waste stream	TSD Unit	Amount in storage (m ³)	Date first waste in storage	Liquid (%)	Solid (%)	Sludge (%)	LLW (%)	TRU/LLW (%)	HLW (%)
16. 324 REC	324 Building	9.6	Mid 1960s	0	100	0	69	31	0
17. 324 HLV	324 Building	3.6	1994	100	0	0	0	83	17

^aInventories for PUREX Ammonia Scrubber Waste and PUREX Process Condensate are included in the DST waste inventory. They were originally estimated at 5,900 m³ and 4,800 m³, respectively. Because of commingling with other DST waste and processing through the 242-A Evaporator, a waste volume is no longer available or meaningful. PUREX Aging Waste is not included in the DST waste inventory. The total DST Waste inventory is 74,182 m³.

^bTank waste contains LLW, TRU, and HLW. However, in the interim storage mode, all DST and SST waste is managed as HLW.

^cProcess 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.

^dThese are the actual waste volumes. The waste is on rail cars with 596 m³ in storage in Tunnel 1 and 1,797 m³ in storage in Tunnel 2 (rail cars included). Barium and selenium are not included because the waste will be added after the 12/31/95 inventory date.

^eConsists of 0.41 m³ in Tunnel 2 and 0.02 m³ in Tunnel 1.

^fWaste from the 4843 and 303-K facilities has been removed to the CWC. Other reported values are for the waste when it was at 4843 and 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 12)

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	6.0 mg/kg	vitrification	TBD ^c	TBD	TBD(onsite)	2005
F002	30 mg/kg	vitrification	TBD ^c	TBD	TBD(onsite)	2005
F003	MCL	vitrification	TBD ^c	TBD	TBD(onsite)	2005
F004	5.6 mg/kg	vitrification	TBD ^c	TBD	TBD(onsite)	2005
F005	36 mg/kg	vitrification	TBD ^c	TBD	TBD(onsite)	2005
F039	MCL	vitrification	TBD ^c	TBD	TBD(onsite)	2005
D001	deactivation and meet 40 CFR 268.48	vitrification	TBD ^c	TBD	TBD(onsite)	2005
D002	deactivation and meet 40 CFR 268.48	vitrification	TBD ^c	TBD	TBD(onsite)	2005
D003	deactivation and meet CN concentration standards	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	0.2 mg/L	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	none ^d	vitrification	TBD ^c	TBD	TBD(onsite)	2005
WT02	none	vitrification	TBD ^c	TBD	TBD(onsite)	2005

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

Waste codes	Required treatment ^a	Planned treatment	Treatment facility	Facility capacity (m ³ /day)	Disposal facility	Treatment date
WP01	none ^d	vitrification	TBD ^c	TBD	TBD(onsite)	2005
WP02	none	vitrification	TBD ^c	TBD	TBD(onsite)	2005
Pretreated Complexed Concentrate Waste (high-level fraction)						
F001	6.0 mg/kg	vitrification	TBD ^c	TBD	repository	2009
F002	30 mg/kg	vitrification	TBD ^c	TBD	repository	2009
F003	MCL	vitrification	TBD ^c	TBD	repository	2009
F004	5.6 mg/kg	vitrification	TBD ^c	TBD	repository	2009
F005	36 mg/kg	vitrification	TBD ^c	TBD	repository	2009
F039	MCL	vitrification	TBD ^c	TBD	repository	2009
D001	deactivation and meet 40 CFR 268.48	vitrification	TBD ^c	TBD	repository	2009
D002	HL VIT	vitrification	TBD ^c	TBD	repository	2009
D003	deactivation and meet CN concentration standards	vitrification	TBD ^c	TBD	repository	2009
D004	HL VIT	vitrification	TBD ^c	TBD	repository	2009
D005	HL VIT	vitrification	TBD ^c	TBD	repository	2009
D006	HL VIT	vitrification	TBD ^c	TBD	repository	2009
D007	HL VIT	vitrification	TBD ^c	TBD	repository	2009
D008	HL VIT	vitrification	TBD ^c	TBD	repository	2009
D009	HL VIT	vitrification	TBD ^c	TBD	repository	2009
D010	HL VIT	vitrification	TBD ^c	TBD	repository	2009
D011	HL VIT	vitrification	TBD ^c	TBD	repository	2009
WT01	none ^d	vitrification	TBD ^c	TBD	repository	2009
WT02	none	vitrification	TBD ^c	TBD	repository	2009

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

Waste codes	Required treatment ^a	Planned treatment	Treatment facility	Facility capacity (m ³ /day)	Disposal facility	Treatment date
WP01	none ^d	vitrification	TBD ^c	TBD	repository	2009
WP02	none	vitrification	TBD ^c	TBD	repository	2009
2. PUREX Aging Waste High-level fraction						
D001	deactivation and meet 40 CFR 268.48	vitrification	TBD ^c	TBD	repository	2009
D002	HLVIT	vitrification	TBD ^c	TBD	repository	2009
D006	HLVIT	vitrification	TBD ^c	TBD	repository	2009
D007	HLVIT	vitrification	TBD ^c	TBD	repository	2009
D008	HLVIT	vitrification	TBD ^c	TBD	repository	2009
Low-level fraction						
D001	deactivation and meet 40 CFR 268.48	Vitrification	TBD ^c	TBD	TBD (onsite)	2009
D002	deactivation and meet 40 CFR 268.48	Vitrification	TBD ^c	TBD	TBD (onsite)	2009
D006	1.0 mg/L	Vitrification	TBD ^c	TBD	TBD (onsite)	2009
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	6.0 mg/kg	vitrification	TBD ^c	TBD	repository	2009
F002	30 mg/kg	vitrification	TBD ^c	TBD	repository	2009
F003	MCL	vitrification	TBD ^c	TBD	repository	2009
F004	5.6 mg/kg	vitrification	TBD ^c	TBD	repository	2009
F005	36 mg/kg	vitrification	TBD ^c	TBD	repository	2009

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

Waste codes	Required treatment ^a	Planned treatment	Treatment facility	Facility capacity (m ³ /day)	Disposal facility	Treatment date
D001	deactivation and meet 40 CFR 268.48	vittrification	TBD ^c	TBD	repository	2009
D002	HL VIT	vittrification	TBD ^c	TBD	repository	2009
D003	deactivation and meet CN concentration standards	vittrification	TBD ^c	TBD	repository	2009
D004	HL VIT	vittrification	TBD ^c	TBD	repository	2009
D005	HL VIT	vittrification	TBD ^c	TBD	repository	2009
D006	HL VIT	vittrification	TBD ^c	TBD	repository	2009
D007	HL VIT	vittrification	TBD ^c	TBD	repository	2009
D008	HL VIT	vittrification	TBD ^c	TBD	repository	2009
D009	HL VIT	vittrification	TBD ^c	TBD	repository	2009
D010	HL VIT	vittrification	TBD ^c	TBD	repository	2009
D011	HL VIT	vittrification	TBD ^c	TBD	repository	2009
Low-level fraction						
F001	6.0 mg/kg	vittrification	TBD ^c	TBD	TBD (onsite)	2005
F002	30 mg/kg	vittrification	TBD ^c	TBD	TBD (onsite)	2005
F003	MCL	vittrification	TBD ^c	TBD	TBD (onsite)	2005
F004	5.6 mg/kg	vittrification	TBD ^c	TBD	TBD (onsite)	2005
F005	36 mg/kg	vittrification	TBD ^c	TBD	TBD (onsite)	2005
D001	deactivation and meet 40 CFR 268.48	vittrification	TBD ^c	TBD	TBD (onsite)	2005
D002	deactivation and meet 40 CFR 268.48	vittrification	TBD ^c	TBD	TBD (onsite)	2005

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

Waste codes	Required treatment ^a	Planned treatment	Treatment facility	Facility capacity (m ³ /day)	Disposal facility	Treatment date
D003	deactivation and meet CN concentration standards	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
4. 242-A Evaporator Process Condensate						
F001 ^k	0.054 mg/L	destruction/ delisting	ETF	600 ^l	SALDS	1995
F002 ^k	0.089 mg/L	destruction/ delisting	ETF	600 ^l	SALDS	1995
F003 ^k	MCL	destruction/ delisting	ETF	600 ^l	SALDS	1995
F004 ^k	0.77 mg/L	destruction/ delisting	ETF	600 ^l	SALDS	1995
F005 ^k	0.28 mg/L	destruction/ delisting	ETF	600 ^l	SALDS	1995
5. 4843 Sodium Storage Facility Waste at the CWC						
D001	deactivation and meet 40 CFR 268.48	deactivation	TBD	TBD	LLBG	TBD
D002 ^m	deactivation	deactivation	TBD	TBD	LLBG	TBD
D003	deactivation	deactivation	TBD	TBD	LLBG	TBD

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

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
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.						
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 or organic recovery	incineration	Diversified Scientific Services, Kingston, TN	12	None (complete destruction)	1991-1994
9. 183-H Solar Evaporation Basins Waste at the CWC						
Note: This waste is now in the CWC. (See Stream 13 in this table.)						
10. PUREX Storage Tunnels Waste						
D001	deactivation and meet 40 CFR 268.48	TBD	TBD	TBD	TBD	TBD
D005	100 mg/L	TBD	TBD	TBD	TBD	TBD
D006	1.0 mg/L	TBD	TBD	TBD	TBD	TBD
D007	5.0 mg/L	TBD	TBD	TBD	TBD	TBD
D008	macro-encapsulation	TBD	TBD	TBD	TBD	TBD

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

Waste codes	Required treatment ^a	Planned treatment	Treatment facility	Facility capacity (m ³ /day)	Disposal facility	Treatment date
D009	amalgamation	TBD	TBD	TBD	TBD	TBD
D010	5.7 mg/L	TBD	TBD	TBD	TBD	TBD
D011	5.0 mg/L	TBD	TBD	TBD	TBD	TBD
WT01	none ⁱ	TBD	TBD	TBD	TBD	TBD
11. PUREX Containment Building						
D006	1.0 mg/L	TBD	TBD	TBD	TBD	TBD
D007	5.0 mg/L	TBD	TBD	TBD	TBD	TBD
D008	macro-encapsulation	TBD	TBD	TBD	TBD	TBD
WT01	none ⁱ	TBD	TBD	TBD	TBD	TBD
12. CWC Stored Low-Level, Transuranic, and PCB Waste Low-level waste ^a						
F001	MCL	Thermal treatment	TBD	TBD	TBD	TBD ^b
F002	MCL	Thermal treatment	TBD	TBD	TBD	TBD ^b
F003	MCL	Thermal treatment	TBD	TBD	TBD	TBD ^b
F004	MCL	Thermal treatment	TBD	TBD	TBD	TBD ^b
F005	MCL	Thermal treatment	TBD	TBD	TBD	TBD ^b
F039	MCL	Thermal treatment	TBD	TBD	TBD	TBD ^b
D001	deactivation and meet 40 CFR 268.48	TBD	WRAP 1 or 2	TBD	TBD	1999 ^c
D002	deactivation and meet 40 CFR 268.48	TBD	WRAP 2	TBD	TBD	1999 ^c

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

Waste codes	Required treatment ^a	Planned treatment	Treatment facility	Facility capacity (m ³ /day)	Disposal facility	Treatment date
D003	deactivation	TBD	WRAP 2	TBD	TBD	1999 ^c
D004	5.0 mg/L	TBD	WRAP 2	TBD	TBD	1999 ^c
D005	100 mg/L	TBD	WRAP 2	TBD	TBD	1999 ^c
D006	1.0 mg/L	TBD	WRAP 2	TBD	TBD	1999 ^c
D007	5.0 mg/L	TBD	WRAP 2	TBD	TBD	1999 ^c
D008	5.0 mg/L and macro-encapsulation	TBD	WRAP 2	TBD	TBD	1999 ^c
D009	amalgamation	TBD	WRAP 2	TBD	TBD	1999 ^c
D010	5.7 mg/L	TBD	WRAP 2	TBD	TBD	1999 ^c
D011	5.0 mg/L	TBD	WRAP 2	TBD	TBD	1999 ^c
D012	0.13 mg/kg	TBD	WRAP 2	TBD	TBD	1999 ^c
D016	10 mg/kg	TBD	WRAP 2	TBD	TBD	1999 ^c
D039	6.0 mg/kg	TBD	WRAP 2	TBD	TBD	1999 ^c
WT01	none ^d	TBD	WRAP 2	TBD	TBD	1999 ^c
WT02	none	TBD	WRAP 2	TBD	TBD	1999 ^c
WP01	none ^d	TBD	WRAP 2	TBD	TBD	1999 ^c
WP02	none	TBD	WRAP 2	TBD	TBD	1999 ^c
U080	30 mg/kg	TBD	WRAP 2	TBD	TBD	1999 ^c
U123	combustion	TBD	TBD	TBD	TBD	TBD ^b
U161	33 mg/kg	TBD	WRAP 2	TBD	TBD	1999 ^c
P029	MCL	TBD	WRAP 2	TBD	TBD	1999 ^c
P030	MCL	TBD	WRAP 2	TBD	TBD	1999 ^c
P098	MCL	TBD	WRAP 2	TBD	TBD	1999 ^c
P106	MCL	TBD	WRAP 2	TBD	TBD	1999 ^c
P120	stabilization	TBD	WRAP 2	TBD	TBD	1999 ^c

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

Waste codes	Required treatment ^a	Planned treatment	Treatment facility	Facility capacity (m ³ /day)	Disposal facility	Treatment date
W001	incineration	TBD	TBD	TBD	TBD	TBD
Transuranic waste						
F003	None ^f	None	WRAP 1 ⁱ	TBD	WIPP	2002
F005	None ^f	None	WRAP 1 ⁱ	TBD	WIPP	2002
D001	None ^f	None	WRAP 1 ⁱ	TBD	WIPP	2002
D002	None ^f	None	WRAP 1 ⁱ	TBD	WIPP	2002
D006	None ^f	None	WRAP 1 ⁱ	TBD	WIPP	2002
D007	None ^f	None	WRAP 1 ⁱ	TBD	WIPP	2002
D008	None ^f	None	WRAP 1 ⁱ	TBD	WIPP	2002
D009	None ^f	None	WRAP 1 ⁱ	TBD	WIPP	2002
WT01	None ^f	None	WRAP 1 ⁱ	TBD	WIPP	2002
WT02	None ^f	None	WRAP 1 ⁱ	TBD	WIPP	2002
W001	None ^f	None	WRAP 1 ⁱ	TBD	WIPP	2002
13. Excavated Suspect-Transuranic and Transuranic Waste Low-level waste (suspect-transuranic)						
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 and meet 40 CFR 268.48	TBD	WRAP 1	TBD	TBD	1999 ^e
D003	deactivation	TBD	WRAP 1	TBD	TBD	1999 ^e
D005	100 mg/L	TBD	WRAP 1	TBD	TBD	1999 ^e
D006	1.0 mg/L	TBD	WRAP 1	TBD	TBD	1999 ^e
D007	5.0 mg/L	TBD	WRAP 1	TBD	TBD	1999 ^e
D008	macro-encapsulation	TBD	WRAP 1	TBD	TBD	1999 ^e

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

Waste codes	Required treatment ^a	Planned treatment	Treatment facility	Facility capacity (m ³ /day)	Disposal facility	Treatment date
D009	amalgamation	TBD	WRAP 1	TBD	TBD	1999 ^e
D011	5.0 mg/L	TBD	WRAP 1	TBD	TBD	1999 ^e
WT01	none ^d	TBD	WRAP 1	TBD	TBD	1999 ^e
WT02	none	TBD	WRAP 1	TBD	TBD	1999 ^e
WP01	none ^d	TBD	WRAP 1	TBD	TBD	1999 ^e
W001	incineration	TBD	TBD	TBD	TBD	TBD
Transuranic waste						
D006	None ^f	None	WRAP 1 ⁱ	TBD	WIPP	2002
D008	None ^f	None	WRAP 1 ⁱ	TBD	WIPP	2002
WT01	None ^f	None	WRAP 1 ⁱ	TBD	WIPP	2002
P015	None ^f	None	WRAP 1 ⁱ	TBD	WIPP	2002
14. 224-T TRUSAF Stored Waste						
D002	none ^f	none	WRAP 1 ⁱ	TBD	WIPP	2002
D005	none ^f	none	WRAP 1 ⁱ	TBD	WIPP	2002
D006	none ^f	none	WRAP 1 ⁱ	TBD	WIPP	2002
D007	none ^f	none	WRAP 1 ⁱ	TBD	WIPP	2002
D008	none ^f	none	WRAP 1 ⁱ	TBD	WIPP	2002
D009	none ^f	none	WRAP 1 ⁱ	TBD	WIPP	2002
WP01	none ^f	none	WRAP 1 ⁱ	TBD	WIPP	2002
WT01	none ^f	none	WRAP 1 ⁱ	TBD	WIPP	2002
15. 303-K Stored Waste						
Note: This waste is now in CWC (see Stream 13 in this table).						
16. 324 REC						
D006	1.0 mg/L, macro-encapsulation	TBD	TBD	TBD	TBD	TBD

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

Waste codes	Required treatment ^a	Planned treatment	Treatment facility	Facility capacity (m ³ /day)	Disposal facility	Treatment date
D007	5.0 mg/L	TBD	TBD	TBD	TBD	TBD
D008	5.0 mg/L, macro-encapsulation	TBD	TBD	TBD	TBD	TBD
WT01	none	N/A	N/A	N/A	N/A	TBD
WT02	none	N/A	N/A	N/A	N/A	TBD
17. 324 HLW						
D002	deactivation	neutralization	324	0.1	TBD	1996
D005	100 mg/L	precipitation	324	0.1	TBD	1996
D006	1.0 mg/L	precipitation	324	0.1	TBD	1996
D007	CCW/5.0 mg/L	precipitation	324	0.1	TBD	1996
D008	CCW/5.0 mg/L	precipitation	324	0.1	TBD	1996
WT02	none	N/A	N/A	N/A	N/A	N/A

^aTreatment required by WAC 173-303-140, 40 CFR 268.40, 59 FR 47982, and 60 FR 242 treatment standards. Nonwastewater category assumed for this table except for the 242-A Evaporator 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 in 40 CFR 268.48.

^bThe 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.

^cVitrification facilities for both the LLW and HLW fractions resulting from pretreatment have yet to be designed.

^dWaste will be retrieved from the SSTs to the extent needed for closure.

^eCommercial 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 commercial services only.

^fThe assumption is made that no LDR treatment is required as WIPP is expected to operate under a no-migration petition.

^gOnly a partial list of waste codes is given (see note for this stream in Table 2-3).

^bA commercial thermal treatment contract has been awarded for low-level mixed waste to support this required treatment.

^bWRAP 1 will process waste to meet WIPP waste acceptance criteria. WRAP 2 is proposed to include the treatments listed in Table 2-7 and the February 28, 1995, proposed change request.

^bMixed extremely hazardous waste may be land-disposed in Washington State in DOE facilities in accordance with Revised Code of Washington 70.105.050(2).

^b200 Area Effluent Treatment Facility delisting levels in 40 CFR 261, Appendix IX supersede these treatment standards.

^bBased on the design-basis feed composition for the 242-A Evaporator process condensate treated in the ETF at 570 L/min and 72 percent efficiency. The ETF has an output capacity of 1.2 m³/day of solid waste.

^aThis waste code reflects the paperwork when the waste was shipped to the CWC. If generated now, the waste would receive state-only waste code WSC2 instead of D002.

CCW = Constituent concentrations in waste.

CWC = Central Waste Complex.

DST = Double-shell tank.

ETF = Effluent Treatment Facility.

HLVIT = High-level Vitrification.

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. Solid Mixed Waste Treatment Cross-Matrix.

Waste Streams/Categories	Onsite or Commercial Treatment Capabilities	Commercial Stabilization Treatment (CST) Contract	WRAP-1 Mixed Waste Treatment Capabilities	Onsite Macroencapsulation Treatment	Mixed Waste Direct Disposal (DD) Efforts
1A - Solidified 183H Basin Liquids ⁽¹⁾	Yes	Yes			Yes (default to CST if DD fails)
1B - Crystalline 183H Basin Solids ⁽¹⁾	Yes	Yes			
1C - 183H Basin Sludge ⁽¹⁾	Yes	Yes			
1D - Misc. 183H Basin Waste (Sand Blast Grit) ⁽¹⁾	Yes	Yes			
1D - Misc. 183H Basin Waste (Debris Waste)	Yes	Yes		Yes	
2A - Ammonium/Sodium Sulfate Powder (Particulate)	Yes	Yes			
2B - ETF/TEDF Ion-Exchange Resins	Yes	Yes			
5A1 - Elemental Mercury	Yes		Yes		
5A2 - Mercury Chemicals/Solutions ⁽²⁾	Yes		Yes		
5A3 - Mercury Contaminated Heterogeneous Solids (Debris)	Yes	Yes		Yes	
5C1 - Elemental Lead	Yes	Yes		Yes	
5C2 - Lead Chemicals/Solutions	Yes		Yes		
5C3 - Lead Contaminated Heterogeneous Solids (Debris)	Yes	Yes		Yes	
9A - Particulate Sludge	Yes	Yes			
9B - Heterogeneous Solids/Debris	Yes	Yes		Yes	
9C - Contained Liquids (Lab-Packs)	Yes		Yes		
Backlog Debris	Yes (subset of waste stream "9B")	Yes		Yes	
Backlog Soils	Yes (subset of waste stream "9A")	Yes			Yes (defaults to CST if DD fails)

⁽¹⁾Formic acid treatment variance or equivalent treatment determination is required prior to stabilization treatment.

⁽²⁾High mercury subcategory waste (i.e., ≥ 260 mg/kg Hg) requires retorting/roasting as the specified RCRA treatment; WRAP-2A abandoned this treatment capability in the facility during design stage (high capital costs/small waste volume). A treatment variance or equivalent determination is required to treat subject waste in WRAP-1. An option is to procure treatment services for the specific waste stream, or to designate the waste stream to another DOE Site with treatment capability under jurisdiction of the FFCA Site Treatment Plans.

Table 2-8. 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	<ul style="list-style-type: none"> Evaporation Minimize frequency of flush Minimize flush volumes 	under way	80%
2. PUREX Aging Waste	N/A ^c	—	—
3. SST Waste	<ul style="list-style-type: none"> Waste is no longer being added to SSTs 	—	—
4. 242-A Evaporator Process Condensate	<ul style="list-style-type: none"> Effluent Treatment Facility will remove ammonia, inorganic salts, metal ions, and destroy organics Recycle a portion of the process condensate at the 242-A Evaporator 	1995	>99%
5. 4843 Sodium Storage Facility Waste ^b	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Distill and incinerate 	Distillation complete (1990), incineration complete (1994)	88%
9. 183-H Solar Evaporation Basins Waste	<ul style="list-style-type: none"> Evaporate liquid 	Complete (1990)	unknown
10. PUREX Storage Tunnels Waste	<ul style="list-style-type: none"> Segregation from nonhazardous waste 	ongoing	variable
11. PUREX Containment Building	<ul style="list-style-type: none"> Reduce use of lead counterweights 	ongoing	variable

Table 2-8. 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. CWC, Stored Low-Level, TRU, and PCB Waste	<ul style="list-style-type: none"> ● Compaction ● Substitution of nonhazardous materials ● Neutralization of corrosive materials ● Treatment of waste to remove hazardous constituents 	Commercial and/or onsite treatment, Tri-Party Agreement Milestone M-33, Proposed M-19 milestones ^d	variable
13. Excavated Suspect-TRU and TRU Waste	<ul style="list-style-type: none"> ● Waste is no longer being added 	—	—
14. 224-T TRUSAF Stored Waste	<ul style="list-style-type: none"> ● Waste is not generated at TRUSAF 	—	—
15. 303-K Stored Waste	<ul style="list-style-type: none"> ● This facility is in the process of RCRA closure. Future generation not anticipated 	—	—

Table 2-8. 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
16. 324 REC	● Waste is no longer being generated	—	—
17. 324 HLV	● Waste is no longer being generated	—	—

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

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

*Aging Waste, Ammonia Scrubber waste, and Process Condensate will remain inactive; the 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.

*Tri-Party Agreement Milestone Change Request M-19-94-02 for revised M-19 milestones to allow alternative treatment and direct disposal options for low-level mixed waste.

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.

3.0 INDIVIDUAL WASTE STREAM INFORMATION

3.1 DOUBLE-SHELL TANK WASTE

Most DST system 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 Facility. Twenty-eight DSTs store 74,182 cubic meters of waste as of December 31, 1995 (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 vitrify/immobilize them for disposal. The TRU and high-level fractions will be vitrified for disposal in an offsite 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 complex 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 1996a).

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:

- Cleaning solutions from decontamination and ion exchange regeneration at the 100 Area
- Spent solvents 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 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 2001 is shown in Figure 3-1 in terms of tank space used versus space available. The average generation rate for DST waste is about 9,300 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 commercial replacement for the WRAP 2B facility. 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 are designated based on the waste streams that have been received. The waste in the DST system may not display many of the characteristics listed on the Part A Form 3 Permit Application.

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. 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 typically does not exhibit the characteristic of ignitability (D001). The DST system has received ignitable waste in the past and the presence of nitrate and nitrite salts in the DST waste may affect this designation. 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 also will determine which underlying hazardous constituents must be quantified to determine compliance (in accordance with 58 FR 29860 and 59 FR 47992) based on knowledge supplied by Hanford Site waste generators at the original point of generation. The DST waste also is suspected to contain spent solvents including 1,1,1-trichloroethane, methylene chloride, methyl ethyl ketone, hexone, acetone, and cresols (waste codes F001 through F005 are assigned). The DST system has received 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) although the DST waste may not display the characteristic. All other waste codes on the DST Part A Form 3 Permit Application have also been received for storage.

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 to DSTs were based on historical knowledge of waste received into the DST system. 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 when historical transfer information for the tanks support this option. Otherwise, the DST system will be coded with all waste codes until the waste is treated to meet LDR requirements.

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. Whenever possible, 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 (WHC 1995c).

3.1.3 Storage

This section describes DST system 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, 1995, the tanks held 67,065 cubic meters of waste (WHC 1996a). 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. Consolidation and evaporation of waste in the DSTs will make more of the existing space available for reuse, which will enable the DSTs to receive waste beyond 1998. Tri-Party Agreement Milestone M-42-00 has been renegotiated to postpone the construction of new DSTs indefinitely.

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 FYs 1990 through 1995 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 generation increased by 7 percent between 1993 and 1994 because of SST to DST pumping. Total waste generation increased by 97 percent between 1994 and 1995 because of increased facility terminal cleanout activities and SST to DST pumping. "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 1995, one evaporator campaign was completed. In Campaign 95-1, DST waste volume was reduced by 8,180 cubic meters (WHC 1996b). In an average year, the volume of newly received dilute waste is projected to be reduced by approximately 71 percent.

3.1.6 Variances, Treatment Equivalency Petitions, 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). The DST system received corrosive and reactive characteristic waste, TCLP metals and organics, and Washington State-only waste.

The Tri-Party Agreement provides for continued storage of restricted waste 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 in accordance with the Tri-Party Agreement). Disposal is intended for a national HLW geologic repository, with an uncertain start-up date.

If additional variances, treatment equivalency petitions, 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 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 DSTs for storage. As of December 31, 1995, 7,117 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, which contained the majority of the fission products from the fuel 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. Sample analyses of the PUREX aging waste stored in the DSTs is 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). In addition, sufficient quantities of heavy metals are present to designate the NCAW as a toxic waste, 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.

3.2.3 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 7,117 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 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, Treatment Equivalency Petitions, Time Extensions

The PUREX aging waste consists of HLW mixed with dangerous waste constituents. The PUREX aging waste is a LDR waste because of the Third-Third Promulgation (55 FR 22520). 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, treatment equivalency petitions, 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 tanks in the SST system 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 to recover plutonium, uranium, and neptunium beginning in 1944; additional tanks were constructed as required.

Liquid waste collection and storage in the SST system 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 SST system consists 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 Complex), 221-T Facility (T Plant Complex), 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 associated sitewide operations. The SSTs received this waste from various Hanford Site activities before 1980.

Waste currently stored in the SSTs was produced by five 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
- B Plant waste fractionization.

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, which is part of the B Plant Complex. 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 1995c).

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 be managed through the WRAP 1 facility or the commercial replacement for the proposed WRAP 2B facility. 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 SST system contains 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 3-3 (WHC 1996a). The salt cake and sludge contain interstitial liquid. The bulk of this liquid, approximately 26,000 cubic meters, is contained in salt cake and is being pumped to the DSTs.

The sludge consists of the solids (hydrous metal oxides, iron, and aluminum) precipitated 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 diatomaceous 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, along with water-soluble complexing agents and carboxylic acids from the B Plant waste fractionation process (RL 1995c). 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 ferrocyanide has degraded significantly over the years of storage and ferrocyanide is no
 | longer a major issue. Ferrocyanide concentrations in the worst case tanks have been shown to be
 | less than 1/10th the amount originally present. Recent information concludes that the cyanides
 | have been destroyed through chemical processes within the tank waste.

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 SSTs are considered to have received ignitable
 | waste (because of the presence of nitrate), corrosive waste, and TCLP toxic waste. The waste in
 | the SST system is designated identically to the waste in the DST system. 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. All of the SST system waste will receive all of the codes from the Part A Form 3 Permit
 | Application. This is because poor information on intra-SST-system transfers and SST-to-DST
 | transfers make distinguishing waste types from the operating records impossible.

| **3.3.2.4 Uncertainty of Waste Designation.** The confidence in the current waste code
 | designations is low because the historical knowledge about the characteristics of the waste
 | received into the SST system is poor.

| **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 2 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 3-4 (WHC 1996a). 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 period are being negotiated.

3.3.4 Treatment

This section discusses the current and proposed waste treatment processes.

3.3.4.1 Current Treatment. One hundred thirteen 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.

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 will meet the requirements of the state RCRA program in 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 1995, portions of tanks T-107, T-111, BX-106, BX-111, BY-102, BY-103, BY-106, BY-109, C-102, C-107, and C-110 were transferred to DSTs.

3.3.6 Variances, Treatment Equivalency Petitions, 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 tank waste retrieval from one SST by December 2003
- Complete closure of all 149 SSTs by September 2024.

If additional variances, treatment equivalency petitions, 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 currently stored in the LERF and treated in 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 3-5.

The 242-A Evaporator heats the feed at reduced pressure and evaporates off some of the water and volatile organic constituents from the slurry. The vapor fraction and slurry fraction are then processed separately. The vapor fraction is condensed, filtered, and discharged to the LERF as process condensate. A schematic of the LERF is shown in Figure 3-6. The remaining slurry is recirculated. When the slurry is sufficiently concentrated, it is pumped to underground storage in DSTs.

The 242-A Evaporator has generated 35,100 cubic meters of process condensate since its restart in 1994. 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. One campaign was completed through 1995. In Campaign 95-1 10,300 cubic meters of process condensate were generated. One evaporator campaign is planned for May 1996 that will generate about 4,500 cubic meters (1.2 million gallons) of process condensate. Two evaporator campaigns are planned per year thereafter; each campaign is expected to generate about 3,800 cubic meters (1 million gallons) of process condensate.

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 F001 through F005 because of the application of the derived-from rule to the DSTs that contain spent halogenated and nonhalogenated solvents, such as 1,1,1-trichloroethane, methylene chloride, acetone, methyl isobutyl ketone (hexone), and cresols.

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 reported in the 242-A Evaporator Process Condensate stream-specific report (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-trichloroethane, methylene chloride, acetone, methyl isobutyl ketone, cresols, and methyl ethyl ketone. These are the constituents under waste codes F001 through F005.

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 in the ETF (Section 3.4.4) to confirm that it has been properly delisted.

3.4.3 Storage

The 242-A Evaporator was modernized and restarted in 1994. The process condensate from the evaporator is stored in the LERF and treated in the 200 Area Effluent Treatment Facility. The LERF can hold about 49,000 cubic meters of process condensate.

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.

At RL's request, in December 1994, the EPA issued a letter stating that the treatment proposed was consistent with the treatment described in 40 CFR 268, Subpart A. This has allowed the continued use of LERF for 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) no longer apply. These milestones have been deleted by Change Request M-26-95-01, approved June 28, 1995.

3.4.4 Treatment

3.4.4.1 Planned Treatment. The 200 Areas Effluent Treatment Facility treats process condensate and prepares the waste for disposal. The current 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 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 or delisting 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.

3.4.4.2 Treatment Alternatives and Accelerated Treatment. The treatment method for 242-A process condensate has been established and initiated with ETF startup in November 1995.

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, Treatment Equivalency Petitions, 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.

Process condensate generated is discharged to and stored in the LERF until it is treated at the ETF. In June 1995, the EPA granted a petition submitted by RL for the delisting of 242-A Evaporator process condensate as hazardous waste based on treatment of the waste stream at the 200 Area ETF and the fact that subsequent disposal will not adversely affect human health and the environment.

Part B Permit applications 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). New revisions of these permits applications will be drafted in 1996 for submittal to Ecology in 1997.

No additional variances, treatment equivalency petitions, or time extensions are expected for this waste stream.

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 was stored in the 4843 Sodium Storage Facility. 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 (RL 1990c).

3.5.1 Generation

The FFTF was 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 and is undergoing closure. No waste is stored in the facility.

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 that was stored in the 4843 Sodium Storage Facility was solid LLW. All of the waste sodium in the storage unit was 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 was 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 was characterized as ignitable (D001), corrosive (D002), and reactive (D003). With the recent amendments to WAC 173-303, solid corrosive waste now receives state-only waste code WSC2 instead of federal code D002.

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 that was 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 estimated capacity of the 4843 Sodium Storage Facility is 84,000 kilograms of alkali metal (RL 1989a). 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 4843 Sodium Storage Facility no longer is used to store radioactive alkali metal waste.

3.5.3.2 Amount in Storage. The 4843 Sodium Storage Facility no longer has an inventory of radioactive alkali metal.

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 formerly 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 was 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 3.12).

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 was managed to ensure that the quantity and toxicity were minimized. No waste has been generated since 1993.

3.5.6 Variances, Treatment Equivalency Petitions, Time Extensions

If variances, treatment equivalency petitions, 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 was historically 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 was historically 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. 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 3-5 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 3-6.

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 at the time the waste was generated, its designation was WT01. Treating the ammonia scrubber feed with sodium hydroxide to raise the pH above 12 occasionally rendered the resulting ammonia scrubber waste corrosive (D002) as well, and created 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 only 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 according to outdated regulatory requirements. The average concentration for ammonia in this waste is less than 0.1 M, as shown in Table 3-5.

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

3.6.2.5 Schedule for Further Characterization. The ammonia scrubber waste currently stored in DST system tanks will be characterized before planned treatment and disposal of the tank contents as necessary. Any 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 Facility. 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, Treatment Equivalency Petitions, Time Extensions

If variances, treatment equivalency petitions, 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 3-8).

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 3-8) (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, NO₂, 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 3-7 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 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 the 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 waste (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, Treatment Equivalency Petitions, 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, treatment equivalency petitions, 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 mixed waste are F003 (hexone) 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 3-8.

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 off site. The offsite incineration destroyed 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 3-9.

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 3.12.4). 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, Treatment Equivalency Petitions, Time Extensions

Hexone is a mixed LLW that is restricted from land disposal because it was spent and met the solvent listing (40 CFR 268.30) description for F003.

If variances, treatment equivalency petitions, 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 in accordance with the approved closure plan that has been incorporated into the Hanford Facility Dangerous Waste Permit.

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 volume 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 a proposed commercial facility. Waste consisting of debris and soils have been generated as a result of closing the TSD unit.

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 3-9 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 3,156 cubic meters. An estimated 8,300 cubic meters of liquid have been "removed" through evaporation and solidification. This is 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. 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). Also applicable to Basin 2 sludge is D007 (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. A contained-in determination for the scabbled concrete residue from the interior surfaces of the concrete basins and other material that contacted the interior of the basins (drummed on or after June 1, 1995) was obtained in September 1995. Neither concrete nor soil is anticipated to be designated as dangerous waste when it is generated during closure of 183-H.

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 3.12. The storage unit compliance status of the CWC is discussed in Section 3.12.3.3.

3.9.4 Treatment

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

All dangerous waste, liquids and sludges, from the 183-H Basins will be retrieved for processing in a proposed commercial treatment facility beginning in FY 1997. Plans for treatment are described in Section 3.12.4.2. No treatment is anticipated to be needed for concrete or soil that will be generated as part of the 183-H closure.

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, Treatment Equivalency Petitions, Time Extensions

The 183-H Solar Evaporation Basins will undergo closure in accordance with an approved closure plan (RL 1991c) contained in the Hanford Facility RCRA Permit. The TSD unit 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) and discarded chemical products.

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

A treatment equivalency petition will be required to allow alternative treatment of waste code U123 (formic acid), for which the required treatment is combustion. 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. The EPA was requested to complete the equivalent treatment determination in a letter dated October 17, 1995.

If additional variances, treatment equivalency petitions, 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 TUNNELS WASTE

The PUREX Storage Tunnels 1 and 2 contain 0.43 cubic meter of elemental lead. The PUREX Storage Tunnel 2 contains 0.07 cubic meter of silver (mostly as silver nitrate), 0.01 cubic meter of elemental mercury, 0.0065 cubic meter of cadmium, and 0.01 cubic meter of chromium. The lead is in jumper counterweights and equipment weights and shielding. 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. The chromium is a corrosion byproduct from a failed stainless steel process concentrator.

As of May 1996, barium, selenium, and additional amounts of cadmium, chromium, lead, and silver will have been added to the PUREX Storage Tunnel 2 from the 324 Building waste. This addition is not included in the 1995 inventory shown in Tables 2-5 and 3-10. Barium, silver, and selenium will be present as dispersible particulate contaminated with process materials from the 324 Building process. Cadmium will be present as dispersible particulate and dried melter feed residue removed from process equipment. Chromium will be present as dispersible particulate and dried metal feed residue. Lead will be present as dispersible particulate, dried melter feed residue, and liquid metal seal material.

As Hanford facilities are deactivated other equipment and materials containing these and other waste types may be added to the tunnels.

3.10.1 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 1995, 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.

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.

On receipt of the 324 Building waste, lead will also be present in dispersible debris, dried melter feed residue, and liquid metal seal material from the 324 Building process. The dispersible debris waste consists of dirt, dust, process residues, equipment, and tools collected from the 324 Building B Cell floor. This debris does not contain any hazardous components, however it has been contaminated with process feed solutions that contained heavy metals and spent fuel particulate. The residual dried melter feed was removed from process equipment after water evaporation from the melter feed slurry used in the Federal Republic of Germany repository program. The liquid metal seal, used as a seal material in a glass melter, is inherently hazardous. Silver, barium, and selenium will be present in the dispersible debris. Cadmium will be present in the dispersible debris and liquid metal seal and chromium will be present in the dispersible debris and residual dried melter feed.

During PUREX shutdown, waste may be generated from the plant's maintenance activities or received from other locations at the Hanford Facility.

3.10.2 Characterization

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

3.10.2.1 Process Knowledge. 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 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. The quantity of barium, selenium, lead, silver, cadmium, and chromium from the 324 Building waste is estimated from process knowledge provided by the generator.

3.10.2.2 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.

3.10.2.3 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 than 5 milligrams per liter should it be exposed to a leachate. 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 5 milligrams of silver per liter should the

salts be exposed to a leachate. Although nitrate is an oxidizer and is designated D001 (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 0.2 milligram per liter.

Cadmium exhibits the characteristics of toxicity as determined by the TCLP and is designated D006. The form of cadmium present could produce an extract greater than 1 milligram per liter should it be exposed to a leachate.

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 5 milligrams per liter.

Barium exhibits the characteristics of toxicity as determined by the TCLP and is designated D005. The form of barium present could produce an extract of more than 100 milligrams per liter if it were exposed to a leachate.

Selenium exhibits the characteristics of toxicity as determined by the TCLP and is designated D010. The form of selenium present could produce an extract of more than 5.7 milligrams per liter if it were exposed to a leachate.

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

3.10.2.5 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.

3.10.3 Storage

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

3.10.3.1 Storage Unit 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, 21 rail cars containing 1,797 cubic meters of discarded equipment and associated waste have been placed in the tunnel, filling 52.5 percent of the storage area. Sufficient storage capacity remains for all future waste projected to be generated from PUREX. A more complete description of the PUREX Storage Tunnels may be found in *PUREX Storage Tunnels Dangerous Waste Permit Application*, Rev. 2 (RL 1990b).

3.10.3.2 Amount in Storage. As of December 31, 1995, 0.43 cubic meter of elemental lead is stored in PUREX Storage Tunnels 1 and 2. PUREX Storage Tunnel 2 currently holds 0.07 cubic meter of silver nitrate, 0.01 cubic meter of elemental mercury, 0.0065 cubic meter of cadmium, and 0.01 cubic meter of chromium.

3.10.4 Treatment

3.10.4.1 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, chromium, barium, and selenium 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).

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

3.10.4.3 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.

3.10.5 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.

3.10.6 Variances, Treatment Equivalency Petitions, Time Extensions

Some of the waste was placed in the PUREX storage tunnels before November 1987 and, therefore, became subject to the LDRs on the effective date of regulation. The waste will be removed from the PUREX Storage Tunnels during PUREX Plant closure, treated to comply with LDR treatment standards, and disposed of at a RCRA-compliant disposal facility.

If variances, treatment equivalency petitions, 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.

3.11 PUREX CONTAINMENT BUILDING

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. In addition, the containment building has also been permitted for chromium. Chromium-contaminated concrete solids from the E Cell floor are stored in F Cell within the containment 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, 1995) is approximately 0.3 cubic meter (approximately 3,362 kilograms) of radioactively contaminated lead (mixed waste). The waste cadmium, chromium, and lead stored in the containment building currently are untreated. Approximately 0.0002 cubic meter consists of 2 kilograms of metallic cadmium and 1.4×10^{-4} cubic meter of chromium. The preferred treatment option is microencapsulation for lead and reduction for cadmium and chromium.

3.11.1 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. The chromium debris stored in a metal box in F Cell originated from concrete solids contaminated with solutions from the E Cell floor.

3.11.2 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.

3.11.2.1 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.

- | **3.11.2.2 Sample Analyses.** No chemical analysis of the waste has been performed on the lead and cadmium and is not required because the waste is accurately characterized based on process knowledge. However, sample analysis were conducted to characterize the E Cell floor solids, in which chromium was detected.
- | **3.11.2.3 Waste Designation and Basis.** The waste (elemental cadmium, chromium, and lead) is designated TCLP toxic for lead (D008), cadmium (D006), and chromium (D007) and toxic (WT01). The materials are a solid, noncombustible metal.
- | **3.11.2.4 Uncertainty of Waste Designation.** The waste designation is accurately known, based on process knowledge.
- | **3.11.2.5 Schedule for Further Characterization.** No further characterization of this waste is scheduled.

| **3.11.3 Storage**

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

- | **3.11.3.1 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.

- | **3.11.3.2 Amount in Storage.** The combined quantity of lead and cadmium waste in storage is 0.31 cubic meter (3,362 kilograms of lead, 1 kg of chromium, and 2 kilograms of cadmium). No additional waste has been added to storage since October 1990.
- | **3.11.3.3 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 Form 3 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.

3.11.4 Treatment

3.11.4.1 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 macroencapsulation (55 FR 22520). Other alternatives have not been studied at this time. There are currently no plans for treatment of the chromium-contaminated concrete solids from the E Cell floor.

3.11.4.2 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 deactivation and closure.

3.11.5 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 permit fuel removal from the canyon floor. Revisions to the PUREX Plant Part A Permit allow for additional storage activities associated with PUREX Plant transition efforts. Additional transfers of waste into the PUREX containment building are possible during the deactivation stages of PUREX shutdown. When PUREX reaches the surveillance and maintenance mode, waste generation will depend on those operations.

3.11.6 Variances, Treatment Equivalency Petitions, 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, treatment equivalency petitions, 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 CENTRAL WASTE COMPLEX STORED LOW-LEVEL, TRANSURANIC, AND POLYCHLORINATED BIPHENYL WASTE

The CWC receives radioactive solid waste and provides temporary storage until treatment by DOE facilities or by commercial entities.

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, storage, 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, 1995, approximately 6,588 cubic meters of mixed LLW subject to LDRs and 19 cubic meters of TRU mixed waste. This includes 3,156 m³ of 183-H Solar Evaporation Basin waste. (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. (Including this waste, approximately 9,483 cubic meters of waste are stored.)

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 Allied Technology Group's thermal treatment contract facility, scheduled to be operational in 2000, will be able to handle some LLW PCBs. The Hanford Facility 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, 1995, 188 cubic meters of PCB-contaminated LLW and 78.4 cubic meters of PCB-contaminated TRU waste are in storage.

3.12.1 Generation

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

3.12.1.1 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 3-11. 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 is anticipated to 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 in the following paragraphs.

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 generated 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 activities conducted by Pacific Northwest National Laboratory (PNNL) in the 300 Area and North Richland generate numerous small-volume mixed waste streams that are land-disposal restricted. The laboratory waste may contain materials that are designated TCLP toxic (D004-D043), ignitable (D001), corrosive (D002), F-listed (F001-F005) or state criteria (WT01, WT02, WP01, WP02, WP03). The waste is generated through various research and development activities including analysis of samples containing toxic metals and solvents (i.e., tank waste samples), the disposal of contaminated equipment, and the use of scintillation cocktails in radionuclide analyses.

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); and methyl ethyl ketone (F005).

3.12.1.2 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 188 cubic meters of PCB-contaminated LLW and 78.4 cubic meters of PCB-contaminated TRU waste were generated between 1970 and December 1995.

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.

3.12.2 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.

3.12.2.1 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* (WHC 1993e).

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.

3.12.2.2 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 either through commercial or onsite treatment facilities.

3.12.2.3 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. In the future, random physical verification will occur on verifiable waste streams. Waste streams not verifiable by physical means will be verified by surveillance. (See Section 3.12.3.4 for details.)

3.12.2.4 Uncertainty of Waste Designation. The designation of the waste stored in the CWC is considered accurate.

3.12.2.5 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 either commercial or onsite treatment facilities. Further characterization may be necessary for newly generated waste and/or as a result of changed regulations.

3.12.3 Storage

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

3.12.3.1 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. Two of these modules are used to store contaminated alkali

metals. 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.

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.

3.12.3.2 Amount in Storage. The amount of dangerous waste restricted from land disposal stored at the CWC as of December 1995 is 6,873 cubic meters. This includes 3,156 cubic meters of waste from the 183-H Solar Evaporation Basins (see Section 3.9).

As of December 1995, 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 1995, 188 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.

3.12.3.3 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 were developed as part of the Tri-Party Agreement (Ecology et al. 1992). Interim-status compliance was achieved in June 1990.

3.12.3.4 Lawrence Berkeley National Laboratory Waste. A preliminary review of the documentation for two containers of waste stored at the CWC indicated that waste sent in labpack form could be incompatible. In September 1994, LBNL sent requests for a storage disposal approval record to WHC. After receiving additional information, WHC rejected many of the requests. In October a rejection letter was sent to LBNL explaining in detail that the labpacked 55-gallon drum contained incompatible waste mixtures that could be shock sensitive, pressurize, form explosive compounds, or continue to react with unknown consequences.

In December 1994, communications with LBNL suggested that LBNL didn't understand the rejection because they had shipped similar waste before. On February 9, four chemists from the 222S Laboratory reviewed the data for two labpacks containing reactive/compatible compounds that were received from LBNL. Based on the way the constituent data were presented, all four chemists agreed that the potential for incompatible chemical mixtures existed in the labpacked subcontainers. The facility was secured and notifications were made so personnel would not approach the suspect waste. The chemical hazards associated with the waste are normal industrial hazards addressed in the response plan. When the two LBNL containers were received, they were stored in the low-level flashpoint modules at the CWC. Operators of the storage facilities where the two containers are stored indicated that additional containers may be in question, but have not been reviewed.

After the potential problem with the containers was discovered, the documentation for all labpack containers stored at the CWC was reviewed to ensure that no other stored containers had similar problems. The organic chemist who reviewed the container contents determined that two additional containers from LBNL had potential problems.

A team of WHC and LBNL experts was immediately assembled to address the problem with the containers. LBNL personnel brought additional paperwork on the containers, which was reviewed by several experienced chemists and an explosives expert. The general opinion was that an immediate shock-sensitivity problem did not exist, but that the containers contained some materials that could react over a long period of time. Based on this information, the CWC was reopened. The containers were marked so that they could not be moved until proper procedures were in place to handle their contents. The team concurred that, to be conservative, the best course of action was to open the containers and segregate the incompatibles and neutralize or treat the containers with chemical mixtures. One of the containers required segregating the internal labpacks. The remaining three containers required physical separation of the actual contents of the labpacks. A special team consisting of representatives from Solid Waste Disposal, 222S Laboratories, the Hanford Fire Department HazMat team, and safety developed the methodology and procedures to accomplish this work. Regulators have been involved to ensure compliance with applicable regulations.

Two of the labpacks contained mineral acids including both hydrochloric and nitric acids. One labpack with the mineral acids had the various acid types (e.g. nitric, hydrochloric) in separate inner bottles. The other labpack had several inner liter-size bottles with the acids blended.

Two of the labpacks contained mixtures of mineral acids and organics stored in liter-size glass or plastic bottle that were packed in absorbent materials inside a 55-gallon drum. The chemical contents of these labpacks included the following:

- nitric acid
- inorganic chloride salts
- acetone
- toluene
- diethyl ether
- hydrofluoric acid
- methyl ethyl ketone
- isopropyl alcohol
- hexane
- tetrahydrofuran.

On March 21, 1995, information was found on one additional container from LBNL that had the same potential problem with tetrahydrofuran and diethyl ether. The drum was located in a flammable storage module at the CWC.

A treatment and segregation plan was completed for the LBNL waste containers. The plan generally described the processes, roles, and responsibilities of each organization and identified the documentation that would be created during treatment and segregation. Nondestructive evaluation was performed on these containers to determine as much as possible about the current state and configuration of the internal containers. On April 3, 1995, the two acid containers were moved to the 224T Facility and examined using real-time radiography. Several inconsistencies were identified. On April 6, 1995, the three organic containers were moved to 224T and examined. Again, several inconsistencies were identified.

All the identified containers will be stored at T Plant in a RCRA-compliant storage area. At this point in the verification process, no incompatibility problem exists. The hazards for storing this waste have not increased based on the current results of field analysis. However, the waste not being fully characterized before packaging and shipment to TSD is an issue.

On May 9, 1995, WHC provided a manifest discrepancy notification to Ecology in accordance with WAC 173-303-370(4)(b). On May 15, 1995, Ecology issued a voluntary compliance letter referencing violations of WAC 173-303 for accepting and storing incompatible waste in the CWC. The voluntary compliance letter cited eight corrective actions to be completed within 90 days. All corrective actions were completed on time.

A new waste acceptance process is being implemented to improve efficiencies and provide more thorough technical reviews of waste. The new Solid Waste Assurance Program includes the Waste Specification System, Verification, and the Performance Evaluation System. Under the Waste Specification System, each waste stream is reviewed individually through the use of a Waste Certification Summary. The summary provides a detailed description of how each waste stream is generated, characterized, segregated from other waste streams (including incompatible

constituents) and packaged. In addition, a preacceptance review and a container inventory review will be performed for each waste package. A description of all inner containers, chemical compositions, and concentrations of all constituents will be provided for all labpacks. The review will include an evaluation for compatibility. Physical and chemical analysis will be performed on a percentage of all waste received at solid waste TSD units. Verification provides an objective means of ensuring that waste acceptance criteria are met and that procedures are followed.

Each generator's waste streams will be reviewed based on conformance issues found during the entire acceptance process. Deficiencies will be identified and the generator's waste management program will be reviewed/audited as necessary to correct any problems. This program provides a continual, performance-based methodology for ensuring that waste meets all regulatory requirements.

On March 6, 1996, a draft occurrence report was received from LBNL indicating the possibility that mixed waste was buried as low-level waste in the Low-Level Burial Grounds at the Hanford Site's 200 West Area. Apparently, this waste was buried improperly because the contents were misrepresented by LBNL. The occurrence report was filed on March 7, 1996. All indications are that the waste presents no imminent danger to personnel safety or the environment. This draft occurrence report from LBNL was evaluated by personnel from Generator Waste Acceptance Services, Solid Waste Management, and Solid Waste Operations of WHC and by RL personnel. The formal occurrence report is the written follow-up to a verbal notification to Ecology, which occurred on March 6, 1996. Further evaluation will be required and the occurrence report (RL-WHC-SOLIDWASTE-1996-002) will be updated as more information becomes available.

3.12.4 Treatment

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

3.12.4.1 Description of Current Treatment. The waste in the CWC currently is not undergoing any treatment, but is in interim storage pending 2336-W WRAP Module 1 operation and start of LLMW treatment programs.

3.12.4.2 Description of Proposed Treatment. The waste currently stored in the CWC will be treated by the WRAP Module 1 facility and under the following: the commercial thermal treatment contract, the Mixed Waste Stabilization Treatment Program, and Tri-Party Agreement Milestone M-33.

3.12.4.2.1 WRAP Module 1. WRAP Module 1, shown in Figure 3-10, is currently under construction and is scheduled to be operational in March 1997. Module 1 will provide examination, characterization, certification, treatment, and shipping for boxes and drums of contact-handled TRU, LLW, and LLMW waste. Only drums are to be opened and processed in the facility. Boxes will undergo only nondestructive examination. Module 1 will also provide for decontamination of small items, primarily drums and overpacks.

Module 1 will provide the capability to process retrieved suspect TRU waste, certify newly generated TRU and LLW, and process small quantities of LLMW. TRU waste will be certified to meet WIPP waste acceptance criteria. LLW will be verified for disposal at the Hanford Site. LLMW will be treated to meet RCRA- and Hanford Site-specific disposal requirements.

When drums enter WRAP Module 1, they will undergo nondestructive examination and analysis, container opening, and material sorting, sampling, and compaction. The TRU and LLW drums will be opened and material sorted in glovebox enclosures. After entering the enclosure, each drum will be deheaded and tipped onto a sorting table where the inner plastic liner will be opened. All sorting will be performed using automatic manipulators; however, some manual sorting through gloveports with extension tools can be performed.

For drums that have been identified as containing potentially noncompliant items based on nondestructive examination or visual inspections, the noncompliant items will be removed, placed in a transfer drum, and transferred to the restricted waste gloveboxes. Examples of noncompliant items include free or containerized liquids, high-efficiency particulate air (HEPA) filters, and large quantities of particulates, aerosol cans, and suspect radioactive mixed waste. The sorting table is designed to contain liquids if they spill. Collected liquids will be transferred to the restrictive waste management gloveboxes.

In the restrictive waste management gloveboxes several operations will be carried out by operators through gloveports using extension tools. Any materials suspected of containing dangerous constituents will be sampled. 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 will be used primarily for characterizing any identified mixed waste and for limited processing primarily to certify waste for WIPP disposal. Limited small-scale mixed waste treatment to meet LDR will occur in Module 1. This treatment includes neutralization, stabilization, amalgamation, macroencapsulation, and controlled reaction with water. Some waste may be repackaged and sent to be processed under the commercial treatment contracts.

The restrictive waste management operators will enter descriptive information on waste materials into the compute 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.

3.12.4.2.2 Commercial Thermal Treatment Contract. The commercial thermal treatment contract will provide treatment for LLMW by thermal destruction of the hazardous constituents and subsequent immobilization of the radionuclides in a grouted or slag/glass final waste form. This contract will provide for treatment of alpha-contaminated PCB waste regulated by the Toxic Substance Control Act and for most listed and characteristic hazardous waste restricted from land disposal under RCRA. In addition to PCBs, a significant quantity of LLMW containing RCRA F-coded, ignitable, and reactive organic constituents is presently stored or will be generated at the Hanford Site. The contract has been awarded to a company planning to build

and operate their treatment facility near Richland, Washington, but off the Hanford Site. Treatment is scheduled to begin in FY 2001. The facility will have the capacity to treat up to approximately 717 cubic meters of waste per year.

3.12.4.2.3. Mixed Waste Stabilization Treatment Program. The Mixed Waste Stabilization Treatment Program was initiated after the termination of WRAP Module 2A (Project W-100) detailed design activities on December 30, 1994. This program replaces treatment plans for the waste originally designated for WRAP 2A. The program is broken into three treatment components: commercial treatment, onsite treatment, and direct disposal.

Commercial Treatment. This component will procure commercial services to treat mixed waste to RCRA, WAC, and Hanford Site disposal requirements. Treatment is to begin no later than September 30, 1999, and have the capacity to treat up to 945 cubic meters of waste per year. Targeted treatment technologies are grout and polyethylene stabilization and or macroencapsulation for debris- and nondebris-type waste. The treatment facility built or used under this contract will be located off the Hanford Site and the treated waste will be returned to the Site for final disposal. Currently, offeror proposals are being reviewed for technical responsiveness. Contract award is scheduled for June 1996. Waste streams selected for commercial stabilization treatment are those with large volume that would require substantial capital equipment investment and/or new facilities for effective waste treatment.

Onsite Treatment. This component provides the capability to treat some mixed waste at the Hanford Site. Targeted treatment technologies are neutralization, stabilization, amalgamation, macroencapsulation, and controlled reaction with water. Facilities to be used to treat subject waste include WRAP Module 1 and 2706-T facilities. Treatment is currently planned to begin in FY 1997. The type of treatment and which waste streams will be treated on site are determined by the following criteria: waste requiring substantial further characterization or treatment-lot sorting should be considered for onsite treatment (e.g., labpacks) and capital equipment and facility expenditures required for treatment shall be minimal (e.g., microencapsulation).

Direct Disposal. This component pursues regulatory strategies and positions that allow for direct disposal of some mixed waste that was previously identified as requiring treatment by filing alternative treatment petitions, verifying that waste currently meets LDR and/or petition acceptance of existing treatment performed on some waste (RL 1995a). If fully successful, this component would dispose of approximately 760 cubic meters of LLMW. A treatment equivalency petition for formic acid (U123) has been submitted to EPA for review. Approval is scheduled by September 1996. The other regulatory strategies are expected to be finalized during FY 1997 with actual waste disposal beginning that year.

3.12.4.2.4 Milestone M-33 Program. Tri-Party Agreement Milestone M-33 has encompassed those waste streams originally designated for the proposed WRAP Module 2B facility. Under M-33, no specific facilities or near-term startup dates are currently defined. Waste streams originally designated for the proposed Module 2B were contact-handled TRU, TRUM, and LLMW in containers too large or heavy to be handled in WRAP Module 1 or under the commercial treatment contracts, and all remote-handled TRU, TRUM, and LLMW waste.

3.12.4.3 Treatment Alternatives for Mixed Organic Wastes. A diagram showing WRAP Module 1 and proposed commercial treatment is shown in Figure 3-11.

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, a privatized thermal treatment contract was awarded. 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. This option has not been approved.

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.

Bid proposals are currently being reviewed for a commercial stabilization contract to treat contact-handled LLMW in lieu of building a new onsite facility. Table 3-12 lists the alternatives reviewed and the possible solutions to the stabilization of contact-handled LLMW.

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

3.12.5 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.

3.12.6 Variances, Treatment Equivalency Petitions, Time Extensions

The CWC contains waste that is restricted from disposal because it contains solvents (40 CFR 268.30), Second-Third LDRs (40 CFR 268.34), and waste identified by the Third-Third LDRs (40 CFR 268.35).

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 and direct disposal options.

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. However, the thermal treatment contract facilities will be able to treat some of this 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 equivalency petition has been submitted to EPA 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 combustion. However, the formic acid concentration is very low compared to other constituents. In addition, Ecology has been approached on a contained-in determination for SST and DST system soils and debris in storage at the CWC.

3.13 EXCAVATED SUSPECT-TRANSURANIC AND TRANSURANIC WASTE AND OTHER REGULATED LLBG 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) in the Low-Level Burial Grounds. The term retrievable storage is used to meet radioactive management requirements. RCRA defines this practice as disposal.

This waste stream that must be excavated to meet DOE radioactive waste management requirements consists of waste that was generated after 1980 and in 1987 or before, when placement in retrievable storage 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 wooden 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 configurations with the intent of excavating this waste in the future. 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 3.14) and in the CWC since 1987 (Section 3.12).

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 (RHO 1985). Approximately 15,000 cubic meters of TRU waste had been placed in the 200 Areas in more than 38,700 containers.

In addition to the waste stream that will be generated on excavation, the Hanford Facility has received submarine reactor compartments for disposal in the Low-Level Burial Grounds TSD unit. The submarine reactor compartments are placed in the 200 East Area Burial Ground 218-E-12B, Trench 94. These defueled reactor compartments are disposed of, 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. As much of the PCBs and lead as practical have been removed from the submarine reactor compartments. The remaining lead and PCBs are encapsulated within the sealed hulls of the compartments.

As of March 1996, 54 reactor compartments were disposed of. Additional reactor compartments will be shipped to the Hanford Site in the future.

A pilot project to excavate and retrieve 138 drums from these locations was started in 1994. To date, 171 drums have been retrieved, inspected in place, or stored at the CWC. Data on the integrity of the drums have been compiled.

3.13.1 Generation

Extensive process knowledge is not available for many of the containers that will be excavated or retrieved. 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.

3.13.2 Characterization

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

3.13.2.1 Process Knowledge. Limited process knowledge has been used to characterize the suspect-TRU and TRU mixed waste that will be excavated or retrieved. 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.

3.13.2.2 Sample Analyses. Sampling for mixed waste constituents will be performed when the suspect-TRU and TRU waste is retrieved. All drums and boxes of TRU waste 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.

3.13.2.3 Waste Designation and Basis. A review of data on suspect-TRU and TRU waste 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 waste placed in the burial grounds 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).

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

3.13.2.5 Schedule for Further Characterization. In situ sampling of the suspect-TRU and TRU waste was initiated in FY 1991 (WHC 1989b). The purpose of the sampling is to assess the current and future integrity of the waste containers and analyze contents. These objectives will be achieved by visual and nondestructive examination of waste containers, retrieval, and nondestructive assay.

The suspect-TRU and TRU pilot retrieval and inspection program conducted in 1994 laid out a three-step approach to gather and provide data on the 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 excavation and retrieval program. Therefore, the second step was undertaken to physically retrieve and inspect stored TRU wastes, while a third step (not yet approved) would fully characterize the retrieved waste.

Locations for excavation/retrieval and inspection were chosen based on waste 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 at several different trench locations and provide the needed retrieval, inspection, and characterization data to the WRAP project and other DOE sites.

Excavation/Retrieval and inspection of TRU waste drums at two sites is complete. (No other retrieval operations are planned beyond these sites.) Twenty-three TRU drums that were placed 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 ± 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 a 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 these 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 excavated/retrieved and processed through the WRAP 1 facility.

3.13.3 Storage

This section describes the current inventories of TRU and suspect-TRU waste that will be excavated or retrieved. RCRA considers the placement of such waste in the Low-Level Burial Grounds as disposal and not storage. DOE radioactive waste management requirements classify this practice as retrievable storage.

3.13.3.1 Storage Unit and Capacity. This waste stream primarily consists of 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 the locations in which they were placed. 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 configurations. These configurations consisted of shallow land trenches, concrete lined "V" trenches, and earth-covered asphalt pads and caissons (Figures 3-12 and 3-13).

Excavated suspect-TRU and TRU waste is located in the 218-W-3A, -4B, -4C, and 218-E-12B Burial Grounds. Newly generated (after 1987-1988) TRU waste is stored in the TRUSAF and CWC storage buildings.

Four different container configurations were used for contact-handled TRU waste at the Hanford Site. The first configuration consists of waste drums stacked horizontally in a gravel-bottom "V" trench. The waste drums were covered directly with soil. This configuration was used from 1970 through 1972.

The second configuration was an engineered concrete and metal structure known as the V-7 trench. In the V-7 trench, drums were stacked on a 45-degree angle. This 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 3-13). Boxed waste in this configuration may contain shoring used to protect it from collapse because of soil pressure. This 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 configuration is the same as the third except the floor is asphalt. This 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 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 3-13). Caissons are equipped with electrically driven exhausters fitted with HEPA filters.

3.13.3.2 Amount of Waste Placed. Approximately 15,440 cubic meters of waste have been placed in the 200 Areas. 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 excavation or retrieval.

3.13.3.3 Storage Compliance Assessment. Because RCRA considers this practice as disposal, this section is not applicable.

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 in the Borehole Completion Packages for the year in which the wells were completed (WHC 1991f, WHC 1992d, WHC 1994c).

The Part B Permit application, which documents the then-current compliance status with the dangerous waste regulations, was submitted in December 1989 for the Low-Level Burial Grounds.

3.13.4 Treatment

This section describes the current and proposed treatment of excavated suspect-TRU and TRU waste.

3.13.4.1 Current Treatment. No waste is being treated.

3.13.4.2 Proposed Treatment. Excavated suspect-TRU and TRU waste from retrievable storage units will be retrieved and shipped to the WRAP Facility, Module 1 or a commercial facility for treatment of 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 1997. Module 2A has been canceled with commercial contracts providing the treatment capacity. Operations are planned to begin in 1999. Module 2B is currently being reviewed as part of Milestone M-33-00.

3.13.5 Waste Reduction

The locations where the suspect-TRU and TRU waste placed no longer accept waste; therefore, a waste minimization program is not applicable. However, waste minimization will be considered when evaluating cleanup and disposal alternatives.

3.13.6 Variances, Treatment Equivalency Petitions, Time Extensions

The waste placed in these 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). This facility has been cancelled; commercial options are being pursued to meet the schedule stipulated in M-19-00.

If variances, treatment equivalency petitions, 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.

3.14 224-T 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.

3.14.1 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 PNNL 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. 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. Action on this matter is pending by DOE-HQ.

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.

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.

3.14.2.1 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 four entities (PUREX, PFP, PNNL, and the spent fuel program) are able to certify waste.

3.14.2.2 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.

3.14.2.3 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.

3.14.2.4 Uncertainty of Waste Designation. The designations of waste stored in TRUSAF are considered to be accurate.

3.14.2.5 Schedule for Further Characterization. Certified waste in interim storage is awaiting shipment to the WIPP. No further characterization is required for this waste.

3.14.3 Storage

This section addresses current storage units, describes inventories, and assesses compliance with applicable regulations.

3.14.3.1 Storage Unit and Capacity. The 224-T TRUSAF building was originally constructed in 1943 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 3-14). 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.

3.14.3.2 Amount in Storage. As of December 31, 1995, 333 cubic meters of TRU mixed waste are stored in TRUSAF.

3.14.3.3 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.

3.14.4 Treatment

This section describes the current and proposed treatment of stored TRU waste.

3.14.4.1 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. However, 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.

| **3.14.4.2 Proposed Treatment.** Certified TRU waste in TRUSAF interim storage will be shipped to the WIPP for permanent disposal.

| **3.14.4.3 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.

| **3.14.4.4 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.

| **3.14.5 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.

| **3.14.6 Variances, Treatment Equivalency Petitions, Time Extensions**

| If variances, treatment equivalency petitions, 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.

| **3.15 303-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 1995b). 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 3.12).

3.15.1 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.

3.15.2 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 will be shipped for burial in 1996.

3.16 324 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).

3.16.1 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.

- Approximately 0.6 cubic meter 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.

3.16.2 Characterization

This section discusses the best available waste characterization information.

3.16.2.1 Process Knowledge. Based on process knowledge, none of the designated mixed waste in the REC is currently classified under RCRA as "listed" hazardous waste. The waste types characterized solely on the basis of process knowledge are as follows.

- Dried melter feed (0.17 cubic meter)--D007, D008
- Liquid metal alloy seal (<0.2 cubic meter)--D006, D008
- Waste elemental lead (0.80 cubic meter)--D008

3.16.2.2 Sample Analyses. In 1993, results of laboratory analyses of some waste became available. The following waste types are characterized on the basis of analytical data.

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

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

3.16.2.4 Uncertainty of Waste Designation. The designation of waste types in the REC is considered accurate.

3.16.2.5 Schedule for Further Characterization. No further waste characterization is planned.

3.16.3 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 3.16.1.

3.16.3.1 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 past inventory in storage (9.17 cubic meters) and the consideration that no future significant generation of waste at this facility is anticipated.

3.16.3.2 Amount in Storage. A detailed explanation of the volumes currently in storage is provided in Section 3.16.1.

3.16.3.3 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. A compliance agreement was negotiated with and approved by Ecology. The 324 REC is in compliance with the terms of this agreement. Milestone M-89 includes both interim and final action to complete the closure of the 324 REC.

3.16.4 Treatment

Currently stored waste in the 324 REC unit is not being treated. Sections 3.16.4.1 through 3.16.4.4 cover treatment options for waste stored in the 324 REC.

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

3.16.4.2 Proposed Treatment. No treatment of 324 REC waste is proposed at the 324 REC.

3.16.4.3 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. Some REC mixed waste will be shipped to the PUREX tunnels and the CWC for interim storage. Waste will be treated in accordance with the proposed treatment scenarios for these units.

3.16.5 Waste Reduction

Waste reduction has been accomplished through waste segregation. Waste volume has been reduced by approximately 35 percent during cleanout of the REC. Also, analytical data have shown that 50 percent less waste is present than was previously believed present.

3.16.6 Variances, Treatment Equivalency Petitions, Time Extensions

If variances, treatment equivalency petitions, 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.

3.17 324 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.

| 3.17.1 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 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.

| 3.17.2 Characterization

This section covers the best available waste characterization information.

| 3.17.2.1 **Sample Analysis.** The 324 HLV waste was designated based on process knowledge and 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.
- Nitrate solution contained in TK-107 (0.62 cubic meter)—D002, D005, D006, D007.

| 3.17.2.2 **Uncertainty of Waste Designation.** The designations of the 324 HLV waste are considered accurate.

| 3.17.3 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.

| 3.17.3.1 **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.

| 3.17.3.2 **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 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.

| Milestone M-89 includes both interim and final action to complete the closure of the 324 HLV. A compliance agreement was negotiated with and approved by Ecology. The 324 HLV is in compliance with this agreement.

| **3.17.4 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.

| Additional treatment options may be addressed in the clean-closure feasibility study.

| **3.17.4.1 Current Treatment.** Waste stored in the 324 HLV is not currently being treated.

| **3.17.4.2 Proposed Treatment.** A treatment approach for the HLV waste has been approved by Ecology. Waste would be transferred to D Cell of the REC. Treatment would consist of precipitation, pH adjustment, ion exchange, and evaporation. Remaining mixed waste would be transferred to the CWC.

| **3.17.4.3 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.

| **3.17.5 Waste Reduction**

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

| **3.17.6 Variances, Treatment Equivalency Petitions, and Time Extensions**

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

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

F3-2.1

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

Figure 3-4. Single-Shell Tank Waste Inventory by Tank Farm.

Figure 3-5. Process Flow Diagram for 242-A Evaporator.

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Figure 3-6. LERF Equipment and Piping.

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

H9503005.2

Figure 3-8. Historical Process Flow Diagram for PUREX
Process Condensate.

79108088.12

Figure 3-9. Process Flow Diagram for Hexone Waste Processing and Disposal.

79108088.15

Figure 3-10. WRAP Module 1, 2336-W.

Figure 3-11. Waste Receiving and Processing Module 1 and Commercial Treatment.

H94020312

Figure 3-12. Typical Configuration of Suspect-TRU and TRU Contact-Handled Waste to be Excavated.

79108088.18

Figure 3-13. Typical Configuration of a Retrievable Storage Unit for Remote-Handled Waste.

79108088.19

Figure 3-14. 224-T Transuranic Storage and Assay Facility Floor Plan.

Legend

- Sealed process canyon area
- Sealed radiation measurement laboratory

79108068.20

Table 3-1. Estimated Mass of Nonradioactive Chemical Components of Single-Shell and Double-Shell Tank Wastes. (2 sheets)

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) ₃ ⁻	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 (0)	1.99 E+03			1.99 E+03		6.78 E+01	6.78 E+01
As ⁺³					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
Ce ⁺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

Table 3-1. Estimated Mass of Nonradioactive Chemical Components of Single-Shell and Double-Shell Tank Wastes. (2 sheets)

Chemical metric tons	Single-Shell Tanks				Double-Shell Tanks		
	Sludge	Salt Cake	Interstitial Liquid	Total	Soluble	Insoluble	Total
NO ₃ ⁻	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
NO ₂ ⁻	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 ^(a)			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 ⁺⁶	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 ₂ O	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 ₂ O	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

^(a)Al⁺³ includes the Al present in cancrinite and Al(OH)₃.

^(b)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).

FY	B Plant	PUREX	Tank Farms	SST to DST Pumping	UO ₂ Plant	PF Plant	S Plant (Laboratories)	100 Area	300 Area	400 Area	Total
1990	2,393	6,882	1,226	0	0	53	151	121	193	136	0
1991	1,317	984	776	859	0	0	140	170	0	208	0
1992	435	363	155	458	0	136	250	106	0	132	30
1993	511	291	144	140	0	19	257	38	0	87	45
1994	53	276	140	836	0	26	76	76	0	110	42
1995	129	1,154	360	1,196	0	0	83	83	0	220	0
											3,225

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

*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.* (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.* (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 .		

^aAfter 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.

^bIndividual 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. 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 (μ S)	4	1.79 E+02
pH (dimensionless)	4	9.35 E+00
Temperature ($^{\circ}$ C)	4	3.24 E+01
TOC	4	2.16 E+03

^aN 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.

^bUnits are parts per billion unless otherwise stated. This ammonia scrubber discharge was sent to cribs.

TOC = Total organic hydrocarbon.

Table 3-6. 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 μ Ci/L

Table 3-7. 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 3-8. 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 3-9. 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 m³)

Table 3-10. 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 chromium 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	--	--	--	--
5-13-88	2	--	--	--	56	--
06-13-88	2	227	--	--	--	--
06-13-88	2	--	--	113	--	--
01-27-95	2	--	--	--	--	8
02-08-95	2	1,924	--	--	--	--
Total	N/A	4,911	129	737	56	8

Note: 4,911 kg of lead has a volume of 0.43 m³.

129 kg of mercury has a volume of 0.01 m³ at 23 °C.

737 kg of silver nitrate has a volume of 0.07 m³.

13 kg of cadmium have a volume of 6.5 x 10⁻³ m³.

8 kg of chromium have a volume of 1.1 x 10⁻² m³.

N/A = Not applicable.

Table 3-10. 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)	Chromium Mass (kg)
06-22-90	1,301.8	--	
06-22-90	--	2.0	
10-27-90	--	--	
04-29-92	--	--	1.0
03-13-95	98.3	--	--
Total	1,400.1	2.0	1.0

Note: 1,400.1 kg of lead has a volume of 0.12 m³.

2.0 kg of cadmium has a volume of 2.3×10^{-2} m³.

1.0 kg of chromium has a volume of 1.4×10^{-4} m³.

Table 3-11. Projected Generation of Solid Waste Operations Complex
Stored Low-Level and Transuranic Waste.

Year	Total (cubic meters)
1996	1,588
1997	1,898
1998	1,878
1999	2,325
2000	2,267
2001	2,922
2002	3,005
2003	2,402
2004	2,797
2005	2,167
2006	2,436
2007	2,556
2008	2,364
2009	2,682
2010	3,020
2011	3,642
2012	4,187
2013	4,163
2014	4,660
2015	5,136
2016	5,344
2017	5,142
2018	2,448
2019	2,672
2020	2,798
2021	3,790
2022	3,627
2023	3,451
2024	3,416

Table 3-12. Contact-Handled Low-Level Mixed Waste Stabilization Treatment Program. (3 pages)

TREATMENT OPTION	WASTE STREAM	EXISTING VOLUMES (m ³) ¹	5-YR PROJ. VOLUMES (m ³) ²	10-YR PROJ. VOLUMES (m ³) ³	WHAT HAS TO BE DONE TO TREAT THE WASTE	WHERE WOULD IT BE PERFORMED	CONTINGENCY PLAN IF PRIMARY OPTION FAILS
DIRECT DISPOSAL	NON-DEBRIS TYPE WASTE: 1A 183H Solidified Liquid.	580.9	0	0	Obtain EPA/WDOE approval for formic acid (UI23) alternative treatment (stabilization) and acceptance of the stabilization treatment already performed on the waste. Once obtained, dispose waste in LLMW Subtitle C landfill.	Onsite at the Central Waste Complex, T-Plant & RMW Burial Ground.	Default to Commercial Stabilization Treatment contract for LLMW treatment.
	NON-DEBRIS TYPE WASTE: Backlog Soils (770 Dr, 5 Bx).	178.5	0	0	Demonstrate to EPA/WDOE subject waste meets LDR treatment standards and dispose in LLMW Subtitle C landfill.	Onsite at the Central Waste Complex, T-Plant & RMW Burial Ground.	Default to Commercial Stabilization Treatment contract for LLMW treatment.
	NON-DEBRIS TYPE WASTE: 2A ETF NH ₄ /Na Sulfate Powder, Tank Dependent (+50% of original forecast).	0	50	133.2	Generator anticipates 50% of total waste stream volume will be below RCRA/WAC hazardous waste designation limits. Verify waste is below RCRA/WAC hazardous waste designation limits and dispose in Low Level Burial Grounds.	200 Area ETF will verify waste designation and SWD will dispose waste in the LLBG (as waste is accumulated).	If waste is designated for RCRA/WAC hazardous waste, treatment of the waste will default to Commercial Stabilization Treatment contract for LLMW treatment.
	OPTION TOTAL	759	50	133			
ONSITE WASTE TREATMENT	NON-DEBRIS TYPE WASTE 5A1 Elemental Mercury.	4.3	4.3	6.8	Treat waste using RCRA-LDR specified or BDA1 treatments (amalgamation, chemical precip., deactivation...etc.), grout stabilize residues to meet other RCRA/WAC/PA requirements (as applicable) and dispose in LLMW Subtitle C landfill. Minimal capital investment and can be performed utilizing standard laboratory scale equipment.	Waste Receiving & Processing Module 1 (WRAP-1).	Default to treating waste at T-Plant or other Onsite TSD facility; otherwise, waste will need to be stored until enough volume is accumulated making it practical for future commercial treatment.
	5A2 Mercury Chem./Particulate, <260mg/kg Hg (~90% of 5A2 total volume).	4.1	3.5	6.7			
	5C2 Lead Chemicals/Solutions.	9.5	0.5	2.0			
	9C Contained Liquids.	17.1	62.0	146.2			
	NON-DEBRIS TYPE WASTE: 5C1 Radioactive Elemental Lead.	114.4	145.5	280.8	Macroencapsulate waste using grout or other approved macroencapsulation application, then dispose in the LLMW Subtitle C landfill. Must obtain treatment capability (purchase or lease) prior to performing waste treatment.	2706T or other permitted TSD facility.	Default to Commercial Stabilization Treatment contract for LLMW treatment under the contract option.
	DEBRIS TYPE WASTE: Backlog Debris (1200 Dr, 200 Bx) 1D 183H Misc. Waste, (Debris) 9B Heterogeneous Debris (Many boxes, 5'x5'x9' was bounding case) 5A3 Hg Cont. Debris 5C3 Lead Cont. Debris	487.5 54.7 19.7 3.7 12.9	0 0 1207 .6 49.0	0 0 3231.5 2.1 192.7	Obtain EPA/WDOE approval for macroencapsulation of debris type waste by utilizing sealed polyethylene containers. Encapsulate waste via Onsite treatment contract and then dispose treated waste in the LLMW Subtitle C landfill.	2706T or other Onsite TSD facility.	Default to Commercial Stabilization Treatment contract for LLMW treatment.

Table 3-12. Contact-Handled Low-Level Mixed Waste Stabilization Treatment Program. (3 pages)

TREATMENT OPTION	WASTE STREAM	EXISTING VOLUMES (m ³) ¹	5-YR PROJ. VOLUMES (m ³) ²	10-YR PROJ. VOLUMES (m ³) ³	WHAT HAS TO BE DONE TO TREAT THE WASTE	WHERE WOULD IT BE PERFORMED	CONTINGENCY PLAN IF PRIMARY OPTION FAILS
ONSITE WASTE TREATMENT (cont'd)	1D 183H Misc. Waste, (Sandblast Grit)	40.0	0	0	Obtain EPA/WDOE approval for formic acid (U123) alternative treatment (stabilization). Procure leased stabilization treatment capability and treat waste to RCRA/WAC/PA requirements. Once treated, dispose waste in LLMW Subtitle C landfill.	2706T or other Onsite TSD facility.	Default to Commercial Stabilization Treatment contract for LLMW treatment.
OPTION TOTAL		768	1472	3869			
COMMERCIAL TREATMENT, UNIQUE WASTE	NON-DEBRIS WASTE: 5A2 Mercury Chem./Particulate (10%), (2260mg/kg Hg) NOTE: This waste was removed from WRAP-2A scope.	0.5	0.4	0.7	Procure commercial treatment services to treat waste to RCRA/WAC/PA requirements (i.e., retorting/roasting and stabilization), verify generator waste characterization information, manifest waste to commercial treater, treat subject waste to RCRA/WAC/PA requirements, verify/accept treated waste and dispose waste in LLMW Subtitle C landfill.	Treatment would take place at the awarded contractor's site (TBD).	Default: Build onsite retorting/roasting capability to treat subject waste (location TBD), designate to another Site's Site Treatment Plan (STP) for treatment, or store waste indefinitely..
OFFSITE COMMERCIAL STABILIZATION TREATMENT	NON-DEBRIS TYPE WASTE: 1B 183H Crystalline Solids 1C 183H Sludge	931.8 980.7	0 0	0 0	Obtain EPA/WDOE approval for formic acid (U123) alternative treatment (stabilization), procure Offsite commercial stabilization treatment services, verify generator waste characterization information, manifest waste to commercial treater, treat subject waste to RCRA/WAC/PA requirements, verify/accept treated waste and dispose waste in LLMW Subtitle C landfill.	Treatment would take place at the awarded contractor's site (TBD by June 1996).	Default: Build or lease Onsite stabilization capability to treat subject waste, designate to another Site's Site Treatment Plan (STP) for treatment, or store waste indefinitely.
	NON-DEBRIS TYPE WASTE: 2A ETF NH ₄ /Na Sulfate Powder, Tank Dependent (~50% of original forecast)	0	50	133.2	Procure Offsite commercial stabilization treatment services, verify generator waste characterization information, manifest waste to commercial treater, treat subject waste to RCRA/WAC/PA requirements, verify/accept treated waste and dispose waste in LLMW Subtitle C landfill.	Treatment would take place at the awarded contractor's site (TBD by June 1996).	Default: Build or lease Onsite stabilization capability to treat subject waste, designate to another Site's Site Treatment Plan (STP) for treatment, or store waste indefinitely.
	2B ETF/TEDF Ion-exchange Resin 9A Particulate & Sludge	0 45.5	21.8 2464	55.3 4033			

Table 3-12. Contact-Handled Low-Level Mixed Waste Stabilization Treatment Program. (3 pages)

TREATMENT OPTION	WASTE STREAM	EXISTING VOLUMES (m ³)	5-YR PROJ. VOLUMES (m ³)	10-YR PROJ. VOLUMES (m ³)	WHAT HAS TO BE DONE TO TREAT THE WASTE	WHERE WOULD IT BE PERFORMED	CONTINGENCY PLAN IF PRIMARY OPTION FAILS
OFFSITE COMMERCIAL STABILIZATION TREATMENT (cont'd)	DEBRIS TYPE WASTE: Basking Debris (1200 Dr, 200 Ba) ID 183H Misc. Waste, (Debris) 9B Heterogeneous Debris (Many boxes, 5' x 5' x 9' was bounding case) 5A3 Hg Cont. Debris 5C3 Lead Cont. Debris	487.5 54.7 19.7 3.7 12.9	0 0 1207 .6 49.0	0 0 3231.5 2.1 192.7	Obtain EPA/MDOE approval for encapsulation of debris type waste by utilizing sealed polyethylene containers. Encapsulate waste via Onsite treatment contract and then dispose treated waste in the LLMW Subsite C landfill.	2706T or other Onsite TSD facility.	Default to Commercial Stabilization Treatment contract for LLMW treatment.
OPTION TOTAL		2537	3793	7649			
TOTAL OF ALL OPTIONS		4,064	5,315	11,651			

Represents through FY1993 actual receipts as specified in WHC-SD-W100-RD-001 Rev-1 (Waste Receiving and Processing, Module 2A, Feed Specification).

Assumes 100% of forecasted non-thermally treatable waste volumes are received based on the 1994 Solid Waste 30-Year Volume Summary (WHC-EP-4768).

February 29, 1996/DOE-RL-96-TB1

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- WHC, 1993e, *Hanford Site Solid Waste Acceptance Criteria*, WHC-EP-0063-4, Westinghouse Hanford Company, Richland, Washington.
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| WHC-SD-WM-ES-295, Westinghouse Hanford Company, Richland, Washington.

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- | 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.
- | WHC, 1995c, *Fiscal Year 1996 Tank Waste Remediation System Tank Waste Analysis Plan*, WHC-SD-WM-PLN-101, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- | WHC, 1996a, *Waste Tank Summary Report for Month Ending December 31, 1995*, WHC-EP-0182-93, Westinghouse Hanford Company, Richland, Washington.
- | WHC, 1996b, *Post-Run Document for 95-1 Campaign*, WHC-SD-WM-PE-005, 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, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended. (WAC 173-303-140 covers land disposal restrictions.)

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APPENDIX A

DATA IN NATIONAL DATABASES

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APPENDIX A

DATA IN NATIONAL DATABASE

Under the Federal Facility 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 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 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 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 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.

The *Mixed Waste Inventory Report* database is available via the internet on the Office of Environmental Management's (EM) World Wide Web home page. The address is <http://www.em.doe.gov>.

1.0 ASSUMPTIONS FOR THE 1995 UPDATE TO THE NATIONAL 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, 1994. The 5-year projection period is 1994 to 1998; the 30-year projection period is 1995 to 2024. 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-shell tanks (SST) and double-shell tanks (DST), 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.
- Homogeneous solids, soils, and labpacks that contain organics and are contaminated with mercury, lead, and/or alpha-bearing PCBs are difficult to treat thermally for the following reasons:
 - Mercury, lead, and PCBs are volatile and heating them results in potential hazardous air emissions
 - Alpha-bearing contaminants require special waste processing.

The following waste streams may contain these difficult-to-treat waste types:

RL-W021, RL-W124, RL-W054, RL-W051, RL-W132, RL-W144, RL-W044, and RL-W027.

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	RL-W178	RL-W181	RL-W191
	RL-W193	RL-W196	RL-W201	RL-W212	RL-W215
	RL-W218	RL-W219	RL-W220		

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	RL-W170	RL-W174	RL-W177	RL-W180
	RL-W182	RL-W194	RL-W197	RL-W202	RL-W206
	RL-W213	RL-W216	RL-W221	RL-W223	RL-W230
	RL-W231				

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	RL-W171
	RL-W173	RL-W198	RL-W203	RL-W205	RL-W214
	RL-W222	RL-W224	RL-W225	RL-W229	

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. Waste that is determined to exceed 260 mg/L will be identified as separate waste streams. The waste

| will be treated by retorting and/or roasting technologies. The selection of a facility with retorting
 | and roasting capability will be conducted when these waste streams are identified and
 | accumulated. The following waste streams make up this category.

	RL-W020	RL-W038	RL-W120	RL-W172	RL-W183
	RL-W195	RL-W204	RL-207		

| **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 being prepared for this waste. The following waste
 | streams make up this category.

	RL-W068	RL-W069	RL-W070
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| **C.2.1.8.** Tank farm backlog soils are assumed to meet the best demonstrated available technology
 | (BDAT) concentration levels for organic solvents. Sampling and analysis of the soil is planned to
 | support a petition to Ecology for concurrence that the waste stream meets the BDAT
 | concentration levels.

| **C.2.2 Debris.** Debris waste, including debris contaminated with low concentrations of organic
 | solvents, oils, or PCBs, will be treated by stabilization. This treatment method also applies for
 | backlog debris. 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.

| An alternative treatment strategy being evaluated is macroencapsulation using sealed
 | polyethylene containers. The plan is to request Ecology to concur that placing waste in sealed
 | polyethylene containers meets the BDAT standard for macroencapsulation.

| 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	RL-W175
	RL-W176	RL-W186	RL-W187	RL-W188	RL-W189
	RL-W199	RL-W200	RL-W208	RL-W209	RL-W210
	RL-W211	RL-W226	RL-W227	RL-W228	RL-W232
	RL-W233	RL-W234			

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 waste streams 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. Services for commercial thermal treatment are expected to be available between FY 1999 and FY 2000.

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 delisting petition filed with the U.S. Environmental Protection Agency for process condensate from the 242-A Evaporator was approved in June 1995. Therefore, after treatment, the process condensate is not a mixed waste and is not included in the national mixed waste inventory for strategic planning purposes.

E. OPTIONS FOR WASTE 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.
- Waste at the Radiochemistry Engineering Laboratory

Pacific Northwest National Laboratory (PNNL) 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 through a commercial treatment service contract (Section C.3.2).

E.2 Alkali Metal Waste

In 1994, the waste was packaged as containerized mixed LLW and shipped to the Central Waste Complex as mixed LLW. The waste will be treated 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.

E.4 Radiochemistry Engineering Laboratory

Nine mixed waste streams from this facility were identified in Calendar Year 1994. One waste stream is HLW, four are remote-handled TRU waste, three are remote-handled LLW, and one is contact-handled LLW.

A treatment plan for these waste streams is under negotiation with Ecology. The specified LDR technologies and the treatment plan have not yet been determined.

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 FACILITY 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, 1994. The 5-year projection covers the waste generation period from January 1, 1995 to December 31, 1999.

1. HIGH-LEVEL WASTE

At the Hanford Facility, waste in SSTs and DSTs 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, 1999 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 (m³).

FFCA waste stream name	Inventory 12/31/94	5-year transactions		Projection 12/31/99
		Inputs	Outputs	
PUREX aging waste	7,234	0		7,234
DST miscellaneous waste	25,333	30,824		56,157
Dilute non-complexed from SSTs		10,744		10,744
DST double-shell slurry feed	17,227	23,499		40,726
DST dilute complexed	3,270	2,029		5,299
DST concentrated phosphate	4,167	0		4,167
DST PFP TRU solids	269	333		602
DST complex concentrate	10,924	0		10,924
DST double-shell slurry	7,778	0		7,778
DST PUREX CRW solids	2,498	0		2,498
Output to Evaporator			62,396	-62,396
Total	78,700	67,429	62,396	83,733 ^a

^aValue is consistent with the *Integrated Data Base*, Rev. 10

CRW = (fuel) cladding removal waste, DST = double-shell tank,

FFCA = Federal Facility Compliance Act, PFP = Plutonium Finishing Plant

TRU = transuranic

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 DOE Byproduct Material Rulemaking of 1986. About one-fourth of the TRU waste generated between January 1, 1987, and December 31, 1994, 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, 1993	189.097 m ³
Revisions/Corrections (+/-)	-4.937 m ³
Annual additions in Calendar Year 1994	104.011 m ³
Inventory as of December 31, 1994	279.172 m ³

The revision/correction is for stored research irradiated fuel that had been categorized as mixed TRU waste. Because the present plan is not to dispose of this waste at WIPP, the waste is no longer included in the mixed TRU waste inventory. The programmatic responsibility for eventual disposition of this waste is the Special Nuclear Materials Management program.

As part of the WIPP documentation for their Part B permit application and their No Migration Petition application, WIPP has initiated and published a baseline inventory report. During 1995, the Hanford Site reconfigured the TRU waste streams so that the mixed TRU waste streams in both the MWIR and the baseline inventory report match exactly. Therefore, someone reviewing both the MWIR and the WIPP regulatory documentation will find consistency between the mixed TRU data sets.

3. MIXED LOW-LEVEL WASTE

Mixed LLW at the Hanford Facility 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 15,141 m³ 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. The inventory of mixed LLW is presented in Table 3.

Table 3. Referenced Hanford Site Mixed Low-Level Waste Inventory. (m³)

Referenced inventory as of December 31, 1993	3,875.685
Revisions/corrections (+/-)	+2.553
Annual additions in Calendar year 1994	2,451.311
Referenced inventory as of December 31, 1994	6,329.549

¹Supplemental 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.

An abrupt increase in the quantity of LLMW generation occurred in calendar year 1994, up from 773,260 the previous year. (This quantity does not include TSCA-regulated PCB waste that is not in the MWIR.) Most of the increase is attributed to backlog debris and soils from the Hanford Site Tank Waste Remediation System. Table 4 presents a breakdown of LLMW by source.

Table 4. Sources of LLMW in 1994.

Source	Annual volume (m ³)
Offsite laboratories	102.313
Tank farms	1,997.684
Decontamination/decommissioning	16.000
Other onsite waste	335.314
Total	2,451.311

The revision/correction in Table 4 is the result of the following:

- A volume of 4,000 m³ reflects waste in storage at the Radiochemistry Engineering Laboratory because the material was reclassified as waste.
- A volume of 1,447 m³ was subtracted because a mixed PCB waste stream that was included in the MWIR has been reclassified.

The distribution of the LLMW inventory by physical form is presented in Table 5. As expected, the majority of nonsludge waste is debris.

Table 5. Physical Distribution of LLMW.

Physical Form	Volume (m ³)
Contained liquid	0.208
Inorganic particulates	347.853
Solidified, dewatered fuel fabrication sludge	2,309.614
Contaminated soils with debris	459.064
Metal debris	233.864
Inorganic nonmetal debris	257.488
Organic debris	1,587.258
Heterogeneous debris	629.698
Not characterized	18.634
Labpacks	263.451
Special waste forms (i.e., mercury, elemental lead)	222.418
Total	6329.550

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 at their request in December 1995. This action was part of the Federal Facility Compliance Act Site treatment plan database update 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 of these cost data represent a snapshot in time. Cost 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), the 200 Area Liquid Effluent Treatment Facility, and Tank Waste Remediation System projects. This appendix is provided for information only.

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Option Cost Estimate Verification Form
Current STP Configuration

Office: Richland

Site: Hanford Site

Option: RL-04 Total Waste Volume (m³): 2,550.10060

Primary Waste Type: MLLW

Treatment

System No: RL-S803

Existing/New: New

Treatment Location: Onsite

Treatment

System Name: Commercial Thermal Treatment Facility

Option Costs by Fiscal Year

Fiscal Year	Operating Dollars (K)		Capital Dollars (K)	
	Constant FY94	Escalated	Constant FY94	Escalated
1995	50 400	50 412	50	50
Option Totals:	50 400	50 412	50	50

DOE/RL-96-08

Option Cost Estimate Verification Form
Current STP Configuration

Office: Richland

Site: Hanford Site

Option: RL-07 Total Waste Volume (m³): 226.78400

Primary Waste Type: MTRU

Treatment

System No: RL-S006

Existing/New: Existing

Treatment Location: Onsite

Treatment

System Name: Waste Receiving And Processing Facility (WRAP I)

Option Costs by Fiscal Year

Fiscal Year	Operating Dollars (K)		Capital Dollars (K)	
	Constant FY94	Escalated	Constant FY94	Escalated
1996	\$11,275	\$11,613	\$0	\$0
1997	\$9,900	\$10,504	\$0	\$0
1998	\$10,877	\$11,889	\$0	\$0
1999	\$10,877	\$12,248	\$0	\$0
2000	\$10,877	\$12,517	\$0	\$0
2001	\$10,877	\$12,998	\$0	\$0
2002	\$10,877	\$13,390	\$0	\$0
2003	\$10,877	\$13,792	\$0	\$0
2004	\$10,877	\$14,205	\$0	\$0
2005	\$10,877	\$14,630	\$0	\$0
2006	\$10,877	\$15,065	\$0	\$0
2007	\$10,877	\$15,522	\$0	\$0
2008	\$10,877	\$15,989	\$0	\$0
2009	\$10,877	\$16,468	\$0	\$0
2010	\$10,877	\$16,957	\$0	\$0
2011	\$10,877	\$17,469	\$0	\$0
2012	\$10,877	\$17,991	\$0	\$0
2013	\$10,877	\$18,534	\$0	\$0
2014	\$10,877	\$19,089	\$0	\$0
2015	\$10,877	\$19,666	\$0	\$0
2016	\$10,877	\$20,253	\$0	\$0
2017	\$10,877	\$20,862	\$0	\$0
2018	\$10,877	\$21,493	\$0	\$0
2019	\$10,877	\$22,135	\$0	\$0
2020	\$10,877	\$22,798	\$0	\$0
2021	\$10,877	\$23,483	\$0	\$0
2022	\$10,877	\$24,190	\$0	\$0
2023	\$10,877	\$24,919	\$0	\$0
2024	\$10,877	\$25,670	\$0	\$0
2025	\$10,877	\$26,442	\$0	\$0
2026	\$10,877	\$27,236	\$0	\$0
2027	\$10,877	\$28,052	\$0	\$0
2028	\$500	\$1,328	\$0	\$0

Option Cost Estimate Verification Form

Current STP Configuration

(Option Continued)

Office: Richland

Site: Hanford Site

Option: RL-07

Total Waste Volume (m³): 226.78400

Primary Waste Type: MTRU

Treatment

System No: RL-S006

Existing/New: Existing

Treatment Location: Onsite

Treatment

System Name: Waste Receiving And Processing Facility (WRAP I)

Option Costs by Fiscal Year

Fiscal Year	Operating Dollars (K)		Capital Dollars (K)	
	Constant FY94	Escalated	Constant FY94	Escalated
Option Totals:	\$347,985	\$589,497	\$0	\$0

DOE/RL-96-08
Option Cost Estimate Verification Form
Current STP Configuration

Office: Richland

Site: Hanford Site

Option: RL-08 Total Waste Volume (m³): 0.00000

Primary Waste Type: HLW

Treatment

System No: RL-S005

Existing/New: Existing

Treatment Location: Onsite

Treatment

System Name: 200 Area Effluent Treatment Facility (ETF)

Option Costs by Fiscal Year

\$2,000k

Fiscal Year	Operating Dollars (K)		Capital Dollars (K)	
	Constant FY94	Escalated	Constant FY94	Escalated
1996	\$25,267	\$26,025	\$4,150	\$4,275
1997	\$26,205	\$27,804	\$4,100	\$4,350
1998	\$26,075	\$28,500	\$4,100	\$4,481
1999	\$27,987	\$31,513	\$3,200	\$3,603
2000	\$28,651	\$33,235	\$200 0	\$232
2001	\$28,650	\$34,237	\$200 0	\$238
2002	\$28,650	\$35,268	\$200 0	\$246
2003	\$28,650	\$36,328	\$200 0	\$254
2004	\$28,650	\$37,417	\$200 0	\$261
2005	\$28,650	\$38,534	\$200 0	\$269
2006	\$28,650	\$39,680	\$200 0	\$277
2007	\$28,650	\$40,854	\$200 0	\$285
2008	\$28,650	\$42,116	\$200 0	\$294
2009	\$28,650	\$43,379	\$200 0	\$303
2010	\$28,650	\$44,665	\$200 0	\$312
2011	\$28,650	\$46,012	\$200 0	\$321
2012	\$28,650	\$47,387	\$200 0	\$331
2013	\$28,650	\$48,820	\$200 0	\$341
2014	\$28,650	\$50,281	\$200 0	\$351
2015	\$28,650	\$51,799	\$200 0	\$362
2016	\$28,650	\$53,346	\$200 0	\$372
2017	\$28,650	\$54,951	\$200 0	\$384
2018	\$28,650	\$56,612	\$200 0	\$395
2019	\$28,650	\$58,303	\$200 0	\$407
2020	\$28,650	\$60,050	\$200 0	\$419
2021	\$28,650	\$61,855	\$200 0	\$432
2022	\$28,650	\$63,718	\$200 0	\$445
2023	\$28,650	\$65,637	\$200 0	\$458
2024	\$28,650	\$67,614	\$200 0	\$472
2025	\$28,650	\$69,648	\$200 0	\$486
2026	\$28,650	\$71,740	\$200 0	\$501
2027	\$28,650	\$73,888	\$200 0	\$516
2028	\$28,650	\$76,094	\$200 0	\$531
2029	\$28,650	\$78,366	\$200 0	\$547

11/07/95

OptVerd.lnx

Option Cost Estimate Verification Form
Current STP Configuration
(Option Continued)

Office: Richland

Site: Hanford Site

Option: RL-08

Primary Waste Type: HLW

Treatment

System No: RL-S005

Existing/New: Existing

Treatment Location: Onsite

Treatment

System Name: 200 Area Effluent Treatment Facility (ETF)

Option Costs by Fiscal Year

Fiscal Year	Operating Dollars (K)		Capital Dollars (K)	
	Constant FY94	Escalated	Constant FY94	Escalated
2030	\$55,000	\$154,990	\$0	\$0
Option Totals:	\$1,020,035	\$1,850,713	\$21,550	\$27,752

DOE/RL-96-08

Option Cost Estimate Verification Form
Current STP Configuration

Office: Richland

Site: Hanford Site

Option: RL-1C

Total Waste Volume (m³):

0.00000

Primary Waste Type: HLW

Treatment

System No: RL-S004C

Existing/New: Existing

Treatment Location: Onsite

Treatment

System Name: TWRS Waste Tank Safety

Option Costs by Fiscal Year

Fiscal Year	Operating Dollars (K)		Capital Dollars (K)	
	Constant FY94	Escalated	Constant FY94	Escalated
1996	\$54,878	\$56,524	\$19,193	\$19,769
1997	\$57,519	\$61,028	\$27,273	\$28,937
1998	\$44,944	\$49,124	\$23,814	\$26,029
1999	\$38,826	\$43,718	\$21,686	\$24,418
2000	\$29,814	\$34,584	\$10,384	\$12,045
2001	\$2,955	\$3,531	\$0	\$0
2002	\$2,869	\$3,531	\$0	\$0
2003	\$2,785	\$3,531	\$0	\$0
2004	\$2,703	\$3,531	\$0	\$0
2005	\$2,625	\$3,531	\$0	\$0
Option Totals:	\$239,918	\$262,633	\$102,350	\$111,198

Option Cost Estimate Verification Form
Current STP Configuration

Office: Richland

Site: Hanford Site

Option: RL-1E Total Waste Volume (m³): 0.00000

Primary Waste Type: HLW

Treatment

System No: RL-S004E

Existing/New: New

Treatment Location: Onsite

Treatment

System Name: TWRS Characterization

Option Costs by Fiscal Year

Fiscal Year	Operating Dollars (K)		Capital Dollars (K)	
	Constant FY94	Escalated	Constant FY94	Escalated
1996	\$72,725	\$74,907	\$7,230	\$7,447
1997	\$58,290	\$61,846	\$5,055	\$5,363
1998	\$48,265	\$52,754	\$3,526	\$3,854
1999	\$46,925	\$52,838	\$2,351	\$2,647
2000	\$33,228	\$38,545	\$1,997	\$2,317
2001	\$27,498	\$32,860	\$1,653	\$1,975
2002	\$26,693	\$32,860	\$1,605	\$1,975
2003	\$25,914	\$32,859	\$1,558	\$1,976
2004	\$25,160	\$32,860	\$1,513	\$1,976
2005	\$24,430	\$32,859	\$1,469	\$1,976
2006	\$22,859	\$31,660	\$1,375	\$1,904
2007	\$22,186	\$31,660	\$1,334	\$1,904
2008	\$21,538	\$31,661	\$1,296	\$1,905
2009	\$20,912	\$31,660	\$1,258	\$1,904
2010	\$20,308	\$31,660	\$1,221	\$1,904
2011	\$13,629	\$21,887	\$819	\$1,316
2012	\$13,232	\$21,886	\$795	\$1,316
2013	\$12,844	\$21,886	\$773	\$1,317
2014	\$12,471	\$21,887	\$750	\$1,317
2015	\$12,105	\$21,887	\$728	\$1,317
Option Totals:	\$561,212	\$712,922	\$38,306	\$47,610

DOE/RL-96-08
Option Cost Estimate Verification Form
 Current STP Configuration

Office: Richland

Site: Hanford Site

Option: RL-1F Total Waste Volume (m³): 0.00000 Primary Waste Type: HLW

Treatment

System No: RL-S004F

Existing/New: New

Treatment Location: Onsite

Treatment

System Name: TWRS Waste Retrieval

Option Costs by Fiscal Year

Fiscal Year	Operating Dollars (K)		Capital Dollars (K)	
	Constant FY94	Escalated	Constant FY94	Escalated
1996	\$37,189	\$38,305	\$16,018	\$16,499
1997	\$31,828	\$33,769	\$31,707	\$33,641
1998	\$60,390	\$66,006	\$38,975	\$42,600
1999	\$61,469	\$69,214	\$39,698	\$44,700
2000	\$68,998	\$103,238	\$36,983	\$42,900
2001	\$123,340	\$147,391	\$51,254	\$61,248
2002	\$119,732	\$147,390	\$49,755	\$61,248
2003	\$116,239	\$147,391	\$48,303	\$61,248
2004	\$112,857	\$147,391	\$46,897	\$61,247
2005	\$109,584	\$147,391	\$45,537	\$61,248
2006	\$133,027	\$184,242	\$55,279	\$76,562
2007	\$129,111	\$184,242	\$53,852	\$76,561
2008	\$125,334	\$184,241	\$52,082	\$76,561
2009	\$121,692	\$184,241	\$50,569	\$76,562
2010	\$118,179	\$184,241	\$49,110	\$76,562
2011	\$118,166	\$189,774	\$49,103	\$78,860
2012	\$114,736	\$189,773	\$47,679	\$78,861
2013	\$111,370	\$189,774	\$46,279	\$78,860
2014	\$108,134	\$189,775	\$44,935	\$78,861
2015	\$104,963	\$189,774	\$43,617	\$78,860
2016	\$65,183	\$121,371	\$27,086	\$50,435
2017	\$63,279	\$121,369	\$26,296	\$50,436
2018	\$61,422	\$121,370	\$25,524	\$50,435
2019	\$59,641	\$121,370	\$24,784	\$50,436
2020	\$57,906	\$121,370	\$24,063	\$50,435
2021	\$18,162	\$39,212	\$7,548	\$16,296
2022	\$17,631	\$39,212	\$7,327	\$16,295
2023	\$17,115	\$39,211	\$7,112	\$16,294
2024	\$16,616	\$39,213	\$6,905	\$16,295
2025	\$16,130	\$39,213	\$6,703	\$16,295
2026	\$2,026	\$5,073	\$842	\$2,109
Option Totals:	\$2,441,449	\$3,725,547	\$1,061,522	\$1,599,450

DOE/RL-96-08

Option Cost Estimate Verification Form
Current STP Configuration

Office: Richland

Site: Hanford Site

Option: RL-1G Total Waste Volume (m³): 0.00000

Primary Waste Type: HLW

Treatment

System No: RL-S004G

Existing/New: New

Treatment Location: Onsite

Treatment

System Name: TWRS Waste Pretreatment

Option Costs by Fiscal Year

Fiscal Year	Operating Dollars (K)		Capital Dollars (K)	
	Constant FY94	Escalated	Constant FY94	Escalated
1996	\$32,375	\$33,346	\$132,323	\$136,293
1997	\$37,814	\$40,121	\$132,283	\$140,352
1998	\$55,577	\$60,746	\$65,464	\$71,552
1999	\$45,547	\$51,286	\$76,810	\$86,488
2000	\$38,460	\$44,613	\$68,098	\$78,994
2001	\$51,028	\$60,979	\$90,354	\$107,973
2002	\$49,537	\$60,979	\$87,712	\$107,974
2003	\$48,091	\$60,979	\$85,152	\$107,973
2004	\$46,691	\$60,979	\$82,575	\$107,973
2005	\$45,338	\$60,979	\$80,277	\$107,973
2006	\$117,285	\$162,440	\$0	\$0
2007	\$113,834	\$162,441	\$0	\$0
2008	\$110,504	\$162,440	\$0	\$0
2009	\$107,292	\$162,440	\$0	\$0
2010	\$104,195	\$162,440	\$0	\$0
2011	\$89,402	\$143,580	\$0	\$0
2012	\$86,807	\$143,579	\$0	\$0
2013	\$84,260	\$143,579	\$0	\$0
2014	\$81,811	\$143,579	\$0	\$0
2015	\$79,413	\$143,579	\$0	\$0
2016	\$75,908	\$141,341	\$0	\$0
2017	\$73,693	\$141,342	\$0	\$0
2018	\$71,530	\$141,342	\$0	\$0
2019	\$69,456	\$141,343	\$0	\$0
2020	\$67,434	\$141,342	\$0	\$0
2021	\$36,583	\$79,199	\$0	\$0
Option Totals:	\$1,819,965	\$2,851,013	\$901,148	\$1,053,545

Option Cost Estimate Verification Form
Current STP Configuration

Office: Richland

Site: Hanford Site

Option: RL-1H Total Waste Volume (m³): 0.00000

Primary Waste Type: HLW

Treatment

System No: RL-S004H

Existing/New: New

Treatment Location: Onsite

Treatment

System Name: TWRS Low-Level Waste Treatment

Option Costs by Fiscal Year

Fiscal Year	Operating Dollars (K)		Capital Dollars (K)	
	Constant FY94	Escalated	Constant FY94	Escalated
1996	\$38,129	\$39,273	\$1,104	\$1,137
1997	\$29,879	\$31,702	\$5,883	\$6,242
1998	\$43,765	\$47,935	\$30,591	\$33,436
1999	\$57,741	\$65,016	\$74,563	\$84,071
2000	\$69,415	\$80,521	\$105,659	\$122,564
2001	\$66,814	\$79,843	\$101,700	\$121,531
2002	\$64,860	\$79,843	\$98,726	\$121,532
2003	\$62,967	\$79,843	\$95,845	\$121,532
2004	\$61,136	\$79,843	\$93,056	\$121,531
2005	\$59,363	\$79,843	\$90,358	\$121,532
2006	\$207,323	\$287,142	\$0	\$0
2007	\$201,221	\$287,143	\$0	\$0
2008	\$195,336	\$287,143	\$0	\$0
2009	\$189,658	\$287,143	\$0	\$0
2010	\$184,184	\$287,143	\$0	\$0
2011	\$181,403	\$291,333	\$0	\$0
2012	\$176,139	\$291,333	\$0	\$0
2013	\$170,970	\$291,332	\$0	\$0
2014	\$166,002	\$291,333	\$0	\$0
2015	\$161,135	\$291,332	\$0	\$0
2016	\$142,558	\$265,443	\$0	\$0
2017	\$138,395	\$265,442	\$0	\$0
2018	\$134,333	\$265,443	\$0	\$0
2019	\$130,438	\$265,442	\$0	\$0
2020	\$126,643	\$265,443	\$0	\$0
2021	\$176,775	\$381,557	\$0	\$0
2022	\$171,608	\$381,557	\$0	\$0
2023	\$166,590	\$381,557	\$0	\$0
2024	\$161,718	\$381,556	\$0	\$0
2025	\$156,996	\$381,558	\$0	\$0
2026	\$13,280	\$33,254	\$0	\$0
Option Totals:	\$3,906,774	\$6,824,591	\$697,585	\$855,108

DOE/RL-96-08

Option Cost Estimate Verification Form
Current STP Configuration

Office: Richland

Site: Hanford Site

Option: RL-11

Total Waste Volume (m³): 309,369.00000

Primary Waste Type: HLW

Treatment

System No: RL-S004I

Existing/New: New

Treatment Location: Onsite

Treatment

System Name: TWRS High-Level Waste Treatment

Option Costs by Fiscal Year

Fiscal Year	Operating Dollars (K)		Capital Dollars (K)	
	Constant FY94	Escalated	Constant FY94	Escalated
1996	\$15,060	\$15,532	\$4,351	\$4,481
1997	\$22,108	\$23,457	\$2,940	\$3,119
1998	\$34,107	\$37,279	\$2,351	\$2,570
1999	\$28,563	\$32,162	\$23,569	\$26,539
2000	\$29,755	\$34,516	\$67,599	\$78,415
2001	\$85,379	\$102,027	\$193,967	\$231,791
2002	\$82,882	\$102,028	\$188,295	\$231,791
2003	\$80,463	\$102,028	\$182,801	\$231,792
2004	\$78,123	\$102,028	\$177,482	\$231,792
2005	\$75,857	\$102,027	\$172,335	\$231,791
2006	\$61,059	\$84,566	\$138,715	\$192,121
2007	\$59,261	\$84,566	\$134,533	\$192,122
2008	\$57,528	\$84,566	\$130,694	\$192,121
2009	\$55,857	\$84,567	\$126,897	\$192,122
2010	\$54,244	\$84,566	\$123,234	\$192,122
2011	\$187,429	\$301,011	\$0	\$0
2012	\$181,990	\$301,011	\$0	\$0
2013	\$176,650	\$301,011	\$0	\$0
2014	\$171,517	\$301,011	\$0	\$0
2015	\$166,489	\$301,011	\$0	\$0
2016	\$160,030	\$297,976	\$0	\$0
2017	\$155,357	\$297,975	\$0	\$0
2018	\$150,797	\$297,975	\$0	\$0
2019	\$146,426	\$297,976	\$0	\$0
2020	\$142,164	\$297,977	\$0	\$0
2021	\$136,613	\$294,947	\$0	\$0
2022	\$132,620	\$294,946	\$0	\$0
2023	\$128,741	\$294,946	\$0	\$0
2024	\$124,977	\$294,946	\$0	\$0
2025	\$121,328	\$294,948	\$0	\$0
2026	\$114,161	\$285,859	\$0	\$0
2027	\$110,840	\$285,856	\$0	\$0
2028	\$107,627	\$285,857	\$0	\$0
2029	\$104,480	\$285,857	\$0	\$0

Option Cost Estimate Verification Form
 Current STP Configuration
(Option Continued)

Office: Richland

Site: Hanford Site

Option: RL-11

Primary Waste Type: HLW

Treatment

System No: RL-S004I

Existing/New: New

Treatment Location: Onsite

Treatment

System Name: TWRS High-Level Waste Treatment

Option Costs by Fiscal Year

Fiscal Year	Operating Dollars (K)		Capital Dollars (K)	
	Constant FY94	Escalated	Constant FY94	Escalated
2030	\$101,439	\$285,856	\$0	\$0
2031	\$37,616	\$109,200	\$0	\$0
2032	\$26,237	\$78,449	\$0	\$0
2033	\$35,455	\$109,201	\$0	\$0
2034	\$34,426	\$109,199	\$0	\$0
2035	\$33,425	\$109,200	\$0	\$0
2036	\$167,120	\$562,357	\$0	\$0
2037	\$162,250	\$562,357	\$0	\$0
2038	\$157,524	\$562,361	\$0	\$0
2039	\$152,939	\$562,357	\$0	\$0
2040	\$148,498	\$562,360	\$0	\$0
Option Totals:	\$4,597,431	\$10,301,908	\$1,669,863	\$2,234,689
Richland:				
	\$19,212,298	\$33,569,715	\$5,506,788	\$7,107,287

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